ICETOL

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ON EDUCATIONAL TECHNOLOGY AND ONLINE LEARNING

6. ULUSLARARASI EĞİTİM TEKNOLOJİLERİ VE ÇEVRİMİÇİ ÖĞRENME KONFERANSI

[ABSTRACT PROCEEDINGS]

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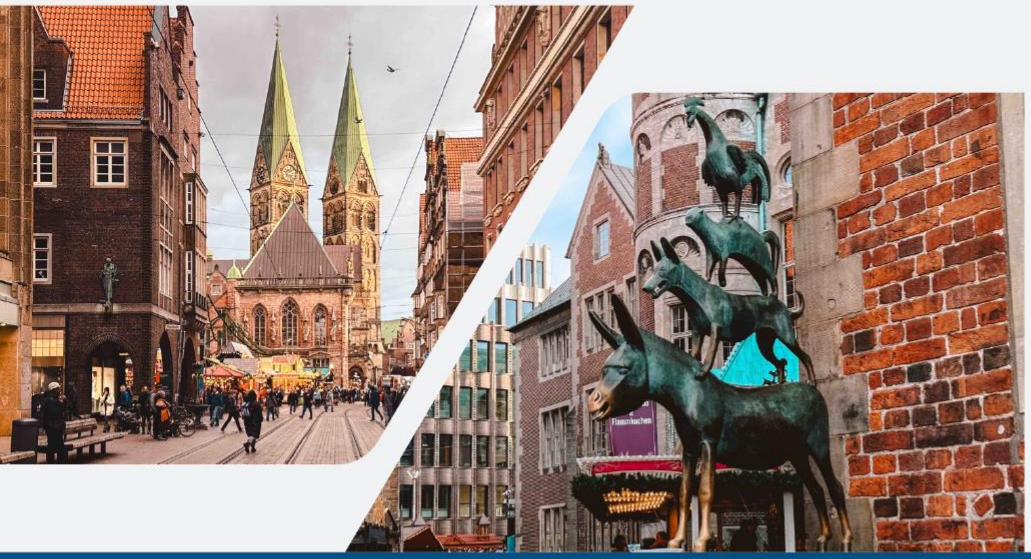

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(3)

Distance and Online Education for Uncertain Futures: Building Resilient Learning Systems with Shared Responsibility

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Uncertainty driven by technological change, socio-economic challenges, and global disruptions has fundamentally reshaped the role of open and distance learning institutions. Open universities, with their mandate of access, flexibility, and equity, are uniquely positioned to respond to these challenges. This study examined how distance and online education at an open university—drawing on the context of Allama Iqbal Open University (AIOU)—contributed to building resilient learning systems and fostering shared responsibility among institutions, educators, and learners.

The study adopted a qualitative case study research design. Data were collected from multiple sources, including institutional policy documents, academic planning reports, program guidelines, and semi-structured interviews with academic administrators, faculty members, and support staff involved in distance and online education. Purposeful sampling was used to select participants with direct experience in academic planning, online course delivery, and learner support systems. Data were analyzed using thematic analysis to identify patterns related to learning resilience, institutional preparedness, and learner responsibility.

Findings indicate that resilience in open and distance learning is strengthened through flexible curriculum structures, diversified delivery modes, decentralized learner support, and strategic use of digital technologies. The study also highlighted the role of institutional responsibility in ensuring quality assurance, inclusive access, and ethical governance, alongside the need to cultivate learner self-regulation and lifelong learning skills. The paper concluded that open universities such as AIOU play a critical role in educating for uncertain futures by aligning learning design, resilience, and responsibility within distance and online education frameworks.

Keywords: Distance And Online Education; Educational Resilience; Uncertain Futures; Institutional Responsibility; Learner Agency

(4)

Digital and AI Literacy, Learning Resilience, and Responsible Technology Use among Students in Türkiye

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Today's technological developments significantly impact the education field. Many different levels of education have begun to use digital and AI-powered technologies. This integration has created a need to understand how students develop resilience and responsibility in complex learning environments. This study investigates the determinants of digital and AI-related self-efficacy among students in Türkiye by focusing on the relationship between digital access, responsible technology use, and learning resilience. Using microdata from the Programme for International Student Assessment (PISA) 2022, the analysis is based on a nationally representative sample of Turkish students and incorporates sampling weights to account for the complex survey design.

Digital self-efficacy is operationalized via the Self-Efficacy in Digital Competencies (ICTEFFIC) scale. The explanatory variables included indicators of digital access, learning- and leisure-oriented technology use, responsible attention management behaviours, socio-economic status, and psychosocial dimensions of learning resilience, such as self-directed learning, self-efficacy, and anxiety. Beyond correlation analyses and interpretations, the study employs a Random Forest model combined with explainable artificial intelligence techniques, specifically Shapley Additive Explanations (SHAP), to identify and interpret the relative importance and directional effects of key predictors.

The findings reveal that learning resilience, particularly self-directed learning self-efficacy, emerges as the most influential factor associated with digital self-efficacy. Socio-economic status remains a significant structural determinant as it underscores persistent digital inequalities. Moreover, responsible digital behaviours such as managing notifications during class and sleep, are positively associated with higher digital self-efficacy. This effect emphasizes the significance of attention management in digital learning environments. On the other hand, according to the analysis, anxiety-related characteristics have a negative effect on digital skills. It demonstrates the significance of psychological well-being in the development of digital abilities.

In conclusion, the findings indicate that digital and AI literacy encompass more than just access to technology or the basic utilization of digital tools. They are closely connected to learners' ability to manage their learning, adapt to challenges, and remain resilient in changing educational contexts. By applying learning analytics and machine learning models interpreted through explainable artificial intelligence techniques, this study provides clear and evidence-based insights that can support educational policy and practice in nurturing responsible, confident, and resilient learners in digital environments.

Keywords: Digital And AI Literacy, Learning Resilience, Responsible Digital Behaviour, PISA 2022, Türkiye, Explainable Artificial Intelligence

(6)

The Impact of Multimodal Input on L2 Reading Comprehension: Evidence from Eye Tracking

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Multimodal materials (e.g., written text supplemented by images and/or audio) are commonplace in language classrooms. While they have been consistently shown to be beneficial for vocabulary acquisition (e.g., Malone, 2018), the efficacy of multimodal input in scaffolding text comprehension is less clear. Conflicting findings have also been reported regarding the relationship between comprehension and attention to pictures as measured by eye tracking (e.g., Pellicer-Sánchez et al., 2020; Pellicer-Sánchez et al., 2021). This pre-registered study provides further empirical evidence to this research base by testing a new population, adult beginners, and including a reading-only, no-image condition as the baseline. In a counterbalanced within-subject design, 65 learners of Spanish were exposed to different parts of a story on an eye tracker under three experimental conditions: Read Only (RO), Read + Image (RI), and Read + Image + Audio (RIA). Results revealed that comprehension was higher in the RIA and RI than in the RO condition, indicative of the usefulness of the audio and/or the image. The number of looks at the images was higher in the RIA condition, confirming that the audio allowed readers to attend to the pictorial information provided. However, attention to the image positively predicted comprehension scores only for the RIA condition. Lastly, this paper discusses the pedagogical implications of the use of various multimodal materials in L2 classrooms to optimize comprehension and retention in L2 reading tasks. As multimodal resources proliferate, this research underscores the urgent need for more empirical studies that inform theoretical frameworks and classroom practices to support effective L2 learning.

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Keywords: Multimodal Input; L2 Reading Comprehension; Eye Tracking; Second Language Acquisition; Instructional Design

(7)

From Open Education to Open Democracy: How OER Strengthen Digital Citizenship

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The introduction of artificial intelligence tools into our lives and the rapid rise of digital technologies can both serve and undermine the democratization of the process, while somehow affecting the inclusion of individuals in democratic processes. While social media and online platforms in particular promise greater accessibility and connectivity, they can also serve to spread misinformation, algorithmic bias and the exclusion of marginalized groups. The digital divide that prevents individuals with low technological literacy or fluency from becoming digital citizens is growing increasingly. This study explores how Open Educational Resources (OER)—freely accessible, adaptable, and participatory learning materials—can serve as a critical tool for rebuilding digital citizenship and promoting democratic flexibility. The study adopts a literature review methodology and analyzes the role of OER in the process toward open democracy. In this context, the study outlines how open educational resources can strengthen digital citizenship and serve open democracy in three key aspects. These important aspects are: a) combating digital misinformation by imparting media and digital literacy skills, b) enabling participatory policy-making through the co-creation of open knowledge, and c) developing practical recommendations for policymakers, educators, and civil society to leverage OER as a digital public infrastructure for inclusive democracy. OER, eliminating the barriers of permission related to cost and sharing in the learning process, provides opportunities for learning, creating, and participating in governance for every young, old, and disadvantaged individual in society. One of the biggest problems when considering the obstacles that may prevent OER from serving this purpose is individuals living in rural areas who do not have sufficient internet and digital infrastructure. These individuals can be considered to be affected by the digital divide, as they do not have the necessary digital equipment. One possible step at this point is to make learning content accessible to these disadvantaged groups through offline materials. Such steps should be under the control of local authorities and civil society organizations responsible for the people living in these areas. It is particularly important for all responsible stakeholders to work together to strengthen digital citizenship, increase individuals' participation in democratic processes, and build open and accessible democratic structures. Addressing OER on digital public infrastructure such as open data or broadband networks for a governance approach based on transparency will be quite effective in creating a resilient civic ecosystem. Therefore, it is recommended that policymakers adopt the mandatory use of OER in public education and establish funds for citizenship literacy.

Keywords: Open Educational Resources, Open Democracy, Digital Citizenship, Digital Divide, Digital Literacy

(11)

Beyond Visual Literacy: A Visual–Algorithmic Literacy Framework for Education in the Age of AI

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AI-generated and algorithmically mediated visual material is becoming more and more common, which has completely changed visual culture and educational practices. Images are no longer produced solely through human intention and aesthetic preference; instead, they are increasingly generated through probabilistic, data-driven, and opaque computational processes. Standard definitions of visual literacy are inadequate to address the pedagogical, ethical, and epistemological challenges presented by generative artificial intelligence, even though it has long been seen as a crucial ability in art, design, and education. In light of the uncertain educational landscape shaped by automation, post-truth dynamics, and rapid technological innovation, there is a growing need to reconceptualize visual literacy beyond traditional aesthetic or representational frameworks.

This study presents a Visual–Algorithmic Literacy Framework (VALF), which synthesises knowledge from research on AI and algorithmic literacy, art and design theory, and visual culture studies. The research utilises a qualitative, theory-driven methodology based on an integrated evaluation and conceptual synthesis of interdisciplinary literature related to visual literacy, media and AI literacy, generative AI in education, and ethical frameworks for responsible technology use.

The suggested framework has four layers that are interconnected. First of all, Visual–Aesthetic Literacy is an important layer which encompasses traditional competencies related to visual language, composition, symbolism, and aesthetic judgment. The second layer, Algorithmic Visual Awareness, extends these competencies by focussing on an understanding of algorithmic processes, including prompt-based generation, probabilistic outputs, and the influence of training data on visual representation. And the next, third layer is Critical and Ethical Visual Judgement. It focusses on figuring out algorithmic bias, representational injustice, authorship, and ethical duty in images made by AI. The last and fourth layer, Meaning-Making and Responsible Visual Practice, situates visual production and interpretation within broader social, cultural, and educational contexts, highlighting learners' responsibilities as both critical interpreters and ethical producers of visual content.

The Visual–Algorithmic Literacy Framework addresses contemporary educational difficulties for unpredictable futures through the integration of these levels. It supports the development of resilient learners who can navigate visual ambiguity, algorithmic opacity, and ethical dilemmas associated with AI-driven visual environments. From an art and design point of view, the framework stresses how important it is to have an aesthetic sense, think critically, and be aware of ethics as parts of digital and AI literacy that are all connected.

Keywords: Visual–Algorithmic Literacy, Visual Literacy, Artificial Intelligence in Education, Algorithmic Awareness, Art And Design Education, Responsible AI

(12)

Learning Theories and ePortfolio Integration: Designing Future-Oriented Distance Education Practices

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Despite the growing use of electronic portfolios (e-portfolios) in distance education, there is a limited understanding of how learning theories can inform their design to enhance student agency, critical thinking, and reflective practice. In open and distance education (ODE), where learner autonomy and engagement are essential, the absence of a clear theoretical foundation can result in fragmented practices that fail to empower students as active participants. This study adopts a prospective approach to explore how learning theories can guide the design and use of e-portfolios, enabling educators to anticipate and shape innovative, learner-centred pedagogical practices in digital education. Using a qualitative case study with semi-structured interviews of six lecturers from a major African ODE university, and thematic analysis, the research examines how educators conceptualise and apply learning theories in e-portfolio practices, and how this alignment influences teaching approaches and student outcomes. Findings suggest that when e-portfolios are deliberately aligned with relevant learning theories, they transform passive learning into interactive, student-driven experiences that cultivate agency, critical thinking, and lifelong learning competencies. The study proposes a forward-looking framework to guide educators in designing and implementing e-portfolios as transformative tools for future-ready education. This framework has implications for institutional strategy, policy, and the evolving practice of distance education, demonstrating how theoretically informed e-portfolio design can support scalable, innovative, and learner-centred approaches in diverse educational contexts.

Keywords: Distance Education, E-portfolios, Future-oriented Educational Design, Learning Theories, Learner-centred Pedagogy, Reflective Practice, Student Agency

(13)

Students' co-construction of the community of inquiry in online learning: The effect of students' e-readiness on teaching, social and cognitive presences

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Within the Community of Inquiry Framework, the success of online learning depends largely on teachers' and students' sustaining their teaching, social, and cognitive presences. While the literature has focused on the institutional and instructional aspects that affect those presences, few studies have examined the role of students' characteristics, such as e-learning readiness. Taking a sociocultural perspective, the present study examined the impact of students' e-readiness on the community of inquiry in online settings. Data were collected from 235 undergraduate Moroccan students using the Students Online Learning Readiness (SOLR) and the Community of Inquiry (CoI) questionnaires and analyzed using Structural Equation modeling. The results indicated a near-perfect one-to-one relationship between the components of SORL and each presence. Specifically, Technical Competence has a positive impact on Cognitive Presence, Communicative Competence on Teaching Presence, Social Competence with Classmates on Social Presence, and Social Competence with Instructor on Teaching Presence. Mediation analysis was also used to examine the effect of students' e-readiness competencies on cognitive presence via teaching and social presence. Teaching Presence emerged as a partial mediator, either alone or in sequence with Social Presence, for three of the four SORL competences. Beyond confirming the theoretical structure of CoI recently suggested, the study argues that students' e-readiness contributes to the construction of each of its three presences, including Teaching Presence, which traditionally has been seen as an institution's/teaching responsibility. The practical implications of this view of the online community as co-construction in online contexts are outlined, along with the limitations and directions for future work.

Keywords: Online Learning, Community of Inquiry, E-readiness, Co-construction

(14)

Learning Across Languages and Modalities: Translanguaging Driven Adaptation in an Online First-Year Academic Literacy Environment

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In rapidly evolving digital learning landscapes shaped by advancing AI and online instructional technologies, universities face increasing pressure to design learning environments that remain adaptive, inclusive, and pedagogically robust. This study responds to these emerging demands by examining how translanguaging—a pedagogy that enables fluid movement across languages for meaning-making—can support adaptable, resilient learning in digitally mediated higher education spaces. While global research on translanguaging has demonstrated its potential in multilingual teaching and learning, less is known about how such practices can be effectively enacted within online, English-dominant African university contexts. This gap is particularly salient for first-year students who must navigate academic literacy expectations in environments that rarely leverage their multilingual repertoires. Drawing on a mixed-methods, quasi-experimental design, the study investigates an online academic literacy intervention implemented in a South African university where multilingualism is the norm, yet English continues to dominate academic communication. The intervention integrated translanguaging practices using African languages within online learning platforms, guided by sociocultural theory, connectivism, and translanguaging fluidity frameworks. These frameworks collectively foreground the importance of social interaction, networked learning, and linguistic flexibility in adaptive digital environments. Findings indicate that the Ubuntu translanguaging approach—incorporating indigenous South African languages within digital academic literacy instruction—enhanced students' ability to understand, summarise, and paraphrase complex English academic texts. Results also show that combining translanguaging with principles of connectivism fostered more adaptive and student-responsive learning pathways, mirroring global trends toward personalised and AI-supported learning environments. Students reported increased confidence and improved academic literacy performance, demonstrating that online translanguaging can serve as a pedagogically sound and contextually relevant tool for strengthening resilience and engagement in multilingual classrooms. The study concludes that translanguaging-infused online learning holds significant promise for higher education systems seeking inclusive, equitable pedagogies responsive to uncertain futures. It recommends further exploration of adaptive online designs—including integration with generative AI, intelligent feedback systems, and learning analytics—to expand opportunities for culturally grounded, linguistically responsive academic literacy development.

Keywords: Translanguaging; Adaptive Online Learning; Multilingualism; Academic Literacy; Digital Pedagogy; Connectivism; African Languages

(15)

Reframing Gen-Z Learning in Higher Education through Adaptive Learning and Behavioral Engagement Model

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Contemporary higher education (HE) systems still heavily depend on mandatory attendance as a key indicator of student engagement, with attendance rates typically between 70% and 90%. For Generation Z students, whose engagement is influenced by personalization, autonomy, and ongoing digital interaction, physical attendance alone may no longer reliably represent meaningful learning. This paper critiques the pedagogical shortcomings of attendance-focused engagement models and proposes an alternative framework grounded in adaptive learning and behavioral engagement theory.

The study employs a two-stage analytical approach. Initially, institutional academic data are analyzed to explore the link between attendance and student performance in semester-based higher education. The results show a weak and inconsistent connection between attendance rates and academic success, indicating that mere physical presence does not fully reflect cognitive involvement or learning effectiveness. These insights challenge the continued reliance on attendance thresholds as high-stakes criteria for summative assessment. The paper contends that, for Gen-Z students in higher education, fear-driven attendance policies may lead to superficial participation, disengagement, and anxiety, without clear improvements in learning outcomes. A new way to view student engagement, shifting it from mere compliance to the formation of habitual learning behaviors. Using well-established theories of self-regulation, motivation, and reinforcement, the framework sees engagement as a process developed through deliberate instructional design rather than just enforced attendance. In this model, adaptive learning systems are key, as they personalize content, pacing, and feedback to fit each learner's profile, encouraging continuous interaction with the learning materials. Complementing adaptive learning, behavioral engagement (ALBE) model is explored as methods to promote consistent study habits, persistence, and intrinsic motivation. Instead of viewing attendance as coercive control, engagement is defined by observable behaviors like interacting with content, progression patterns, and reflective activities. In this framework, habit-forming engagement involves establishing stable, self-reinforcing learning routines that foster academic achievement independently of external factors.

The paper emphasized reframe engagement as a design-focused and offers valuable insights for curriculum development, assessment policies, and quality assurance. This framework is particularly useful for institutions aiming to align pedagogical practices with the learning traits of Gen-Z students while ensuring academic rigor and accountability in increasingly technology-mediated educational contexts.

Keywords: Gen-Z, Adaptive Learning, Instructional Modalities, Higher Education, Behavioral Engagement

(16)

Foundations of Research: Understanding Supervisors' Roles in NQF8 Success

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PhD attrition rates in South Africa exceed 50%, primarily due to challenges such as inadequate funding, limited employment opportunities, and insufficient supervision capacity (DSI, 2022). Despite the existence of postgraduate support programmes, students often lack the academic and personal support necessary for successful completion of their PhDs. Establishing a solid foundation for the research process at the Honours level (NQF8 or fourth year of undergraduate studies) is critical, as students' experiences with research projects at this stage significantly influence whether they continue to Master's and Doctoral studies (Malcolm, 2020). Literature indicates that PhD graduates must possess a satisfactory understanding of the research process, which is cultivated during the Honours programme through the teaching and application of research skills (Galpin, Hazelhurst, Mueller & Sanders, 1999). Continuous exposure to and adequate support in navigating the complexities of the research process are essential for Honours students (Riley & Spurling, 2023; Galpin et al., 1999). The self-determination theory (SDT) highlights that supervisors' unique interpretations and experiences shape their ability to support students effectively (Kumar, Summerell, Spehar & Cranney, 2021). The completion of Honours research projects lays the groundwork for future academics to pursue advanced qualifications and contribute to their disciplines (Barwick & Horstmanshof, 2022; Malcolm, 2020). South African Honours programmes require a research project worth a minimum of 30 credits (CHE, 2013), thus necessitating that supervisors are well-prepared and fully understand the research process and institutional requirements to provide effective support (Kumar et al., 2021).This study aims to explore supervisors' perspectives on the supervision process for NQF8 research projects at a private higher education institution. Following a positivist research philosophy, a quantitative methodology will be employed. A structured questionnaire with a 3-point Likert scale will evaluate supervisors' agreement on key aspects of the research process, alongside closed-ended questions regarding geographical location and qualifications. The target population includes all supervisors overseeing students in NQF level 8 programmes at a PHEI, where a full research project is a requisite for programme completion. Simple random sampling will ensure a minimum of 278 supervisors complete the online questionnaire. The study will use factor analysis, regression analysis, and relevant t-tests and ANOVAs/MANOVAs to derive insights into supervisors' perspectives. Comparisons across disciplines will facilitate tailored interventions to support students' successful completion of research projects. Recommendations for relevant support programmes and workshops for supervisors will follow. Findings will be disclosed after data analysis completion.

Keywords: Research Project, Supervision, Supervisor Experience, Higher Education

(17)

Interaction Designs to Support Emotional Inclusion in Mathematics Education for Students with Mild Intellectual Disabilities

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In education for uncertain futures, educational technologies are expected to address emotional inclusion alongside cognitive outcomes. However, many learning environments still rely on verbal explanation and written expression, which limits the visibility of learners' emotional experiences. This challenge is particularly evident for students with mild intellectual disabilities, who may participate actively but struggle to communicate their experiences within instructional and research contexts. Despite this need, interaction formats in mathematics education are rarely examined as interaction design choices rather than assessment tools. To address this gap, the present study explores how interaction designs support emotional inclusion and increase the visibility of students' learning experiences. In this study, interaction is treated as an instructional design decision shaping learner–system communication. Emojis, star-rating scales, and reflective letters were integrated into the instructional process as interaction mechanisms. The study followed a Type-1 Design and Development Research framework supported by the ADDIE instructional design model. A qualitative, process-focused design was adopted with seven students with mild intellectual disabilities participating in six model-eliciting mathematics activities implemented through a structured process combining the 5E learning model and a flipped classroom approach. Data were collected through pre–post emoji reflections, star ratings, reflective letters, and classroom observations, and analyzed using thematic analysis. Across the activities, students' emotional expressions showed generally positive or stable patterns, with meaningful variation across tasks. Reflective letters helped interpret these patterns by linking enjoyment, perceived clarity, and moments of difficulty. Offering multiple response formats increased the visibility of students' learning experiences and supported emotional inclusion. The findings emphasize the importance of ethically responsible and human-centered human–computer interaction design in the education of students with mild intellectual disabilities. Rather than technological complexity, simple interaction design choices supported emotional inclusion and meaningful participation, contributing to discussions on responsible educational technologies for uncertain educational futures.

Keywords: Emotional Inclusion, Design And Development Research, Human–computer Interaction, Mathematics Education, Students with Mild Intellectual Disabilities

(18)

Data-Related Skills and Mathematical Literacy of Pre-Service Mathematics Teachers Within the K12 Framework

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The purpose of this study is to determine pre-service elementary and secondary mathematics teachers' self-efficacy perceptions regarding data-related skills and data-driven decision-making within the K12 framework, as well as their self-efficacy perceptions toward mathematical literacy, and to examine the relationship between these two variables. In the Türkiye Yüzyılı Maarif Model, mathematics domain skills are addressed as components of a holistic structure aimed at enhancing mathematical literacy; however, these skills are associated with learning outcomes at different frequencies within the curriculum. Within this structure, data-related skills are closely connected to the functional dimension of mathematical literacy, as they directly support interpreting data, making sense of information, and engaging in data-driven decision-making in real-life contexts, a relationship that has also been emphasized in the literature. Nevertheless, it is noteworthy that data-related skills are associated with a more limited number of learning outcomes compared to other mathematics domain skills in the curriculum. Therefore, this study focuses on data-related skills by considering their functional relationship with mathematical literacy.

The study was conducted using a quantitative research approach based on the correlational survey model. The study group consists of pre-service elementary and secondary mathematics teachers enrolled at a public university located in the Marmara Region of Türkiye. A total of 100 pre-service teachers participated in the study. Data were collected using the Mathematical Literacy Self-Efficacy Scale and the Statistics Self-Efficacy Belief Scale. Through these instruments, pre-service teachers' self-efficacy perceptions regarding mathematical literacy and data-related skills were determined.

The data analysis process is currently ongoing. The analyses aim to identify the levels of pre-service teachers' self-efficacy perceptions related to mathematical literacy and data-related skills, as well as to examine the relationships between these two variables. In addition, differences in self-efficacy perceptions according to teaching field and grade level will also be investigated.

This study is expected to reveal the current status of pre-service teachers' data-related skills and mathematical literacy and to provide a holistic perspective on the relationship between these two constructs. The findings are anticipated to contribute to teacher education programs by emphasizing the joint consideration of data-driven thinking and mathematical literacy

Keywords: Data-Related Skills, Mathematical Literacy, Pre-Service Mathematics Teachers

(19)

Reframing Computational Thinking Through Model-Eliciting Activities for Students with Mild Intellectual Disabilities

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In the context of education for future uncertainties, developing future-ready skills such as computational thinking and algorithmic literacy has become a key priority of mathematics education, as these skills support learners' adaptation to complex and unpredictable problem situations. However, computational thinking is still largely treated as a technology-driven or test-based competence measured through isolated performance outcomes, which particularly constrains the pedagogical interpretation for students with mild intellectual disabilities. Since conventional assessment practices often fail to reflect these students' reasoning and decision-making processes, this study aims to reframe computational thinking as a process-based and human-centered cognitive practice. The research examines how computational thinking can be identified through students' active engagement with real-life problem situations within mathematical model-eliciting activities, which allow for the observation of computational thinking components—such as abstraction, decomposition, and algorithmic thinking—through concrete tasks tailored to the cognitive levels of students with special needs. Conducted via a Type-1 Design and Development Research approach, the study involved the design and implementation of six model-eliciting activities with seven vocational high school students with mild intellectual disabilities. Data collected through written responses, audio recordings, field notes, and interviews were analyzed by synthesizing descriptive and content analysis methods in line with data triangulation principles. Findings indicate that computational thinking components became meaningfully observable within structured modeling environments; notably, "decomposition" and "algorithmic thinking" emerged as the most prominent components as students broke down complex data into manageable sub-problems. These results suggest that computational thinking should be viewed as a set of cognitive processes emerging within carefully designed mathematical contexts rather than a skill dependent on technology use. Ultimately, this study provides context-specific evidence that the focus should shift from the "absence" of computational thinking skills in students with intellectual disabilities to "how" these processes unfold, showing that computational thinking can be meaningfully supported and evaluated through process-based practices in inclusive mathematics classrooms.

Keywords: Computational Thinking, Mathematical Modeling, Model-eliciting Activities, Mild Intellectual Disability, Inclusive Education, Design And Development Research.

(20)

Understanding the Landscape of Digital Parenting in Kuwait: Measures to Take at the Age of Digital Risks

Fayiz A Aldhafeeri

The world is living in a new electronic transformation with implications which change society world-side have penetrated down to family life and the education of children. This technological revolution has opened up a new way of parenting, it's called digital parenting and that means helping young kids to navigate their way around the online world. While it provides incredible opportunities to learn, connect and engage, this online world also poses substantial risks to children – risks to their safety, well-being and development as it attracts a wide range of potential offenders. The digital rich environment that characterizes Kuwait, which has a high level of Internet and technology penetration1, render it an interesting domain in which to explore how families are adjusting their parenting in response to these digital norms. From a policy perspective, these findings can help inform work aimed at creating a safe, healthy and supportive online environment for Kuwaiti youth in the context of the digital age. The proposed is a dedicated study to investigate the scene of digital parenting in Kuwait and in particular for tackling what measures a parent can take to protect their kids within the prevailing digital threats in such this age.

Keywords: Digital Risks, Parents, Kuwait

(23)

Enhancing Academic Writing and Integrity: Training Student Teachers in ODeL Contexts with Technological Challenges

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Open Distance e-Learning (ODeL) environments have become increasingly central to teacher education, yet many student teachers continue to struggle with academic writing and maintaining academic integrity, particularly in contexts marked by unequal access to technology. This study explores how academic writing and integrity can be enhanced through targeted training for third-year student teachers navigating ODeL programmes. Guided by four research questions, the study examines students' experiences of academic writing, the challenges they face in upholding academic integrity, the role of technology in supporting or hindering their writing development, and the types of training and institutional support available to them. Data are generated through biographical surveys and semi-structured open-ended interviews, focusing on students' access to technology, prior exposure to academic writing and ODeL, and their perceptions of support from lecturers, tutors, and digital platforms. Preliminary findings indicate that while digital tools can facilitate referencing, feedback, and drafting processes, inconsistent internet connectivity, limited device access, and insufficient training in ethical writing practices often undermine students' confidence and competence. Participants also report challenges related to paraphrasing, plagiarism avoidance, and understanding institutional integrity guidelines. The study highlights the critical need for responsive, scaffolded training that integrates technological literacy, ethical writing guidance, and ongoing academic support. Ultimately, the research argues that strengthening academic writing and integrity in ODeL requires a holistic approach that addresses both pedagogical and technological barriers, thereby better preparing student teachers for professional practice and responsible knowledge production.

Keywords: Open Distance E-Learning (ODeL); Academic Writing; Academic Integrity

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Medical and Biomedical Students Perspective on Digital Health Integration in Medical Curricula

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Digital health technologies are revolutionizing healthcare delivery by improving accessibility, efficiency, and patient outcomes. This study aims to explore the medical and biomedical students' perspectives on the integration of digital health in medical curricula.

A cross-sectional study was conducted from August until November 2023 on medical and biomedical undergraduate students at the College of Medicine and Health Sciences at Sultan Qaboos University (SQU). Data were collected using a self-administered questionnaire. Descriptive statistics present the demographic data and questionnaire items presented using frequencies, bars, and pie charts.

The comments made by the participants suggested that there is a definite need for more structured and thorough training. While some students were able to take advantage of digital literacy classes and specific e-health technologies, the majority of students believed that the curriculum that was currently being offered was insufficient. The fact that the e-Health courses they were given, were frequently brief and that they typically lasted for less than five hours indicates that comprehensive training is deficient. An extensive range of topics, ranging from fundamental digital literacy to more specialised fields such as telemedicine, artificial intelligence, data security, health informatics, and the utilisation of medical applications, were suggested for inclusion.

Introduction of digital health concepts into medical curricula is essential for bridging the gap between traditional medical education and the demands of modern clinical practice. There is a need for embedding digital health education within medical programs and implementing a structured, competency-based approach to prepare future physicians for the digital era.

Keywords: Digital Health, Medicine, Curriculum

(25)

Corporate Employees' Attitudinal Perceptions of Company-Sponsored E-Learning Platforms: A Phenomenological Study

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This study investigates the experiences and perceptions of corporate employees regarding the use of company-sponsored e-learning platforms and explores factors influencing their engagement with these systems. In today's highly competitive business environment, continuous professional development has become essential for employees; however, participation in organizational e-learning programs often remains limited. This research aims to examine the underlying reasons for low platform usage and to identify strategies for increasing employee engagement.

A qualitative phenomenological research design was employed. Data were collected through semi-structured, in-depth interviews with six employees from different departments of a large private company in Istanbul. In addition, learning management system (LMS) usage records were analyzed to support the interview data. The collected data were analyzed manually using descriptive phenomenological analysis and open coding techniques.

The findings revealed that employees demonstrated low levels of interest, motivation, and interaction with the e-learning platforms. Participants reported difficulties in establishing personal and professional relevance with the course content, limited interactivity, time constraints, insufficient managerial support, and usability issues as major barriers to system use. Furthermore, organizational policies and the absence of clear incentives were found to negatively affect participation. LMS records confirmed that platform usage rates were considerably low.

Participants emphasized the importance of internal marketing strategies, managerial encouragement, personalized learning recommendations, and reward mechanisms to enhance platform attractiveness. They also highlighted the need for improved system usability, clearer communication regarding learning outcomes, and greater alignment between organizational goals and individual development needs.

The study concludes that merely providing e-learning platforms is insufficient to ensure effective utilization in corporate settings. Instead, learner-centered designs, supportive organizational policies, and strategic engagement initiatives are required to promote sustainable participation. The findings offer practical implications for corporate training managers, human resource departments, and policymakers seeking to improve workplace e-learning practices.

Keywords: Adult Learning, E-learning, Corporate Training, Employee Perceptions, Phenomenology, Learning Management Systems

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Artificial Intelligence in Project Management Decision-Making for Uncertain Futures: Bias, Accountability, and Responsible Governance

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Artificial intelligence (AI) is increasingly integrated into project management decision-making to enhance analytical efficiency and address complex optimisation tasks. Across portfolio selection, resource allocation, risk management, and performance evaluation, AI-driven systems enable advanced analysis in data-intensive contexts. However, these technologies also introduce ethical, legal, and organisational risks. The growing interaction between AI and project management raises critical challenges, particularly under conditions of uncertainty, where accountability, transparency, and human judgement remain essential to responsible and effective decision-making. This study adopts a conceptual and interdisciplinary approach to examine the opportunities and risks of AI in project management decision-making. The analysis draws on a structured review of literature on AI-supported project management, decision-support systems, and AI ethics. The proposed governance model is informed by the EU Artificial Intelligence Act and Turkey's Personal Data Protection Law (Law No. 6698). Selected academic and regulatory cases show how weak oversight can reproduce bias, erode trust, and blur responsibility. The findings highlight that AI systems in project management should not be positioned as autonomous decision-makers but rather as explainable, auditable, and human-centred decision-support tools. In uncertain contexts, over-reliance on opaque algorithms can reinforce inequality. Institutional resilience requires human-centric decision-making structures. Supported by appropriate governance, AI strengthens learning, foresight, and adaptability while maintaining human agency. Building on this analysis, the study proposes a three-layered Responsible AI Governance Model for project management. The strategic layer focuses on institutional leadership and calls for the establishment of interdisciplinary AI ethics and risk committees that define organisational principles, risk tolerances, and compliance standards. The tactical layer addresses project-level practices by embedding ethical impact assessments, human-in-the-loop oversight, and structured appeal mechanisms into AI-supported decision processes. The operational layer translates ethical commitments into technical requirements, emphasising bias detection, explainable AI techniques, and transparent audit trails throughout the system lifecycle. From an educational perspective, this framework underscores the growing importance of digital and AI literacy as core professional competencies. Project managers and future leaders must be equipped not only with technical skills to use AI tools but also with the critical capacity to question, interpret, and responsibly govern algorithmic recommendations. In this sense, AI-supported project management becomes a learning-orientated practice that strengthens organisational resilience rather than merely a productivity-enhancing technology.

Keywords: Artificial Intelligence (AI), Project Management, Responsible AI, Algorithmic Bias, Human-in-the-Loop Decision Making, Ethical And Legal Governance

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Artificial Intelligence in Education and Employability: A Systematic Literature Review and Bibliometric Analysis in Schools of Jakarta

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Artificial intelligence (AI) is rapidly reshaping the educational landscape worldwide, influencing teaching practices, curriculum design, assessment systems, and skill development pathways. However, its structured integration within school systems—particularly in developing urban contexts such as Jakarta—and its direct implications for student employability remain insufficiently examined. While global scholarship on AI in education has expanded significantly, limited research systematically maps how AI is being adopted in Jakarta's schools and how this adoption aligns with workforce-oriented competencies. Addressing this gap, the present study conducts a systematic literature review combined with bibliometric analysis to examine the evolution, scope, and thematic patterns of AI-related educational research focused on Jakarta between 2018 and 2025.Drawing upon peer-reviewed publications indexed in Scopus and other recognized academic databases, the study applies transparent inclusion and exclusion criteria to identify relevant empirical and conceptual works. Bibliometric mapping techniques are employed to analyze publication trends, citation networks, keyword co-occurrence, and patterns of scholarly collaboration. The findings reveal a modest yet steadily accelerating body of literature, reflecting increasing academic interest in AI-driven learning environments within Indonesia. Collaboration networks show growing partnerships among Indonesian researchers and Southeast Asian institutions, indicating regional momentum in AI scholarship. Thematic analysis identifies three dominant research clusters: AI-driven pedagogy and adaptive learning systems; teacher readiness and digital competence; and the emerging discourse on AI and employability skills. Although AI adoption in Jakarta's education system is expanding—particularly through intelligent tutoring systems, learning analytics, and digital assessment tools—the implementation remains largely technology-centric. Pedagogical transformation, curriculum redesign, and structured integration of AI into competency-based learning models appear limited. Moreover, the linkage between AI-enabled education and employability competencies—such as creativity, critical thinking, collaboration, and adaptability—remains underdeveloped and insufficiently theorized. The review underscores the need for coherent policy frameworks, sustained teacher professional development, and clear ethical guidelines to ensure equitable AI integration. It concludes by proposing strategic directions for future research and practice, emphasizing alignment with Indonesia's Merdeka Belajar initiative and Jakarta's broader vision of nurturing a technologically empowered, innovation-driven, and employable generation prepared for the demands of the Fourth Industrial Revolution.

Keywords: Artificial Intelligence (AI); Education; Employability; Systematic Literature Review; Bibliometric Analysis; Jakarta Schools; Indonesia; Teacher Readiness; Digital Transformation; Merdeka Belajar.

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A Dynamic Approach of Artificial Intelligence to Inculcate Algorithmic Thinking in Language Learning

Saman Ashraf

This research study aims at inculcating a dynamic approach of artificial intelligence for inculcation of algorithmic thinking in learning of language. It includes dynamicity of automated systems which are involved in rapidity of language learning. This trend has a dynamic approach; hence this trend keeps on improving changes and procedures of learning. The objectives of the research are to demonstrate automated systems, illustrate dynamicity of artificial intelligence and express algorithmic thinking for language learning through artificial intelligence. The research study is facilitated through a hypothesis. In the hypothetical statement it has a dependent and an independent variable. Algorithmic thinking is an independent variable and learning language is a dependent variable. The research methodology for this research study is a quantitative research approach. The questionnaire is a research instrument and consists of ten items based on thematic perception called discreet variables. The research is analyzed through SPSS (Statistical Package of Social Sciences). The research is further analyzed through ANOVA achieving numerical values of mean square and Sig. The values of mean and standard deviations of discreet variables are also calculated through Statistical Package of Social Sciences. Hence, it was found that nowadays, there is an AI revolutionization of language. Turboscribe is an application of language learning and is an online for reading and listening. Gliglish is an AI-powered assistant of language learning and design fluency. Jenni.AI, an automated system for writing skills. There are automated systems which are multimodal, spoken and written. These are speech recognition devices for pronunciation in a language. Gamification utilization is for language learning. There are intelligent systems for learning and thinking. Hence, there is a dynamicity of algorithmic thinking which promotes operations of thinking such as thoughts of computer and computations. CALL (Computer Assisted Language Learning) is used for investigating language partners by using computers. These systems include dialogue systems, chatbots, and intelligent personal assistants. Therefore, it implies that curriculum is an algorithmic implementation for design and development of teaching outcomes.

Keywords: Dynamic, Algorithm, Automated Systems, Language, Learning.

(32)

Translanguaging for inclusive classrooms: The impact of using keystroke logging at various universities in multilingual South Africa

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Multilingualism has become the "hot" topic globally where researchers from various countries are trying to find ways to accommodate our multilingual learners (Pfeiffer, 2024). In this study I focus on academic writing among our multilingual students at various universities in South Africa. With the use of a keystroke logging program the students had to write an argumentative essay in English and an argumentative essay in their home language (Afrikaans, IsiXhosa, IsiZulu, Tsepedi). This qualitative study was conducted at five different universities where the students were interviewed after completing the writing of their essays in English and their home language. My objective was to see which language the student was better at in writing (home language or second language), as well as to determine how many times the student paused, back spaced or deleted words while writing in both languages. With the keystroke logging program, the students were not able to use spell check or get any assistance in their sentence structure like they normally would while working on a word document as they had limited time to complete the writing task. My findings suggest that with the use of this keystroke logging program our multilingual students' academic writing could improve because they had to solely rely on their entire language repertoire, and I could determine whether much translanguaging was occurring in their writing in English. The students had mentioned in the interview that because they had to write within a certain timeframe, they had to think faster than usual in English, and they had to be completely dependent on their knowledge of English without the assistance of the internet or the word document program. The students had also mentioned that such a program could assist them in their academic writing and that such a program should have been introduced to them in their first year at university. In conclusion, it appears as though a program like this in South Africa will definitely assist our multilingual students to learn how to spell correctly, write within a certain timeframe in a language that is not their home language, and also create proper sentence structures in their academic writing. In addition, the students are forced to rely solely on their entire language repertoire while writing in our English medium institutions.

Keywords: Multilingualism, Keystroke Logging, Home Language, Academic Writing, Translanguaging

(36)

Teaching in the Age of Algorithms: Lecturers' Perspectives on Students' Use of AI in a Comprehensive Open Distance and e-Learning (CODeL) Institution

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The introduction of artificial intelligence (AI) into higher education has led to significant changes in teaching and learning methods, particularly in Comprehensive Open Distance and e-Learning environments. The use of AI technology raises issues with ethical behaviour, the reliability of evaluations, and the changing role of lecturers, even though it also presents opportunities for improved learning support. Though AI technologies can improve learning and support, there are drawbacks to their use, including issues with moral behaviour, the reliability of tests, and the changing role of lecturers. The study aims to investigate the lecturers' perspective of students' use of AI tools for learning at a CODeL context. The objectives are to examine lecturers' awareness and understanding of AI tools used by students, to identify the perceived advantages and disadvantages of AI-assisted learning, and to determine how the use of AI may affect teaching methods and institutional policy. A mixed-methods research design will be employed, incorporating survey questionnaires and semi-structured interviews with lecturers across different academic colleges. The quantitative data will provide insights into general trends in lecturers' perspectives, while the qualitative data will offer a deeper understanding of their experiences and related concerns of student use of AI. The study seeks to contribute to broader discussions on fostering equitable, ethical, and effective AI-supported learning in the CODeL environment.

Keywords: Artificial Intelligence, Comprehensive Open Distance And E-Learning (CODeL), Lecturers, Higher Education, Students

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Artificial intelligence in higher education South Africa: The role of ChatGPT in students' learning

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We conducted this systematic review pertaining to the role of ChatGPT in higher education, with a particular focus on its impact in South African universities and on students' learning experiences. We reflect on students' use of ChatGPT's in their learning processes to provide accurate and helpful responses. Furthermore, considering the unique challenges faced by South African institutions, including uneven access to technology and varying levels of digital literacy, we evaluate its implications for academic integrity. Using PRISMA guidelines, we analysed 31 peer-reviewed articles including studies from South African universities and comparable international contexts published between 2022 and 2024. Findings indicate that ChatGPT3.5 provides a convenient and adaptable learning resource that promotes student engagement and conceptual understanding in South Africa. However, ethical concerns, including plagiarism and over-reliance on Artificial Intelligence, were noted, alongside specific challenges such as the digital divide in the South African higher education system. The study highlights the need for South African higher education institutions to develop contextually appropriate strategies for the ethical and effective integration of ChatGPT, ensuring that it enhances rather than undermines academic integrity while addressing local technological and socioeconomic disparities. Additionally, the study emphasises the importance of rethinking the digitalised curriculum in higher education to incorporate reference to ethical considerations in AI to ensure that the use of tools like ChatGPT aligns with broader educational goals and ethical standards. We recommend further research to explore the broader implications and potential ethical issues associated with AI tools in education, particularly in the South African higher education sector.

Keywords: ChatGpt, Higher Education, Students, Reliability, Fourth Industrial Revolution, Artificial Intelligence

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From Knowledge Transmission to Capability Development: Preservice Teachers' perspectives

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The 21st century demands have fundamentally shifted education from discrete bodies of knowledge. Studies assert that the traditional pedagogical models that are centred on rote learning are being challenged by approaches that prioritise broad competencies. Scholars argue that preparing PST for a rapidly changing world, there must be a shift towards development of favourable competencies. Literature further highlights that training PST to prioritise content coverage and standardized assessment modes, limit development of 21st skills. This misalignment creates a gap between contemporary educational goals and classroom practices, limiting their capacity to cultivate capacity-based learning environments. Hence, this study explored PST' understanding and enactment of the shift from knowledge to capacity development within teacher education programmes. Framed from connectivism and networked learning theories, this qualitative, phenomenological design, study explored the lived experiences of PST encountering competency-based approaches. 20 preservice teachers enrolled in competency-based programmes were sampled for the study. Data was collected through semi-structured interviews with individual preservice teachers following a focus group. All ethical procedures concerning research with humans were followed. Using Braun and Clarke strategy, the study found that rote learning is not sufficient, competencies are contextual and transferable, PST' s beliefs and pedagogy are central to the shifting. The study contributes to the rich contextualized insights into how capability-oriented approaches are conceptualized and implemented, as well as how they shape emerging teachers' professional identities and pedagogical practices.

Keywords: Competency-based, Preservice Teachers, Memorisation

(40)

Preservice teachers' experiences with computational breakdown and repair in visual programming

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Visual programming environments are widely used in teacher education to introduce foundational computational practices through immediate, visible program execution. Despite their accessibility, preservice teachers frequently encounter breakdowns in computational logic when translating intended geometric designs into executable code. These breakdowns often stem from block misconfigurations, incompatible parameter values, sequencing faults, execution constraints, and precision-related errors rather than from abstract reasoning difficulties.

Purpose: To examine the specific error states, compatibility tensions, and precision challenges that arise when preservice teachers coordinate movement, angle, repetition, sequencing, temporal control, and automation in a block-based programming environment.

Method: A qualitative multiple-case design was employed. Data were collected from preservice teachers working in pairs on structured tasks involving triangles, squares, and joint geometric patterns. Data sources included screen and video recordings, programming artifacts, and process documentation. Analysis was guided by a framework centered on breakdowns and repairs in computational logic.

Findings: Participants encountered recurring tensions, including incomplete shape closures, distorted angles, unintended repetitions, alignment gaps, overlapping outputs, and automation failures when extending simple shapes into more complex patterns. Learners often assumed that blocks would produce the intended designs, leading to mismatches between expectations and execution. As task complexity increased, minor inaccuracies in parameter selection or block placement led to more frequent breakdowns in pattern automation. Participants responded by repeatedly executing, iteratively adjusting parameters, restructuring nested blocks, introducing timing controls, and reconfiguring virtual robot (or sprite) positioning. Through these repair processes, decomposition, abstraction, and recursive structuring emerged dynamically as learners sought to restore alignment between intended and produced outputs.

Conclusion: Structured geometric tasks in visual programming expose tensions in block compatibility, parameter precision, execution timing, and automation logic that are often underexamined in teacher education contexts. By foregrounding computational error states and repair activity, this research provides a detailed account of how breakdowns shape programming practice and how preservice teachers develop increasing control over executable logic in visual programming environments.

Recommendations: Teacher education programs could intentionally incorporate tasks that surface computational breakdowns and require iterative repair rather than emphasizing immediate correctness. Instruction should address block compatibility, parameter precision, sequencing logic, and execution timing to help preservice teachers develop stronger control over automation and pattern scaling.

Keywords: Visual Programming, Block-based Programming, Computational Breakdowns, Block Misconfiguration, Preservice Teachers

(42)

Leveraging Educational Technology for Inclusive Online Learning: A UDL-Based LMS Model in Moroccan Higher Education

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In spite of expanding policy rhetoric in favour of inclusion, Moroccan higher educational institutions face problems with addressing learner variability in both fully online and blended learning environments. As empirical evidence about the influence of Universal Design for Learning (UDL) within Moroccan higher education is limited, this paper explores how an LMS model influenced by UDL can contribute to inclusive online learning and can be supportive to student motivation and engagement. The intervention took place in the context of an Educational Research course, taught to S5 students at ESEFB, Morocco, whose course design, assessment forms and learning activities were likewise designed according to UDL tenets for multiple means of engagement (recruitment), representation (access) and expression (participation). That is, the LMS was used not just as a content replication tool but also as part of pedagogical delivery which facilitated flexibility, learner autonomy and alternative pathways through assessment. A case study design using mixed methods was used. The quantitative data included in the present study were derived from LMS analytics (number of logins, patterns of resource access and assignment submissions), academic performance data as well as a post-course motivation and engagement questionnaire. Descriptive statistics were calculated as well as correlations between LMS patterns of interaction, students' motivation perception along with their behavioral engagement and academic performance. Preliminary results suggest that assessment flexibility and topic autonomy essential elements of the UDL-informed LMS model positively affected students' perceived motivation and active participation in the online learning environment. Additionally, a moderate positive correlation was noted between LMS activity levels and final course performance. This study offers empirical evidence validating the implementation of UDL in Moroccan higher education and illustrates how strategically utilised educational technology can foster inclusive online learning, enhance student engagement, and lead to improved academic results.

Keywords: Universal Design for Learning (UDL), Students Motivation And Engagement, Learning Management Systems, Moroccan Higher Education

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Learning Analytics–Based Personalized Learning Pathways in Social Studies Education: An Implementation Example

Fatih Pala

Milli Eğitim Bakanlığı

Recent advances in learning analytics have enabled more data-informed, adaptive, and personalized learning environments across various educational contexts. However, despite the growing interest in learning analytics, its systematic integration into social studies education remains limited. Social studies courses, which aim to foster critical thinking, citizenship awareness, and contextual understanding, often rely on uniform instructional approaches that may not adequately address learners' diverse needs, learning paces, and engagement patterns. This situation highlights the need for instructional designs that leverage learning analytics to support personalized learning pathways in social studies teaching. The purpose of this study is to examine the implementation of learning analytics–based personalized learning pathways in social studies education and to explore their effects on students' engagement, learning processes, and academic performance. Specifically the study seeks to demonstrate how learner interaction data can be used to design adaptive instructional pathways and provide timely feedback in a technology-supported learning environment. The study adopts a mixed-methods research design. Quantitative data were collected through learning management system (LMS) analytics, including students' access frequency, time-on-task activity completion rates, and assessment scores. Qualitative data were obtained from student reflective journals and semi-structured interviews to gain deeper insights into learners' experiences with personalized learning pathways. The participants consisted of middle school students enrolled in a social studies course implemented in a blended learning environment. Based on the learning analytics indicators, students were guided through differentiated learning pathways aligned with their performance levels and learning behaviors. The findings indicate that learning analytics–based personalized learning pathways positively influenced students' engagement and learning outcomes in social studies courses. Students demonstrated increased participation, more consistent learning behaviors, and improved academic achievement compared to traditional instruction. Qualitative findings further revealed that personalized pathways enhanced students' sense of autonomy, motivation, and responsibility for learning. However, challenges related to data interpretation, instructional workload, and ethical considerations such as data privacy were also identified. In conclusion, this study suggests that learning analytics–based personalized learning pathways offer significant pedagogical potential for social studies education. The study recommends integrating learning analytics into instructional design processes, providing professional development opportunities for teachers, and establishing ethical frameworks to ensure responsible data use. Future research should explore long-term effects and scalable models for different educational levels.

Keywords: Learning Analytics, Personalized Learning Pathways, Social Studies Education, Blended Learning, Student Engagement, Adaptive Instruction

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Pedagogical Effects of Virtual and Augmented Reality–Supported Experiential Learning Environments for Gifted Students in Social Studies Education

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Milli Eğitim Bakanlığı

Meeting the advanced cognitive, affective, and analytical needs of gifted students remains a significant challenge in social studies education. Although social studies courses aim to foster higher-order thinking skills, historical empathy, and citizenship awareness, traditional instructional approaches often fail to provide sufficiently enriched and differentiated learning experiences for gifted learners. Immersive and experiential learning environments supported by emerging technologies offer promising opportunities to address this challenge; however, empirical research examining their pedagogical effects on gifted students in social studies contexts remains limited. The purpose of this study is to examine the pedagogical effects of virtual reality (VR) and augmented reality (AR)–supported experiential learning environments on gifted students' learning processes in social studies education. Specifically, the study investigates the effects of immersive learning environments on students' engagement, motivation, conceptual understanding, and higher-order thinking skills. The study employs a mixed-methods research design. The participants consist of gifted middle school students enrolled in a social studies course implemented in an enriched learning environment. Quantitative data were collected using pre- and post-intervention achievement tests, as well as engagement and motivation scales. Qualitative data were gathered through student reflective journals, classroom observations, and semi-structured interviews. The instructional intervention included VR- and AR-based experiential learning activities aligned with the social studies curriculum, such as virtual historical site explorations, simulated socio-political scenarios, and interactive multimedia tasks. The findings indicate that VR- and AR-supported experiential learning environments positively influenced gifted students' engagement, motivation, academic achievement, and conceptual understanding. Qualitative findings further reveal that immersive learning experiences enhanced students' historical empathy, critical thinking skills, and their ability to connect past and present social issues. Students also reported increased interest in course content and greater autonomy in their learning processes. However, challenges related to instructional design complexity, technological accessibility, and teachers' expertise in managing immersive learning environments were identified. In conclusion, VR- and AR-supported experiential learning environments offer substantial pedagogical benefits for gifted students in social studies education. The study emphasizes the integration of immersive technologies into differentiated instructional practices and recommends targeted teacher professional development, curriculum-aligned immersive content development, and further research on long-term learning outcomes and scalability across diverse educational contexts.

Keywords: Virtual Reality, Augmented Reality, Experiential Learning, Social Studies Education, Gifted Students

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Creating Space(s) For Voice In First-Year English Academic Writing Contexts Through Memoir Writing

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This paper examines the extent to which memoir writing can contribute to first-year undergraduate students' development of voice in academic writing. In this paper, voice is construed as a fundamental aspect of academic writing proficiency. It entails stance-taking and an engagement with the discourses of a disciplinary community. In this qualitative case study, data was collected through individual interviews with five first-year students to gain a deeper understanding of their perceptions of voice in academic writing and how memoir writing can contribute to its development. The students were registered for an English Module at ODeL university in South Africa. The findings suggest that memoir writing enhances meta-cognitive skills that are necessary for academic writing. Students can transfer some of the skills learned through Memoir Writing Project into their academic essay writing assignments. This article provides a broader understanding of how life writing genres like memoirs can serve as a tool that can boost students' confidence to express themselves in academic writing.

Keywords: Voice; Memoir Writing; Academic Writing; Space(s)

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In Heidegger's Fundamental Phenomenological Ontology The Technologization of Education as a Fundamental Problematic

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The philosophy of the German philosopher Martin Heidegger (1889-1976) is, by its very nature, ontological. Furthermore, an entire philosophy, like his own, must essentially be a fundamental phenomenological ontology based on hermeneutics. Heidegger's philosophy also has implications for education, technology, and the technologization of education. He did not develop a philosophy of education and technology independent of ontology, nor did he view the technologization of education as a separate issue from being and, consequently, from ontology. Even while writing within the scope of his philosophy of education and technology, Heidegger continued to write about being by engaging in ontology. It should be remembered that, in addition to his thinking and writing activities, he himself was an educator, a professor who taught at German universities for decades. In Heidegger's perspective, ontological inquiries are precisely of pedagogical priority, and a comprehensive and fundamental educational curriculum will also mean ontological inquiries. On the other hand, the technologization of education is one of the most fundamental problems that the philosopher must address when discussing education. In addition, the leadership dimension of educational activity is particularly important for Heidegger.

For Heidegger, education is neither an appendage to philosophy that can be added later, nor a temporary addition or a different field whose existence or non-existence makes no difference. For Heidegger, the practical aim of philosophy, in its broadest and deepest sense, is already inherent in education. The essence and characteristic of philosophy is education. Therefore, the philosopher did not feel the need to develop a philosophy of education independent of his fundamental phenomenological ontology. Why is this? Because the technologization of education is directly linked to the technological conception and technologization of being. In short, the technologization of education is not an isolated process but a continuation of the global ontological technologization of being. In Heidegger's perspective, which is not technophobe, power-willed technologization has brought about nihilistic, inauthentic, and suffocating results in the Nietzschean sense. The only way to overcome this dystopian situation is through a philosophical approach focused on education. The aim of this study is to analyze the technologization of education, a fundamental problematic in Heidegger's ontology, in as critical a manner as possible. Methodologically, the study is a 'documentary research' and is qualitative, not quantitative. It is expected that the study will ultimately reveal refined findings regarding the educational dimensions of Heidegger's philosophy.

Keywords: Heidegger, Philosophy, Fundamental Phenomenological Ontology, Education, Technologization of Education

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Collaborative Learning in Virtual Environments: Teacher and Student Perceptions in a Pre-University Program

Maria Teresa Wulf

This research focused on analyzing the experiences of teachers and students in a non-formal education program under the virtual modality, with the purpose of analyzing the perceptions of teachers and students about collaborative learning as a teaching-learning strategy in virtual environments and its impact on a pre-university education program.

Within virtual environments, collaborative learning is configured not only as a key pedagogical strategy, but also as a permanent challenge aimed at promoting the joint construction of knowledge and the development of cognitive skills.

The study was carried out during the course of the academic year 2023 at the CPECH Pre-university of Chile, using a mixed research methodology with a case study approach, allowing a comprehensive view of the institutional reality. The qualitative data were collected through the application of focus groups with teachers and students, with a group size that varied between 4 and 6 participants. The analysis of the data obtained from the virtual focus groups was carried out using the Atlas. Ti version 8, following the specific objectives of the research. In addition, virtual questionnaires were applied to a sample of 31 teachers and 28 students. The quantitative data obtained through the implementation of the virtual questionnaires were processed automatically through Google Forms, while the open answers were analyzed qualitatively to deepen the perspectives of the participants and respond to the objectives and research questions raised.

From the teaching and student perspective, a correlation was evidenced between the methodology used and the didactic strategies implemented, which significantly influence the teaching-learning process. The findings position collaborative learning as a strategy that favors the collective construction of knowledge, the active participation of students and the development of social and cognitive skills, promoting a more dynamic learning environment, where the exchange of ideas and joint reflection strengthen and facilitate the understanding of the contents.

In this context, collaborative learning emerges not only as a determining element of academic performance, but also as a fundamental element to mitigate the absence of physical interaction inherent in virtual environments, thus favoring a social and shared construction of learning.

Keywords: Collaborative Learning; Online Learning; Non-formal Education; Educational Technology

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Assessment Redesign in Response to Generative AI: A Mixed-Methods Survey of Educators in Moroccan Higher Education

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The prevailing validity of generative artificial intelligence tools is profoundly challenging the validity of traditional recall-based assessment tasks in higher education. Given how students gained access to AI systems that are capable of producing essays, answering factual questions, and solving structured problems with minimal effort, educators and institutions are now facing a pressing necessity to reconsider what assessment tasks are really measuring and why. This paper presents findings from a mixed-methods survey examining how university educators have redesigned their assessment in response to this shift. Drawing on questionnaire data collected from 60 to 100 educators across multiple disciplines, the study documents the specific changes made to assessment design, the pedagogical rationale underpinning those changes, and the institutional and practical challenges encountered in the process. Quantitative data from Likert-scale items are analyzed using descriptive and inferential statistics, while qualitative responses are examined through thematic analysis. The study is grounded in three theoretical frameworks: Bloom's Revised Taxonomy, constructive alignment theory, and authentic assessment principles. Findings reveal a typology of assessment redesign strategies, ranging from incremental modifications to deep structural reforms, and identify the conditions that enable or obstruct authentic change. This paper, thus, argues that AI should not be perceived as a threat to academic integrity alone, but as an agent assisting with the alignment of assessment practice with educational theory, which has long advocated the development of higher-order reasoning, critical thinking, and transferable problem-solving competencies. The study concludes with a set of evidence-based design principles for AI-resilient, learning-centered assessment in higher education that offer practical guidelines for faculty, instructional designers, and curriculum policymakers.

Keywords: Generative AI, Assessment Redesign, Higher-order Thinking, Authentic Assessment in Higher Education, Academic Integrity, Bloom's Taxonomy

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Generative AI in Deaf Higher Education: Students' Attitudes and Ethical Challenges

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The rapid development of generative artificial intelligence (AI) technologies is transforming the landscape of higher education, introducing innovative tools that can enhance learning, teaching, and academic engagement. Deaf students represent a unique population whose educational experiences are influenced by distinct communication, accessibility, and social factors. Understanding how these students perceive and engage with generative AI is essential to ensure that technological advances are inclusive, equitable, and ethically grounded. This proposed study aims to investigate deaf university students' attitudes toward the adoption of generative AI in higher education and to explore potential ethical challenges related to its use.

A survey-based methodology will be employed to gather data from a representative sample of deaf students enrolled in various academic programs. The survey is designed to assess multiple dimensions, including students' perceptions of the usefulness, accessibility, usability, and reliability of AI tools, as well as anticipated concerns regarding privacy, fairness, transparency, and culturally responsive implementation. Special attention will be given to how generative AI may support independent learning, enhance academic performance, and provide adaptive learning opportunities tailored to the specific needs of deaf students.

The anticipated outcomes of this research are expected to inform educators, policymakers, and technology developers about best practices for designing AI-supported learning environments that are inclusive, accessible, and ethically responsible. In addition, this study will contribute to the broader discussion on responsible innovation and digital inclusion, highlighting how AI technologies can be implemented in ways that respect diversity and promote equitable educational opportunities for students with disabilities. By examining both the potential benefits and the challenges associated with generative AI, this study aims to provide comprehensive insights that guide future educational practices, policies, and technology development. Ultimately, the research seeks to enhance understanding of how emerging AI technologies can be leveraged to support deaf students' academic success while ensuring ethical considerations and inclusive design principles are prioritized.

Keywords: Generative AI; Deaf Students; Higher Education; Educational Technology; Ethics in AI

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Interactive Web-Based Game Learning versus Video-Based Instruction for Psychomotor Skills Training: A Randomized Controlled Trial

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Background:
Intramuscular injection (IMI) is a fundamental psychomotor competency in nursing education and directly associated with patient safety. However, traditional demonstration-based teaching methods often rely on passive observation and may not sufficiently engage digital-native learners or reduce the anxiety experienced during performance-based assessments. Technology-enhanced learning approaches, including video-based instruction and interactive web-based games, have been increasingly incorporated into skills training. Nevertheless, limited experimental evidence exists directly comparing their effectiveness in improving psychomotor performance and mitigating test anxiety.
Objective:
This study aimed to compare the effects of an interactive web-based game and video-based instruction on nursing students' IMI skill performance, test anxiety, and satisfaction with the instructional method.
Methods:
A parallel-group randomized controlled trial was conducted with 48 first-year nursing students who were randomly assigned to either a web-based game group (n=24) or a video-based instruction group (n=24). Both groups received standardized theoretical instruction and laboratory practice prior to the intervention. Psychomotor performance was evaluated using the Intramuscular Injection Skill Checklist. Test anxiety was measured with the Revised Test Anxiety Scale, and satisfaction was assessed using a Visual Analogue Scale. Data were analyzed using independent-samples t-tests and Pearson correlation analysis, with statistical significance set at $p<0.05$.
Results and Conclusions:
Students in the web-based game group demonstrated significantly higher IMI skill performance, lower levels of total test anxiety, and greater satisfaction compared with those in the video-based instruction group ($p<0.05$). No significant correlations were identified between anxiety and performance outcomes. These findings suggest that interactive, feedback-oriented game-based learning environments may enhance both psychomotor competence and emotional readiness more effectively than passive video-based approaches. The results highlight the instructional design value of integrating interactive digital tools into psychomotor skills education. Future implementations of technology-enhanced training should prioritize learner agency, real-time feedback, and scenario-based progression to optimize both cognitive and affective learning outcomes.

Keywords: Game-Based Learning; Psychomotor Skills Training; Nursing Education; Test Anxiety; Instructional Design; Digital Learning

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From Technology Adoption to Innovation: The Role of Artificial Intelligence in Transforming Teaching Practices

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The world is now modifying industries with the advent and advancement of AI and robotics. The educational sector too has undergone a redefining wave. The paper investigates how AI and robotics have a great role to play in the educational sector taking into consideration some of the factors that determine the promotion of innovation among educators. Surveying teachers has involved a quantitative approach to explore the implications of AI and robotics on some of the teacher skills. These competencies are problem solving, critical thinking, teamwork and communication. The results of the findings have been exposing that AI supported tools present big improvements of individual learning, interactive learning/experience and efficient learning that promote innovation amongst teachers. This paper explores the way AI and robotics can be integrated into the teaching process as a way of encouraging innovation among educators. The results will be used to give recommendation to the teachers, administrators, policy makers and researchers who would wish to have some evidence to validate the fact that these technologies have improved the quality of teaching.

Keywords: Artificial Intelligence, Problem Solving, Critical Thinking, Innovation, Teaching;

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Bridging Educational Gaps through Distance Education: Implications for Human Capital Development in Pakistan

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The current research examined the application of Open and Distance Education (ODE) in developing human capital in Punjab, Pakistan. The open and distance education programs are strategic platforms for improving intellectual capacity and developing literacy and managerial efficiencies, which are required to sustain the socio-economic growth. The population of the study was the students of the Virtual University of Pakistan. There was a purposive sampling technique that was used to pick a sample of 280 students. The research design was a survey research design that was used to obtain quantitative data by using descriptive statistics. A structured questionnaire designed by the researcher due to the relevant literature and other earlier studies to gather data through the employment of a five-point Likert scale was used to gather data. The construct was evaluated based on face validity by a group of experts in teaching and education disciplines and subsequently piloted to a small sample of respondents in order to confirm its internal consistency and reliability.

The results showed that distance teaching and learning can be greatly developed by intellectual capacity building, character development of the learners, provision of qualified and certified facilitators, and good administration coordination, hence improving human capital growth. Moreover, open and distance education was discovered to foster literacy, self-reliance, consciousness, and the development of society. The paper concludes that good management and a well-organized distance education system can play a significant role in the development of the workforce and economic well-being in Punjab, Pakistan. It is suggested that governance structures based on merit be established with a stronger foundation, the government should be given proper instructional facilities, and the distance education syllabus should correspond with the improvement of literacy, problem-solving ability, and discipline-oriented development of human capital to cater to the demands of the modern socio-economic needs in Punjab, Pakistan.

Keywords: Open And Distance Education, Human Capital, Intellectual Capacity Building, Socio-economic, Punjab, Pakistan.

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Determinants of Academic Integrity Judgement in the Era of Artificial Intelligence in South African Higher Education

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The growing adoption of AI tools in higher education has raised substantial ethical concerns, particularly around the use of AI-generated content in student assessments. This study investigates lecturers' intentions and ethical decisions in response to AI-generated assignments at South African universities. Based on the Theory of Planned Behavior (TPB) and moral reasoning theory, the study investigates how attitudes toward AI use, subjective norms, perceived behavioral control, and moral judgments influence lecturers' responses to AI-assisted academic work. TPB provides a framework for understanding lecturers' intentions to identify, tolerate, or censure AI-generated contributions, whereas moral reasoning provides insight into ethical evaluations relating to academic integrity, fairness, and professional accountability. A quantitative descriptive research design was used. A structured online questionnaire was conducted via SurveyMonkey to academic staff at three South African universities. The survey assessed lecturers' understanding and usage of AI technologies, opinions of institutional policies, confidence in recognizing AI-generated content, and ethical perspectives on AI use in evaluations. The findings add to a more complex understanding of how ethical reasoning and behavioral goals interact to influence lecturers' choices about AI-generated assignments. The findings have practical implications for institutional policy development, academic integrity frameworks, and professional development programs focused at promoting ethical and informed responses to AI integration in South African higher education.

Keywords: AI Tools, Theory of Planned Behavior (TPB), SA Higher Institution, Ethical Decision Making

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Teachers and learners' co-creation in an AI-integrated learning environment: the technology stewardship and challenges in higher education

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To automate interactions between stakeholders, such as students, instructors, administrators, technology providers, and academic governing bodies, higher education institutions (HEIs) have embraced AI-integrated platforms. HEIs employ gamification, AI-integrated pedagogies, authoring tools, video conferencing, and learning management systems to co-create educational value. The overwhelming use of AI is transforming how knowledge is created, shared, and evaluated, necessitating technological stewardship from stakeholders. Hence, the AI and value co-creation have catalyzed a critical discourse concerning responsible AI adoption. Literature describes responsible AI as “a way to design, use, and manage AI systems in higher education that focuses on principles, good governance, and people, ensuring ethics, transparency, accountability, fairness, and alignment with teaching goals, while allowing everyone involved to co-create value together”. Yet an AI-integrated learning environment has brought complexities and challenges, including technology stewardship, resource disparities, algorithmic bias, data security, intellectual integrity, and faculty readiness to accept students as co-creators. There is a noticeable research gap on how contemporary learners responsibly adopt technology while leveraging their inherent tech-savviness and digital fluency. HEIs initially position students as partners, but contemporary learners are assuming their roles as co-creators without understanding requisite competencies. The literature lacks focus on the adoption of responsible AI integration, which overlooks learners’ readiness to transition from students to co-creators and teachers' stewardship. Hence, the research question is, “What are the typologies of technology stewardship and challenges associated with engaging contemporary learners as co-creators in an AI-integrated environment?”. This qualitative study was conducted in HEIs while exploring the co-perspectives. With purposive sampling, data were collected from fifteen learners through a focus group, followed by structured interviews with eight teachers. The data showed that HEIs have significant difficulties in involving digital natives in AI-integrated learning as co-creators, such as capacity building, balancing agency among actors, incentives, transparency, workload management, data privacy, and multifaceted collaboration styles. It is also inferred that technology stewardship is more challenging for teachers as they are reluctant to share their powers and roles with learners. HEIs can develop customized strategies and training programs for teachers and contemporary learners to produce educational value in an AI-integrated learning environment. It can also unleash the potential of contemporary learners, enabling them to actively engage in customizing their educational experiences.

Keywords: Value Co-creation, AI-integrated Learning, Higher Education, Contemporary Learners

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A Case Study of Gender and Major Differences in Extracurricular Activities in the Context of a Gender-Equity Change

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The present study examined extracurricular activities through the lens of female and male undergraduate students' participation, engagement, and academic attainment. It focused on an unrepresented population of undergraduate students whose country has only recently implemented gender-equity laws, overshadowing a long-standing patriarchal system that curtailed education and employment opportunities for women. Selected were 1424 undergraduate students who attended extracurricular events offered during an entire semester. Participants included both male and female learners who were pursuing either a STEM or a non-STEM degree. Students were surveyed at the end of each event they attended to measure their cognitive, affective, and behavioral engagement. In this study, female students were more motivated to participate in extracurricular activities and displayed higher cognitive engagement than males. There were no gender differences in affective and behavioral engagement. However, for females only, behavioral engagement was higher among STEM than among non-STEM learners. For both sexes, academic attainment, as measured by GPA, was modestly correlated with cognitive engagement. These findings underscore women's struggle to emerge as reliable members of the workforce within a social fabric that is adjusting to their country's recent gender-equity changes in educational and professional fields.

Keywords: Innovation, Technology, Research Projects

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Redefining ODL under NEP 2020: Policy Integration and Implementation Trends

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National Education Policy 2020 (NEP 2020) is a transformative step in the Indian education system. NEP 2020 has aimed to achieve 50% gross enrolment ratio (GER) in higher education by 2035. The introduction of the NEP 2020 has initiated comprehensive reforms across Indian higher education. It emphasises providing flexibility, multidisciplinary, digital integration, and inclusive access to the learners. Open and Distance Learning (ODL) institutions play a key role in achieving the objectives of NEP and expanding the Gross Enrollment Ratio and democratising education. However, the extent to which NEP 2020 will be able to structurally and pedagogically transform ODL remains underexplored in academic literature.

As the policy suggests, NEP has introduced multiple entry and exit systems, an academic bank of credit, value and skill-based courses that leverage education. Multiple Entry and Exit will allow students to exit after completing one/ two/ three years and storing the credits earned in the Academic Bank of credit and it further allows students to rejoin at their desired year in the same or different institution. It also gives the opportunity to the student to earn additional credits to complete a degree/diploma/certificate through other openly available MOOCs, other approved courses, etc. The students shall be able to seamlessly move from a regular mode institution to a distance mode institution and earn credits online from recognised portals. The NEP 2020 policy mandates that the quality of open and distance mode learning must be at par with the highest standards of on-campus programs. The NEP 2020 has brought distance education in fore front from second class alternative to regular mode education. By ensuring credit mobility and maintaining quality parity with regular mode education, the policy will make ODL a core pillar for achieving the GER target.

This review paper aims to systematically examine the provisions of NEP 2020 and the evolving framework of distance education in India. It shall help in identifying various emerging trends, pedagogical shifts, institutional challenges, and research gaps between effective implementation of NEP in the ODL System, which shall be useful to strengthen distance education.

Keywords: National Education Policy 2020; Open And Distance Learning; Higher Education Reform; Digital Transformation; Academic Bank of Credits; Blended Learning; Policy Implementation.;

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Role of Artificial Intelligence in Higher Education: A Bibliometric Mapping

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Artificial Intelligence (AI) has rapidly transformed over the years, with a dramatic impact on education. It has drastically reshaped higher education by impacting pedagogical methods, evaluation systems, student roles, and administration. Although there are various studies that have focused upon the technological applications of AI, there are very few which have focused upon the impact of AI on the psychological aspect. In this study, a thorough bibliometric and scientific mapping analysis of 4,204 Scopus-indexed publications shall be carried out on Artificial Intelligence in Higher Education, published across the years from 2020 to 2026.

Findings indicate that there has been an exponential increase, with scholarly articles and research papers rising over 3,800% from 2020 to 2025. It signifies a transition from experimental adoption to systemic academic integration. Thematic analysis highlights research areas in the field of adaptive learning systems, learning analytics, generative AI tools, and academic integrity, as well as developing themes including student motivation, cognitive load, emotional reactions to AI-mediated learning, and teacher preparedness. Recent work increasingly emphasises ethical governance, psychological well-being, and human–AI collaboration in academic environments.

The findings highlight the necessity of aligning AI implementation with the psychological principles of engagement, autonomy, and socio-emotional development within the framework of India's National Education Policy 2020 (NEP 2020). The policy highlights the importance of technology integration, multidisciplinary learning, and a learner-centric approach. This paper focusses upon the the conceptual progression of AI research in higher education, offering suggestions and directions to the stakeholders and policymakers aiming to balance technical advancement with psychological welfare and pedagogical integrity.

Keywords: Artificial Intelligence, Higher Education, Educational Psychology, Learning Analytics, Student Engagement, NEP 2020, Human–AI Interaction

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The Intelligent OER Ecosystem: How AI, Analytics, and Collaboration Shape Learner Autonomy and Engagement

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Open Educational Resources (OER) provide free access to learning materials, but many existing platforms are still passive and do not support active or personalized learning. This study presents the Intelligent OER Ecosystem, a new model that uses artificial intelligence (AI), learning analytics, and collaboration tools to improve learner autonomy and engagement in higher education. The research is based on Self-Determination Theory, the Community of Inquiry framework, and Connectivist learning theory. A mixed-method approach was used with students from the College of Education at SQU University, combining surveys with interviews and focus groups. The results show that learning analytics helped students plan and manage their learning more effectively, while collaborative tools encouraged communication and teamwork. Students reported higher motivation, independence, and interaction. The study suggests that intelligent OER systems can transform open learning into a more adaptive, engaging, and learner-centered experience for university students.

Keywords: OER, Learning Analytics, Learner-centered Experience, Connectivist Learning Theory

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Curtailing the Cognitive Miser Phenomenon: To Use or Not to Use Generative-AI for Writing Assignments

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The notion of cognitive misery refers to human beings' basic tendency to prefer cognitive operations with low computational demands (shortcuts). The popularity of AI generative tools has led educators to be concerned about the potential impact on students' cognitive functioning. Namely, students' excessive reliance on AI, such as for writing homework assignments, may reinforce this human tendency to the point at which the writing product is good, but the student cannot thoroughly explain its content. The present field study examined the consequences of writing assignments in class or at home on test performance for questions involving level 4 of the Bloom taxonomy (analysis). Sections of freshman-year general education courses (Introduction to Psychology and World Civilizations, 1500 – Present) offered during separate semesters were randomly assigned to one of two conditions: control and treatment. In the control condition, students wrote the assignments at home under specific instructions not to use generative AI. In the treatment condition, they wrote the assignments in class with the aid of the materials that would have been available at home (i.e., the textbook and selected readings). All students were instructed to prepare for assignments by relying on their textbook and/or selected readings while avoiding generative AI tools. Two assignments were written before the midterm test, and two were written after it. All assignments involved level 2 (understanding) and level 3 (application) of the Bloom taxonomy. Tests engaged level 4 (analysis). In this study, students who wrote assignments in class exhibited higher test grades on analysis questions than students who wrote the assignments at home. Attendance rates, which measured behavioral engagement, did not differ. Scores for in-class participation activities, which indexed cognitive engagement, also did not differ. Yet, in the treatment condition, students' expectations for their final test performance tended to be less inflated. It was concluded that preventing the use of AI in writing by monitoring students' assignment completion may foster deeper levels of learning, ultimately benefiting test performance based on higher-order critical thinking skills and metacognition.

Keywords: Critical Thinking, Bloom Taxonomy, Deep Learning, Global South

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EduSphere: Dynamic OER Platform for an Active Learning Lifecycle

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Digital transformation is rapidly reshaping higher education, creating an urgent demand for learning materials that are freely accessible, interactive, adaptive, and engaging. Open Educational Resources (OER) have made it easier for teachers and students to access affordable learning content, but many existing platforms still act as static libraries. They allow access to open learning materials but do not fully support the active learning processes i.e., collaboration, and reflection.

This study introduces EduSphere as a dynamic OER platform designed to support the full active learning cycle, from initial engagement to reflection and knowledge sharing. EduSphere integrates tools that align with the 5Rs of OER: allowing users to retain content for personal use, reuse it in different contexts, revise it for local needs, remix it to create new materials, and redistribute it for wider sharing. The system also includes collaboration features and analytics tools to personalize learning and track student progress.

This study employed the Technology Acceptance Model (TAM) as a theoretical underpinning framework to examine student adoption and subsequent use of EduSphere. The research followed three phases. Phase 1 involved developing the EduSphere system with collaborative and analytics features. Phase 2 implemented a six-week study with 57 undergraduate students from the College of Education at Sultan Qaboos University (SQU). The experimental group used EduSphere, while the control group used a traditional OER platform. Phase 3 collected data through pre- and post-questionnaires on learner autonomy and engagement, as well as usage analytics.

What emerges from the preliminary results reported that that EduSphere improved students' ability to plan, monitor, and reflect on their learning. Students using EduSphere showed higher motivation, more interaction with materials, and greater participation in peer learning. The study provides a model for designing intelligent OER platforms that move beyond content access to promote personalized, collaborative, and open learning based on the 5Rs of OER.

Keywords: EduSphere, OER, Student Engagement, Collaborative Learning, Higher Education

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Reimagining Studio-Based Art Education: An Augmented Reality Mobile Learning Model

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Rapid digital transformation necessitates a reconsideration of the traditional studio-based structure of art education. Art education, in the context of uncertain futures, must cultivate not only aesthetic production but also practical competence, adaptability, digital literacy, and responsible creative engagement. This study introduces EduArt Mobile, an augmented reality (AR)-based mobile learning model, and discusses how it contributes to the digital transformation of art education. By enriching experiential learning with digital layers, the model aims to make practice-based art education spatially independent, flexible, and accessible.

The application was developed using a design-based research approach grounded in theories of digital transformation, experiential learning, and mobile learning. The model was initially designed for the Darkroom Practices course, which holds significant importance in the history and teaching of photography. Augmented reality overlays three-dimensional instructional materials, technical prompts, guided directions, and interactive content onto the physical environment. This enables simulation-supported experiences of enlarger operation, chemical processing stages, and printing procedures. Gamification elements were incorporated to foster enjoyable learning experiences and enhance motivation. The prototype was piloted with fine arts students and instructors, and qualitative data were collected through observation, reflective feedback forms, and semi-structured interviews.

Preliminary evaluations indicate that the model was perceived as engaging, motivating, and pedagogically supportive. By offering unlimited repetition without consuming film, paper, or chemicals, the application reduces material waste and provides a cost-efficient, environmentally responsive alternative. In traditional studio settings, instructors may struggle to provide equal guidance to large groups of students simultaneously, resulting in unequal learning experiences. EduArt Mobile functions both as a supportive instructional tool in face-to-face classroom environments and as an independent learning platform accessible anytime and anywhere. The system can be readily adapted to hybrid and online learning contexts and enables students with mobility impairments to experience course content and practice simulations without being physically present in the workshop. In this respect, the model promotes a more inclusive and accessible approach to art education. Furthermore, the system architecture allows for future integration of AI-supported personalized feedback and adaptive guidance modules. Overall, the study proposes a scalable pedagogical model for a digital, inclusive, sustainable, and resilient future of art education.

Keywords: Photography Art Education, Digital Transformation, Augmented Reality, Mobile Learning, Sustainable Learning, Inclusive Education

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Understanding Generative-Ai Use in Higher Education: Evidence From Nigeria

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The rapid evolution of Generative Artificial Intelligence (Gen AI) has significant transformative impact on higher education systems universally. This study investigated lecturers' and students' awareness, accessibility, intention, and use behaviour of Generative AI tools in universities in Borno State, Nigeria. Grounded on two theories, the Technology Acceptance Model (TAM) and Theory of Planned Behaviour (TPB), the research adopted a descriptive survey design and analysed data using Partial Least Squares Structural Equation Modelling (PLS-SEM). Findings revealed moderate awareness but limited accessibility and low actual utilisation of Gen AI for academic practices. Perceived usefulness and perceived ease of use significantly predicted lecturers' intention to use Gen AI, while behavioural intention strongly influenced actual use behaviour. Accessibility also had a direct impact on utilisation. The major constraints identified include infrastructural deficits, limited training for the lecturers, high subscription costs, ethical concerns, and absence of institutional policies governing AI use in the universities. Consequently, the study concludes that structured institutional frameworks, AI literacy programmes, and infrastructural investment are critical to fostering responsible and effective Gen AI adoption in Nigerian universities.

Keywords: Generative Artificial Intelligence, Awareness, Accessibility, Behavioural Intention, Use Behaviour, Higher Education, Nigeria

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AI-Mediated Hospitality English Labs: Repositioning English as a Professional Working Language in Vocational Tourism Education

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Artificial Intelligence is transforming tourism and hospitality workplaces by reshaping how communication, service delivery, reservation systems, and customer interaction are organized. Yet in many vocational education contexts, English is still taught as a general academic subject rather than as a professional working language embedded in authentic occupational tasks. This creates a gap between classroom learning and the evolving realities of AI-augmented service environments.

This presentation introduces an innovative pedagogical model developed in a vocational tourism high school in Türkiye: AI-Mediated Hospitality English Labs. The model integrates English language learning, vocational simulation, and AI-supported task design through realistic hospitality scenarios. Rather than practicing language through isolated exercises, students engage in professional tasks such as welcoming international guests, handling reservations, responding to complaints, designing travel suggestions, and managing front-office communication with AI-supported scaffolding.

The model is based on the principle that vocational language education should reflect workplace realities. In this approach, AI is not treated as a separate technical topic, but as a pedagogical support tool that helps learners perform meaningful professional communication. As a result, students develop not only language competence but also digital awareness, adaptability, confidence, and problem-solving skills relevant to future tourism occupations.

The presentation shares the pedagogical rationale, learning design, sample task structures, and early classroom reflections from the implementation process. It argues that AI-supported vocational language learning can offer an inclusive, practice-oriented, and future-responsive approach to education in uncertain times. The study contributes to current discussions on AI-driven innovation in teaching and learning, AI-supported language education, and teacher professional development for digitally enriched vocational education.

Keywords: AI in Education; Vocational Education And Training; Tourism Education; English Language Teaching; Educational Technology; Future Skills

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AI Use Among Language Teachers in Higher Education Institutions

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The rapid development of artificial intelligence (AI) is reshaping teaching and learning practices in higher education, particularly in language education. Artificial intelligence (AI), particularly generative AI tools such as ChatGPT and AI-enabled writing assistants, is increasingly influencing language education in higher education (Belda-Medina & Calvo-Ferrer, 2022). Tools such as text generators, grammar checkers, and automated feedback systems offer new possibilities for lesson planning, material development, and assessment (Lee, 2025). Yet, little is known about how language teachers in Azerbaijan's universities and colleges are adopting these tools, the purposes for which they are used, and the concerns teachers associate with their integration. This study investigates AI use, practices, and perceptions among language teachers in higher education in Azerbaijan, with attention to pedagogical applications, professional needs, and ethical considerations.

The research employs a cross-sectional survey design. Data are collected via an online questionnaire distributed to language teachers (e.g., General English, EAP/ESP, and other foreign languages) working at higher education institutions across Azerbaijan. The survey contains demographic and professional background items, questions on awareness and frequency of AI use, items on specific instructional and administrative uses (e.g., lesson planning, material development, feedback on student writing, assessment design), and Likert-scale statements measuring perceived usefulness, risks, and readiness for institutional adoption. Open-ended prompts capture teachers' views regarding benefits, limitations, and policy needs. Quantitative data are analyzed using descriptive statistics and group comparisons (e.g., experience level, course type), while open responses are examined using thematic coding to identify recurring opportunities and concerns.

Preliminary findings suggest that a growing number of language teachers are experimenting with AI tools, primarily for lesson preparation, material creation, and providing feedback on student writing. While many teachers view AI as a supportive and time-saving resource, concerns regarding academic integrity, student over-reliance on technology, and the absence of clear institutional guidelines are also evident. The study highlights the need for targeted professional development and clear policy frameworks to support responsible and effective AI integration in language education. By providing insight into teachers' experiences and perceptions, this research contributes to the ongoing discussion on the role of AI in higher education. It offers implications for teacher training and institutional decision-making.

Keywords: AI, Language Education, Higher Education

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Exploring the Impact of Unsupervised AI Interaction on Adolescent Identity: A Case Study from MIB High School

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In the era of unstoppable growth and widespread use of artificial intelligence (AI), students are more likely to engage with AI tools independently. This raises questions about the impact of such unsupervised utilization on their identity development. The study investigates the relationship between these two variables among high school students; Common Core students in Mouad Iben Jabal High School in Oujda, Morocco. Two different tests were adopted to collect data: the first assessed the participants' unsupervised use of AI, and the second measured their identity development. The first test is the Composite AI Utilization Index (CAI), developed to quantitatively measure the extent, Autonomy, and purpose of students' AI use, conforming to the level of adult or institutional supervision: CAI = (Frequency + Autonomy + Purpose Score) − Supervision. This is grounded in self-determination theory (Deci & Ryan, 1985), the Uses and Gratifications Theory (Blumler & Katz, 1974), and the Technology Acceptance Model (Davis, 1989).The second instrument is designed based on Erikson's Psychosocial Theory to assess the students' coherent sense of self compared to their experience of role confusion, uncertainty, and instability. The scores obtained from the two tests were analyzed using Pearson's correlation test. The present inquiry appeals to the urgent implementation of AI literacy programs in educational contexts. The establishment of the CAI instrument is a contribution to the academic realm that supports future longitudinal and cross-cultural research endeavors.

Keywords: CAI, Erickson Theory, Identity, Self-Determination Theory, Technology Acceptance Model, Unsupervised AI Use, Uses And Gratifications Theory.

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GenAI and Multilingualism: Comparing ChatGPT and Educators' Detection of Cross-Linguistic Transfer in University Students' Essays Written in English (L3)

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Recent advances in Generative artificial intelligence (GenAI) have sparked growing scholarly interest in its potential role in multilingual language assessment. Prior GenAI–educator assessment studies largely examined surface features of writing, with limited attention to how each identifies cross-linguistic transfer (CLT). To fill this gap, the current mixed-methods study compares the efficacy of ChatGPT (GPT-5) as a tool for detecting instances of CLT and educators' assessments of university students' narrative essays written in English as a third language (L3). A corpus of essays was analyzed, using a feature-based coding framework, based on transferred category (phonological/orthographic, lexical-morphological, syntactic, semantic, and discourse-pragmatic), type of transfer (negative or positive), and directionality (from Standard Arabic (L1) or French (L2). Descriptive and inferential analyses, including chi-square tests and Cramér's V effect sizes, revealed that ChatGPT outperformed educators in both detecting more instances of transfer across all five aspects as well as the type of transfer. However, a non-statistically significant effect was found at the level of transfer directionality between the two. Moreover, qualitative thematic analysis revealed several disparities, including ChatGPT's lower accuracy compared to educators in detecting transfer instances from L1 to L3. Accordingly, several implications were offered for educators, multilingualism researchers, and AI developers.

Keywords: ChatGPT-generated Feedback, Educators-provided Feedback, Cross-linguistic Transfer, Multilingualism, University Students

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Development and Validation of an Adult Education Framework in The Philippines

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This study proposes a unified adult education model designed to guide the development of a comprehensive adult education framework within Philippine higher education institutions. Adult education programs are conceptualized as encompassing professional advancement, personal enrichment, socioeconomic mobility, and community development. These programs are structured to support diverse adult learning experiences, including experiential, non-experiential, and certified forms of learning. Recognizing the growing demand for lifelong learning and flexible educational pathways, the study positions adult education as a strategic mechanism for inclusive and sustainable national development.

Employing a transnational research approach, the study examines existing adult education frameworks at both national and global levels. Specifically, it aims to: (a) review best practices and analyze current policy frameworks worldwide, identifying their stages of development, critical issues, implementation barriers, and systemic challenges; and (b) design a typology of adult education supported by a coherent set of concepts and operational definitions to inform national policy and institutional development in the Philippines. By situating the Philippine context within broader international and Southeast Asian experiences, the study draws comparative insights that enhance policy relevance and contextual responsiveness.

Methodologically, the research is grounded in the interpretative-exploratory paradigm. It seeks to generate both insider (emic) and outsider (etic) perspectives on adult education practices, allowing for a nuanced understanding of how regional and local realities shape institutional responses. Data were analyzed to determine how adult education initiatives within Southeast Asia and other global contexts influence the strategic direction of Philippine higher education institutions.

The resulting framework is anchored on five guiding principles: enabling individuals, expanding access and opportunities, ensuring sustainable communities, fostering strong institutional and community linkages, and strengthening information and communication technology (ICT) infrastructure. To operationalize these principles, the model integrates key support systems, including professional development for educators, responsive program design, competency management, recognition of prior learning and certification mechanisms, knowledge management systems, flexible and distance learning modalities, quality assurance structures, and sustained research support. Collectively, the proposed framework provides a strategic blueprint for institutionalizing adult education as a dynamic, inclusive, and future-oriented component of Philippine higher education.

Keywords: Adult Education, Higher Education Institutions, Lifelong Learning

(85)

Innovation in Second Language Learning for Rural Senior Citizens: A Hybrid Model involving Universal Design for Learning and Generative Artificial Intelligence

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This study presents a proposal for hybrid training in second language learning (2LL) aimed at senior citizens living in rural environments, together with an exploratory analysis of its potential cognitive and psychosocial impact. The theoretical framework is based on Universal Design for Learning (UDL), an approach that seeks to create inclusive and accessible educational environments for diverse learners. These principles are particularly relevant to 2LL due to the expected diversity of cognitive styles, educational backgrounds, and learner needs. In addition, recent developments in digital technologies and Artificial Intelligence (AI) tools have expanded the possibilities for applying these principles through multimodal resources, personalized support systems, and interactive practice environments.

The study presents the I-ASES (AI Supported 2LL for Senior Students in Rural Environments) pilot experience, which was developed in a small rural town in northwestern Spain. The research adopted an exploratory and qualitative approach based on the triangulation of data from initial and final questionnaires, observation of the training experience, and analysis of participants' learning outcomes. The sample consisted of 25 individuals over the age of 55. Following their preferences, a five-week course was structured around thematic projects related to local memory, regional culture, and participants' personal experiences. Learning activities included the creation of micro-stories, visual projects, musical productions, etc., and were strategically integrated with everyday life and community interaction. The training process combined autonomous work using digital tools with weekly face-to-face meetings coordinated by a course facilitator and continuous support through an instant messaging group. A central element of the model was the development of TioBot, an AI-based conversational agent specifically designed to support 2LL among older adults. The system acted as a digital tutor, providing adapted conversational practice, explanations, and suggestions for further personalized activities. Its design aligned with UDL principles by offering multiple forms of interaction, learning, and demonstration of progress.

The results of the study suggest that this hybrid model may contribute positively to language learning, cognitive stimulation, and psychoemotional well-being, while also creating opportunities for social interaction in contexts characterized by demographic aging and territorial dispersion. Although the small sample size and exploratory nature of the research prevent generalizable conclusions, and several technological and competence-related aspects were identified as areas for improvement in future iterations of the course, findings point to the potential of Hybrid AI-assisted Language Learning (h-AILL) as an educational modality for older adults' that enhances active aging and overall wellbeing in rural areas.

Keywords: Universal Design for Learning; Hybrid Artificial Intelligence Assisted Language Learning; Vulnerable Learners in Deprived Areas.

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Critical Adoption of Generative AI in Scientific Research: Evidence from Omani Higher Education

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The rapid advancement of Generative Artificial Intelligence (GenAI) tools is reshaping scientific research practices across disciplines, raising critical questions about adoption, ethics, and governance in higher education. This study examines academics' perceptions and use of GenAI in scientific research within higher education institutions in the Sultanate of Oman, guided by the Technology Acceptance Model (TAM). Using an explanatory sequential mixed- methods design, quantitative data were collected through a survey of 450 academics across diverse disciplines, followed by in-depth interviews with 10 academics. The study investigated five core dimensions: Actual Use, Ease of Use, Perceived Usefulness, Perceived Challenges, and Intention to Use. Findings indicate that GenAI tools - particularly ChatGPT - are already embedded to varying degrees in research practice, with nearly four-fifths of academics reporting at least occasional use. Perceived usefulness and ease of use were high, especially for early-stage research activities such as idea generation, framework development, and drafting, and both were strongly associated with positive adoption intentions. At the same time, academics reported substantial challenges, including concerns about overreliance, reduced critical thinking, fabrication of references, and threats to academic integrity. Regression analysis showed that ease of use and perceived challenges significantly predicted perceived usefulness, suggesting a pattern of critical rather than unreflective adoption. Despite strong intentions to continue using GenAI, awareness of institutional policies regulating its use in scientific research was limited, revealing a governance gap. The study extends TAM by highlighting the co-existence of perceived benefits and challenges in high-stakes research contexts and offers policy-relevant insights for guiding the responsible, ethical, and sustainable integration of GenAI in higher education research.

Keywords: Perceptions; Academics; Generative Artificial Intelligence (GenAI); Scientific Research; TAM; Higher Education; Sultanate of Oman

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From Awareness to Action: Building Student Resilience Against Deepfakes in a VUCA World

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The rapid advancement of Generative AI (GenAI) and deepfake technologies has transformed digital communication and content creation, offering both innovative opportunities and profound ethical challenges especially in a volatile, uncertain, complex, and ambiguous (VUCA) world. This study investigates the digital awareness of deepfake technologies among university students, focusing on their ability to identify, interpret, and respond to manipulated media. Adopting a sequential mixed-methods approach, the study first surveyed 102 students at Sultan Qaboos University using a structured questionnaire, followed by focus group interviews for deeper qualitative insights. Findings reveal that while students exhibit basic familiarity with GenAI and deepfakes, most lack the critical skills needed to verify and evaluate such content. Scenario-based responses indicated a strong influence of institutional authority and a higher susceptibility to visual misinformation compared to text-based content. Students often relied on peer opinion or source credibility rather than systematic fact-checking. Ethical awareness of deepfakes was present but limited, with many students unaware of the legal and societal consequences of misuse. The study recommends integrating digital literacy, critical thinking, and AI ethics into university curricula to build students' capacity for responsible digital engagement. Institutional policies should also support structured verification protocols and awareness campaigns. By addressing these gaps, higher education institutions can play a pivotal role in preparing students to navigate the complexities of an AI-driven, VUCA world.

Keywords: Generative AI; Deepfake Technologies; Digital Awareness; Student Resilience; VUCA World

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Enhancing Statistical Understanding Through Experiential Learning: Evidence from an Undergraduate Statistical Methods Course

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Teaching statistics effectively remains a persistent challenge in higher education, as many students perceive statistical concepts as abstract and disconnected from practical application. Bridging this gap requires pedagogical approaches that allow students to actively engage with data and develop meaningful analytical skills. This study examines the impact of experiential learning strategies implemented in the Statistical Methods (MATH 1313) course at Prince Mohammad Bin Fahd University (PMU).

The course was redesigned to incorporate experiential learning activities that connect statistical theory with real-world contexts. These activities included student-led data collection, collaborative statistical investigations, case-based analysis, and project-based interpretation of statistical outputs. Students worked with authentic datasets and applied statistical software to perform descriptive and inferential analyses, encouraging active participation in the complete statistical inquiry process.

The study employed a mixed-methods research design combining classroom observations, student perception surveys, and comparative analysis of student performance before and after the introduction of experiential learning activities. The results indicate improvements in student engagement, conceptual understanding of statistical methods, and confidence in applying statistical reasoning to real-world problems.

When we look at the results, it's clear that adding hands-on learning to statistics classes can really make a big difference in how well students understand statistics, think critically, and stay motivated. The framework we're suggesting is a flexible teaching model that can help colleges develop students' skills in working with data. This approach can be used in many different settings, making it a great way to improve undergraduate education. By focusing on real-world experiences, we can help students develop the skills they need to succeed in a data-driven world.

Keywords: Experiential Learning; Statistics Education; Active Learning; Student Engagement

(90)

From Probation to Progression: An Early Detection and Retention Framework for Academic Success — A Case Study of Prince Mohammad Bin Fahd University

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Student retention and progression remain major challenges in higher education, particularly for students who encounter academic probation during their studies. In many universities, probation functions as a reactive status applied after academic performance has already declined. This study proposes a data-driven early detection and support framework designed to identify students at academic risk and provide timely academic intervention. The framework is examined through a case study at Prince Mohammad Bin Fahd University (PMU).

The approach combines the school's academic rules with learning analytics to monitor how students are doing throughout their degree programs. Some important signs of how students are doing include their overall GPA, whether they have failed classes more than once, how often they attend classes, how many credits they complete, and how they are doing compared to the maximum time they have to finish their studies, as set by the Saudi Ministry of Education. All these signs are put together to create a Student Academic Risk Index, which helps find students who might need extra academic help early on.

When students are identified as needing help, they get to be part of a system that gives them extra support. This system includes things like advisors who help them plan their studies, personalized plans to help them learn, tutors to assist them, and regular checks to see how they're doing. If students are having trouble and are at risk of not meeting the school's requirements or have been on probation multiple times, they go through a special review process to figure out what they need to do to get back on track.

Research shows that when schools keep a close eye on their policies and use learning analytics, they can step in earlier to help students and improve their progress. This approach can change the way probation is used, from just being a reaction to a student's struggles to a proactive way to support them and help them succeed and stay in school. By doing so, it can become a powerful tool to boost student success and retention, rather than just a sign of trouble.

Keywords: Student Retention; Academic Probation; Early Detection Systems; Academic Advising; Academic Risk Identification; Data-driven Decision Making.

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Special Educational Needs Coordinator's (SENCOs) Perspectives on the Role of Technology in Supporting Autistic Students in Irish Post-Primary Schools

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This research aims to explore how Special Educational Needs Coordinators (SENCOs) perceive the role of technology in supporting autistic students in Irish post-primary schools. With increasing emphasis on inclusive education and the use of digital and assistive technology within policy and practice, there remains limited research examining how this technology is understood and implemented by SENCOs to support autistic students in Irish post-primary schools.

Adopting a qualitative, interpretivist approach, the study aims to gain an in-depth understanding of SENCOs professional perspectives, experiences, and decision-making processes in relation to technology use. The research will be guided by one main research question and three embedded questions focusing on the role of technology, the barriers and supports influencing its implementation, and its contribution to inclusion, participation, and equality for autistic students. Data will be collected through semi-structured interviews with six to eight SENCOs working in Irish post-primary schools and analysed using thematic analysis following Braun and Clarke's six-phase framework.

The findings of this study are expected to provide insight into current practice, contextual challenges, and support needs associated with the use of technology in post-primary schools. The research aims to contribute to ongoing discussions around inclusive practice and digital inclusion, and may be of interest to schools, policymakers, and organisations supporting Additional Educational Needs (AEN) within the Irish education system.

Keywords: Assistive Technology (AT); Autism / Autistic Students; Special Educational Needs Coordinators (SENCOs); Inclusive Education; Post-Primary Education (Ireland)

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From Antropocentric Human Learner to Postantropocentric Posthuman Learner: The Impact of Chatgpt Plus on L2 Learners' Speaking Skills

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Since the launch of ChatGPT's beta version in November 2022, there has been significant debate about the use of ChatGPT Plus in education, particularly in second language (L2) education. While some researchers regard it as a tool that facilitates and supports learning, others argue that it impedes or even undermines learning due to its perceived negative effects. This study first revisits the conceptualization of human learner as framed by Enlightenment thought, reinterpreting its anthropocentric structure in the context of education. Subsequently, it examines the concept of the posthuman learner, which emerged at the end of the twentieth century in response to postanthropocentric concerns and challenged many established concepts of previous eras. Within a posthumanist learning model, posthuman learners adapt their traditional learning methods to digitalization and machine learning, thereby creating deterritorialized contexts that provide increased autonomy and flexibility. The posthuman learner increasingly perceives learning as a personalized domain, managed according to individual attitudes, behaviors, and ontological structures shaped by socio-cultural backgrounds. Technological innovations such as ChatGPT Plus have contributed to the deterritorialization of learning, moving it beyond conventional L2 classroom environments. Thus, this study investigates the new learning assemblage formed by posthuman learners in conjunction with various entanglements and agentic forces, both human and non-human, with a particular focus on L2 learning. The study also aims to explore the impact of ChatGPT Plus on L2 learners' speaking skills and to establish a connection to the evolving learning preferences of posthuman learners. Some pedagogical implications will be provided, and suggestions for further research will be presented.

Keywords: Human Learner, Posthuman Learner, ChatGPT Plus, L2 Speaking Skill, Deterritorialization

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Conceptual, Theoretical, and Technological Perspectives in Computer-Supported Collaborative Learning: Preliminary Findings from a Cross-Sectional Survey

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The necessity of a common paradigm enabling research communities to build deep and focused knowledge has been widely emphasized across many scientific fields. In the field of Computer-Supported Collaborative Learning (CSCL), where multiple disciplines such as Learning Sciences, Educational Technology, Computer Science, and Psychology intersect, the need for a common ground, a unified language, or “one framework for all” has become an important consideration point due to ongoing disciplinary fragmentation of the CSCL field. Although the necessity of a fully unified language may be controversial, investigating the degree/specturum to which a common language already exists can provide valuable contributions to the field. Based on this, in this study, we aim to identify the conceptual, theoretical, and technological tools used by researchers in the CSCL community, as well as their expectations for the future, through self-reported data. The study employs a cross-sectional survey design. The sample consisted of 71 participants, of whom 52.1% were female (n = 37), 45.1% were male (n = 32), 1.4% identified as non-binary (n = 1), and 1.4% preferred not to disclose their gender (n = 1). The sample included PhD students (43.7%, n = 31), professors (23.9%, n = 17), associate professors (14.1%, n = 10), assistant professors (8.5%, n = 6), and other academic positions such as teachers, research assistants, instructors, and postdoctoral researchers (9.9%, n = 7) from the CSCL community. In data analysis, both inductive and deductive thematic analysis methods were used. Preliminary analyses indicate that although key CSCL terms converge on the themes of learning process and the role of the technology, notable points of divergence exist within the main themes. From a theoretical perspective, socio-cultural and socio-constructivist approaches appear to be widely adopted. In terms of technology use, Artificial Intelligence (AI) emerges as a prominent tool, and participants’ projections for the near future also emphasize the increasing role of AI in the CSCL field. Overall, the prelimanry findings of this study provide important empirical evidence by mapping the spectrum of a potential unified language within the CSCL field.

Keywords: Computer-Supported Collaborative Learning (CSCL), Collaborative Learning, Cooperative Learning, Common Ground, Artificial Intelligence

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Addressing Student Mental Health in Moroccan Universities: Institutional Challenges and Possible Solutions

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Mental health has become an increasingly significant issue in higher education, as university students are often expected to cope with academic pressure, personal challenges, and social adjustment at the same time. However, these challenges not only affect their emotional well-being, but also their ability to succeed in their academic cursus and immerse themselves in university life. As a follow-up to our previous study and many studies that have tackled students' mental health difficulties, less attention has been given to universities' role in supporting students through these challenges. In the Moroccan context, this question is raised as universities are even more called upon to provide environments that not only focus on academic requirements but also are supportive of students' well-being. This study explores how Moroccan university students perceive their universities' role in supporting mental health. More precisely, it examines students' feelings towards their institutions in providing adequate mental health resources, encouraging help-seeking, offering peer-support opportunities, promoting mental health awareness, and supporting student well-being through institutional policies. To address these issues, the study adopted a quantitative descriptive design and collected data from 206 university students through a structured questionnaire. The data were analyzed using SPSS to identify general patterns in students' feedback. The findings show that most students perceive limited university support for mental health. A large number of participants reported that their universities do not provide sufficient mental health resources, do not promote mental health awareness, and do not offer clear peer-support programs. The results also suggest that most students feel uncertain or uncomfortable about looking for help for mental health concerns, and that institutional policies are not seen as supportive of student well-being. Taken together, these findings indicate a gap between what the students' needs are and the universities' strategic objectives. This study highlights the importance of viewing student mental health not only as an individual matter, but also as an institutional responsibility. By focusing on the Moroccan university context, much attention should be drawn to the need for stronger university engagement in student well-being, and further reflection on how higher education institutions can create more supportive and inclusive environments for their students.

Keywords: Mental Health, Moroccan Universities, Student Well-being, Institutional Support, Higher Education

(96)

Digital Learning, Gendered Capabilities, and Educational Inclusion: Reframing Women's Empowerment in Moroccan Higher Education

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The expansion of digital learning has significantly reshaped higher education by transforming pedagogical practices and widening access to academic resources. In countries undergoing rapid educational and technological change, such as Morocco, the growing integration of online learning environments has created new possibilities for women's participation in higher education. This paper examines the extent to which digital learning contributes to women's empowerment within Moroccan universities while also considering the structural factors that continue to shape unequal access to digital education.

The study adopts a qualitative analytical approach grounded in the Capability Approach developed by Amartya Sen and further elaborated by Martha Nussbaum, combined with an intersectional perspective. These frameworks provide a conceptual basis for examining how digital learning environments influence women's educational opportunities and participation. Morocco is used as a case study to explore how gender, socio-economic background, geographic location, and digital literacy interact in shaping women's engagement with online learning in higher education.

The analysis suggests that the increasing integration of digital learning within Moroccan universities has begun to expand opportunities for female students by facilitating greater flexibility, access to knowledge resources, and participation in academic networks. At the same time, persistent disparities in digital infrastructure, technological access, and socio-economic conditions continue to influence the extent to which women can fully benefit from these opportunities.

The paper argues that digital learning can function as an important mechanism for advancing women's educational empowerment when supported by inclusive institutional policies, improved digital infrastructure, and initiatives that strengthen digital literacy. More broadly, the study highlights the need to situate technological innovation within wider social and institutional contexts in order to ensure that the digital transformation of higher education contributes to more equitable educational outcomes.

Keywords: Digital Learning, Women's Empowerment, Capability Approach

(97)

Understanding the Ethics of Teaching with AI in South African Higher Education Institutions

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The rapid expansion of generative artificial intelligence (GenAI) technologies, including tools such as ChatGPT, is transforming higher education globally. In South Africa, however, this transformation is complicated by socio-economic disparities and uneven digital access, raising ethical concerns around academic integrity, authorship, transparency, privacy, accountability, and equity. Despite increasing adoption, there is no consolidated framework guiding ethical AI use across South African higher education institutions (HEIs), resulting in fragmented and inconsistent practices. This study investigates how South African HEIs interpret and apply ethical principles in the integration of GenAI within teaching practices. Its purpose is to address the absence of a coherent, context-sensitive ethical framework and to map the principles underpinning institutional guidelines. The research is informed by digital ethics, which emphasises fairness, autonomy, accountability, and human dignity, and by critical pedagogy, which foregrounds dialogical, participatory, and socially situated education. Together, these frameworks enable a justice-oriented analysis of AI adoption.

Methodologically, the study employs a qualitative case-based design. Document analysis was conducted on publicly available AI policies and guidelines from 11 universities, selected through convenience sampling. Using inductive thematic coding with ATLAS.ti software, themes were derived directly from institutional documents to ensure alignment with lived realities.

Findings reveal convergence around several principles. In teaching, institutions encourage lecturers to model responsible AI use, integrate AI thoughtfully into curricula, and promote critical engagement rather than dependence. AI is framed as augmentative rather than substitutive, reinforcing human oversight and reflective practice. Students are expected to declare AI use, critically evaluate outputs, and develop AI literacy as a graduate attribute linked to accountability. Assessment practices emphasise authenticity, context-based tasks, and human-centred evaluation, with institutions favouring pedagogical redesign over reliance on detection tools.

The study concludes that South African HEIs are negotiating a balance between innovation and integrity, but responses remain fragmented due to the absence of a nationally coordinated framework. Recommendations include the development of a unified, context-sensitive ethical framework, investment in professional development on AI ethics, and the promotion of dialogical, human-centred approaches that align with values of dignity, integrity, and social justice. By mapping institutional principles, this study contributes to national and international debates on ethical AI in education and provides practical insights for policymakers, academic leaders, and educators.

Keywords: Generative AI, Digital Ethics, Higher Education, South Africa, Academic Integrity, Critical Pedagogy

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The Role of Digital Mind Mapping in Fostering Self-Reflection and Strategic Learning in Turkish EFL Academic Writing

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This study investigates the impact of digital mind mapping on self-reflection and strategic learning behaviours in Turkish EFL preparatory students' academic writing. Acknowledging the difficulties that A2-level learners face in organizing ideas, achieving coherence, and engaging metacognitively, a qualitative case study design was employed to explore how digital tools can enhance both writing processes and reflective practices. Over a six-week period, data were collected from 12 participants using multiple sources, including students' essays, reflective journals, and semi-structured interviews. The data were analysed through a synthesis of genre-based analysis and reflective thematic analysis to examine how the use of digital mind maps affected students' metacognitive engagement, planning, organization, and writing development. Findings indicate that digital mind mapping facilitated students' reflective practices by helping them visualize and link ideas, while also promoting strategic learning behaviours such as planning, revision, and effective argumentation. Participants reported increased confidence in producing coherent, academically appropriate texts. These results suggest that integrating digital mind mapping into English for Academic Purposes (EAP) instruction can support genre-sensitive pedagogy and foster learner autonomy. The study contributes to EFL research by demonstrating how digital tools can promote both cognitive and metacognitive growth in preparatory writing programs, particularly in the Turkish context.

Keywords: Digital Mind Mapping, Self-reflection, Strategic Learning Behaviour, Academic Writing

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A Human-Centered Pedagogical Framework for AI-Assisted Foreign Language Learning: Self-Regulated Learning, Learner Autonomy, and Academic Integrity

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Language serves as the primary medium through which individuals express their thoughts, emotions, and ideas. For this reason, foreign language learning has been recognised as a complex process. It is not only related to the acquisition of linguistic structures but also the development of cognitive and communicative competencies. In the modern era, technological developments have influenced language learning. Generative artificial intelligence (AI) is becoming more popular in education among students. It has changed the way that people learn languages by allowing immediate feedback, adaptive practice, idea generation, conversational support, and personalised support for all language skills. At this point, emerging literature has focused on some specific topics. For instances, tool adoption, performance improvement, and user perceptions are the most discussed aspects of the AI integration into education. However, the pedagogical aspects through which AI influences learning processes are still not well studied and understood. More conceptual models are needed that can explain how AI-mediated environments shape learner behaviour, learning processes, and educational values.

This study proposes the Human-Centred AI Language Learning Framework (HCAILL), which integrates self-regulated learning, learner autonomy, and academic integrity within AI-assisted foreign language learning. The framework conceptualises AI not merely as a technological tool or performance enhancer, but as part of a pedagogically structured learning process. It argues that the educational value of AI depends on how learners critically and reflectively engage with AI systems during the learning process. In this respect, the framework is grounded in three interrelated constructs: self-regulated learning, learner autonomy, and academic integrity.

The first dimension of the proposed framework is self-regulated learning. AI-supported learning environments may facilitate self-regulated learning by enabling goal setting, progress monitoring, feedback interpretation, and strategic revision. Through these processes, learners can monitor their progress, evaluate their performance, and set new learning goals independently. The second factor is learner autonomy. Learner autonomy in AI-powered language learning is the ability of individuals to develop and support their skills, such as independent decision-making, self-directed practice, and critical thinking. Generative AI enhances learner independence by offering a safe, non-judgemental environment where students can practise anytime, receive instant feedback, and revise their mistakes without relying solely on instructor guidance. The third dimension is academic integrity. Though generative AI provides instant support, it is important to consider its limitations in the learning process. Excessive reliance on AI may reduce learners' cognitive engagement and metacognitive regulation.

Keywords: Generative Artificial Intelligence, Second Language Learning, Human-Centered Pedagogy, Self-Regulated Learning, Learner Autonomy, Academic Integrity

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The Effect of Artificial Intelligence-Assisted Instruction on Sixth-Grade Student Achievement in The Unit on Light Reflection and Colors

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This study aimed to examine the effect of artificial intelligence-assisted instruction on the academic achievement of sixth-grade middle school students in the unit "Reflection of Light and Colors". The study group consisted of sixth-grade students studying in a province located in western Turkey, selected using a convenient sampling method. The "Reflection of Light and Colors Academic Achievement Test" was used as the measurement tool. The AI-assisted activities used in the research were prepared by the researcher and turned into lesson plans. Gemini, Word Wall, PhET Interactive Simulations, Claude, Canva AI, and Google Lens are among the artificial intelligence programs used. In the instruction, the experimental group received AI-assisted instruction, while the control group received instruction according to the existing curriculum, and the two groups were compared. According to the research results, it was determined that AI-assisted instruction applications significantly increased the academic achievement of students in the "Reflection of Light and Colors" unit topics, in favor of the experimental group. Based on these results, it is recommended that the use of AI-assisted instruction processes in science education be increased and made more effective.

Keywords: Artificial Intelligence, Colors, Light Reflection, Mirrors, Science Education.

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The Effect of Artificial Intelligence-Assisted Instruction on Student Achievement in The Fifth-Grade World of Light Unit

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The aim of this research is to examine the effect of artificial intelligence-assisted instruction applications on the academic achievement of fifth-grade middle school students regarding the "World of Light" unit. The study group consists of fifth-grade students studying in a province located in the Aegean Region of Türkiye. The study group was determined using an appropriate sampling method. The Light Propagation Academic Achievement Test, whose validity and reliability have been established in the literature and for which usage permissions have been obtained, was used as the measurement tool. Lesson plans prepared by the researcher were used in the study. These lesson plans include AI-assisted activities. The AI programs used are, in order: Microsoft Bing Image Creator, Gemini, Light Both, Google AI Studio, Word Wall, and Google Teachable Machine. During instruction, the experimental group received AI-assisted instruction, while the control group received instruction according to the existing curriculum, and the two groups were compared. The research results showed that AI-assisted instruction significantly improved the academic achievement of students in the "World of Light" unit topics, favoring the experimental group. Based on these findings, it is recommended that the use of AI-assisted instructional processes in science education be increased and made more effective.

Keywords: Artificial Intelligence, Light, Propagation of Light, Science Education, World of Light.

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Beyond Monolingual Mindsets: How Linguistic Identity Shapes AI-Mediated Language Learning

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This quantitative study investigates how linguistic background and individual differences shape the use of technology, social media, and artificial intelligence (AI) tools for multilingual communication and language learning among Spanish youth. A total of 830 participants completed a survey measuring their technology-mediated language practices, AI tool usage, and affective responses to multilingualism in digital environments. Descriptive statistics revealed generally positive attitudes toward technology for language learning, with the highest agreement observed for technology providing easy access to multilingual resources and making language learning enjoyable. Regarding specific digital tools, streaming platforms and YouTube or TikTok videos were the most frequently used for language learning, while AI tools like ChatGPT were used by approximately half of the participants, primarily for translation and grammar queries rather than for conversational practice. Moreover, non-parametric tests were conducted to examine differences across gender, native language background, number of languages spoken, plurilingual identity, and educational background. Results revealed that women scored significantly higher than men on using AI tools in a language other than their home language, while men scored higher on using ChatGPT for grammar and vocabulary questions. Plurilinguals demonstrated significantly higher engagement than bilingual and monolingual peers across multiple digital practices, including using social media in other languages, watching videos or reels in other languages, and using YouTube and streaming platforms for language learning. Monolinguals showed the strongest preference for using only their home language on social media. Additionally, participants speaking four or more languages consistently reported the highest engagement with AI tools for language practice and digital platforms for learning. Native English speakers reported greater confidence and pride in their multilingual identities when using technology. School type also influenced outcomes, with students from bilingual schools with monolingual programs showing the highest engagement with social media in other languages and using AI tools in languages other than their home language. These findings highlight the significant role of linguistic background and identity in shaping technology-mediated multilingual practices. The study also underscores the need for educational interventions that leverage diverse digital tools and AI applications to support plurilingual development, while also addressing the varying needs and preferences of different learner profiles. This study has been developed within the Project ‘Pluridentities: Protecting and stimulating plurilingual identities in learners in Europe via inclusive policies and classroom practices,’ granted by the European Union’s Horizon Europe research and innovation programme (Grant No. 101178914).

Keywords: AI-mediated Language Learning; Multilingual Identities; Linguistic Identity

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Privacy-Aware AI Cybersecurity Education Model (PACE): A Privacy-Preserving Framework for Secure AI-Based Educational Systems

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Today, artificial intelligence technologies are increasingly used in educational settings. However, in order for AI-based education systems to function correctly and effectively, sensitive personal data such as students' identifying information, behavioural interaction data, and academic performance records must be processed. When such data are collected in traditional centralised systems, it may lead to serious privacy and cybersecurity risks such as identity theft, unauthorised data usage, and algorithmic profiling. This situation necessitates the development of new security approaches in educational technologies, especially within the scope of data protection regulations.

In this study, a privacy-focused security architecture called the Privacy-Aware AI Cybersecurity Education Model (PACE) is proposed, aiming to protect student data in AI-supported educational platforms. The PACE Model consists of a multi-layered structure that combines data minimisation, anonymisation, and privacy-preserving machine learning techniques. Within the scope of the model, the principles of data minimisation and purpose limitation are applied by using anonymous identity identifiers instead of students' real identity information. In addition, data sets are reorganised with anonymisation and pseudonymisation methods before being transferred to artificial intelligence systems. The PACE Model consists of five dimensions: (i) real-time data detection and masking, (ii) machine learning-based anomaly detection, (iii) prompt injection defence, (iv) physical and digital access integration, and (v) GDPR and KVKK compliance monitoring.

The proposed PACE model aims to ensure that educational institutions can protect students' digital privacy while leveraging AI-powered learning analytics and personalised educational technologies, creating a secure educational ecosystem that complies with data protection regulations. Within the system, students' personal data are automatically detected and protected through real-time anonymisation and masking processes. The main target of this process is to prevent the exposure of sensitive identity information. To identify potential security threats, a support vector machine (SVM) based anomaly detection module is implemented. Additionally, the model includes a prompt injection defence layer which combines rule-based filtering with machine learning-based classification. The PACE model also integrates users' physical and digital access information to prevent unauthorised access and to provide a more comprehensive security monitoring mechanism. Finally, all system processes are continuously monitored in accordance with the data protection regulations. With all these dimensions, the proposed PACE model contributes to the literature by providing a multi-layered privacy-preserving and cybersecurity architecture for AI-based educational environments.

Keywords: Artificial Intelligence (AI), Privacy-Preserving, Educational Technology, Student Data Protection, Federated Learning, Differential Privacy

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Linking Rasch Item Difficulty with Response Time in Online Classroom Quizzes: A Multilevel Learning Analytics Study

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This study will investigate the relationship between Rasch item difficulty parameters and student response times in weekly online classroom quizzes that will be administered during the 2025–2026 Spring semester in an undergraduate course titled Computer-Assisted Educational Measurement. Over an eight-week period in the 2025–2026 Spring semester, students will complete weekly computer-based quizzes consisting of eight multiple-choice items each. Participation is expected to range from approximately 20 to 25 students per week. For every item response, the system will record both response accuracy and response time, enabling detailed analysis of student interaction with assessment tasks.

For each weekly quiz, item difficulty parameters will be estimated separately due to the absence of common items across weeks and the changing composition of participating students. Response time data will be log-transformed to account for the typically skewed distribution of time measures. To examine the relationship between item difficulty and response time while accounting for individual differences among students, multilevel regression models will be estimated for each week. In these models, item difficulty will serve as a fixed predictor of response time, while student-level random effects will be included to capture individual differences in response speed.The analysis will explore whether more difficult items require longer response times and whether this relationship is consistent across different weekly quizzes and content topics. By modeling responses at the student–item level, the study aims to provide a view of how item characteristics relate to observable response behavior in classroom-based computer assessments.

The findings are expected to contribute to the growing literature on learning analytics and technology-enhanced assessment by demonstrating how response time data can be integrated with psychometric item parameters to better understand cognitive demand during assessment tasks. Such insights may help instructors and assessment designers interpret student performance more effectively and identify patterns of effort, guessing, or difficulty in digital learning environments. Moreover, the results could highlight the potential of combining behavioral trace data with measurement models to support evidence-informed instructional decisions.

Keywords: Learning Analytics, Rasch Measurement, Formative Assessment, Computer Assisted Language Assesment, Response Time

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A Conceptual Framework for Human-AI Interaction in L2 Writing: Promoting Learner Autonomy and Self-Regulated Learning

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Writing proficiency remains a fundamental aspect of language education; however, many learners face persistent challenges in developing this skill. Artificial intelligence (AI) presents a promising solution to these obstacles. The increasing integration of AI into educational settings has transformed learners' engagement with writing tasks and learning processes, particularly in terms of cognition, autonomy, self-efficacy, self-regulation, and critical thinking. AI technologies have been progressively incorporated into writing practices through interactive AI systems that generate ideas, deliver feedback, and support revision. However, the cognitive implications of human-AI interaction remain underexplored. Specifically, there is limited understanding of how human-AI interaction influences learner autonomy, self-regulated learning, and critical thinking during writing activities. This study proposes a conceptual framework to examine how human-AI interaction in writing informs cognitive engagement, self-regulation, self-efficacy, and critical thinking. Drawing on sociocultural theory, self-regulated learning theory, and research on learner autonomy, the framework conceptualizes AI as a mediational cognitive tool that learners interact with at various stages of the writing process. Through this interaction, learners engage in cognitive and metacognitive activities such as planning, monitoring, strategy use, and evaluation, which are essential components of self-regulated learning. Additionally, human-AI interaction may foster learner autonomy in writing strategies, language use, and revision practices. The framework identifies key influential factors, including learner characteristics, engagement with AI systems, and underlying cognitive processes. The proposed model also addresses potential cognitive risks, such as cognitive offloading, overreliance on AI feedback, and reduced depth of processing. By synthesizing interdisciplinary literature and employing a theoretically grounded approach, this research seeks to offer insights into how human-AI interaction in writing can support cognitively responsible and autonomy-oriented learning environments in language education.

Keywords: Artificial Intelligence (AI), Self-regulated Learning, Learner Autonomy, Learner Cognition, Language Education

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Harmonizing Human Values and Educational Technologies: Conceptual and Contextual Insights from Value Sensitive Design

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This study explores how value sensitive design (VSD) principles—a method that embeds ethical considerations into the design process—can be integrated into educational technology (EdTech) through the systematic examination of fourteen key human values, including welfare, ownership and property, privacy, freedom from bias, usability, trust, autonomy, informed consent, accountability, identity, calmness, environmental sustainability, accessibility, and respect. Drawing on this framework, the study combines a conceptual framework of these fourteen values in relation to VSD with a content analysis of 17 Web of Science–indexed articles that explicitly address the intersection of VSD and EdTech. The analysis highlights key themes such as the integration of human values in EdTech, ethical implications and moral considerations, value-based and participatory design approaches, fairness and equity in AI-driven applications, and the use of VSD to address complex societal challenges in education. Findings show a growing yet still limited body of VSD-in-EdTech research, characterized by an increase in publications after 2020, a dominance of qualitative case studies in higher education, a wide but fragmented set of theoretical and conceptual frameworks, and a strong emphasis on undergraduate learners as participants. Across the reviewed work, VSD is used to guide human-centered and ethically oriented design decisions, while quantitative evidence and large-scale, multi-stakeholder evaluations remain scarce. Overall, the findings indicate that integrating these fourteen values through VSD can help educational technologies support inclusive, privacy-preserving, and ethically aligned learning environments, while underscoring the need for more diverse empirical studies to examine the impact of value-sensitive EdTech across contexts and stakeholder groups.

Keywords: Value Sensitive Design; Educational Technology; Ethical Design; Human Values; Content Analysis; Higher Education; Human-centered Design; Digital Ethics; Participatory Design; Inclusive Learning Environments

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Socially Assistive Robots as Catalysts for Social Inclusion: Empowering Adolescents on the Autism Spectrum through AI-Driven Interaction

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This research investigates the transformative potential of Socially Assistive Robots (SARs) and AI-driven digital avatars as facilitators of social inclusion for adolescents with Autism Spectrum Disorder (ASD). In the developmental stage of adolescence, social demands become increasingly complex, often leading individuals with ASD toward social isolation. This study addresses this gap by positioning Artificial Intelligence (AI) not merely as a tool, but as a "social mediator" capable of providing a safe, predictable, and low-anxiety environment for social practice.

The theoretical framework is grounded in Social Mediation and the concept of "Social Scaffolding." By utilizing Large Language Models (LLMs) and embodied AI interfaces, we explore how "Embodied Interaction" can transition the digital screen from a passive tool to an active social partner. The methodology follows a multi-phase descriptive design. Initially, a quantitative requirements analysis was conducted with a panel of 10 expert special education teachers. Using a 1-5 Likert scale, the experts prioritized ten critical design parameters, such as stylized morphology, lip-sync accuracy, and visual simplicity, specifically aimed at mitigating sensory overload and the "Uncanny Valley" effect.

The second phase involved a pilot case study with two adolescents with ASD. Interaction was facilitated through the Character.ai platform, utilizing custom-designed digital personas that offer real-time scaffolding and digital empathy. Evaluation was conducted through proxy-reporting by specialized educators using the System Usability Scale (SUS) and a Technical Behavior Checklist.

The results demonstrate a robust consensus among experts, highlighting "Stylized Morphology" (M=4.8) and "Lip-Sync Accuracy" (M=4.7) as the primary catalysts for engagement. The pilot application yielded a high usability score (SUS = 82.5/100), while observational data showed a significant stabilization of eye contact, maintained at 75% of the interaction duration. These findings suggest that the synergy between SARs and Generative AI creates a secure "social laboratory." This environment allows for "Zero-Pressure Interaction," facilitating the gradual generalization of social skills—such as turn-taking and emotional recognition—into real-world contexts. Ultimately, this study proposes a scalable model for inclusive education where technology adapts to the student's unique neurodiverse profile.

Keywords: Socially Assistive Robots (SARs), Artificial Intelligence, Autism Spectrum Disorder (ASD), Social Inclusion, Digital Avatars, Case Study.

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Fact, Fiction, or AI? Students' Strategies in the Post-Truth Era

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The rapid integration of artificial intelligence into digital learning environments has significantly transformed access to information while simultaneously amplifying the risk of AI-generated misinformation. In the post-truth era, students increasingly encounter content produced or mediated by generative AI systems, making the ability to critically evaluate information accuracy and credibility a fundamental learning challenge. This study investigates the strategies students employ to identify and evaluate AI-generated misinformation in online learning contexts.

Grounded in theories of critical digital literacy, epistemic cognition, and AI literacy, the study aims to explore how learners assess the reliability of AI-generated content and what cognitive and behavioral strategies they use when confronted with uncertain or misleading information. Accordingly, the study seeks to answer the following research questions: What strategies do students use to evaluate AI-generated information? What challenges do they experience during this evaluation process and how do these challenges influence their decision-making processes? How do students evaluate the credibility of AI-generated information in online learning contexts?

The study will consist of undergraduate students who have prior experience using generative AI tools (e.g., ChatGPT or similar systems). Participants will be selected through purposeful sampling. To investigate students' evaluation processes in depth, the study adopts a qualitative case study design focusing on how learners engage with AI-generated misinformation in online learning contexts. Data will be collected through scenario-based tasks and semi-structured interviews. The scenario-based tasks will consist of carefully designed AI-generated artifacts, some of which intentionally include subtle misinformation or hallucinated references. Participants will be asked to evaluate the credibility of each scenario, identify potential inaccuracies, and justify their decisions by explaining their reasoning processes. The collected data will be analyzed using thematic analysis. The analysis process will begin with initial open coding to identify meaningful units within the data.

The study is expected to provide insights into the strategies students use when evaluating AI-generated content. It may also highlight potential challenges learners experience, including overreliance on perceived AI authority, limited awareness of AI limitations, and difficulties distinguishing sophisticated misinformation from accurate information.

By examining how students respond to AI-generated misinformation, the study aims to contribute to ongoing discussions on education in the post-truth and AI era. The findings are expected to offer pedagogical implications for educators and instructional designers seeking to strengthen students' critical digital literacy and AI literacy skills in increasingly AI-mediated learning environments.

Keywords: AI-generated Misinformation, Critical Digital Literacy, AI Literacy, Epistemic Cognition

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Analysing the Relationship Between Artificial Intelligence Usage and University Students' Academic Practices

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This study examined university students' attitudes toward artificial intelligence technologies. The findings indicate that students generally have a positive attitude toward artificial intelligence. In particular, knowledge level, perceived self-efficacy, frequency of use, and future expectations significantly influenced students' attitudes toward artificial intelligence. Students who frequently use AI and feel competent in this field evaluate technology more positively and see the role of AI in education as a decisive factor in future academic processes. The study found that 89% of students used AI for educational purposes, with the lowest usage rates in the fields of security, art, and finance. Furthermore, the percentage of participants who wanted AI to be incorporated into course content was extremely high. These results demonstrate that attitudes toward AI are shaped not only by technical knowledge but also by self-efficacy, digital capital, and the cultural context. This study highlights the societal impact of AI technologies in higher education and the importance of inclusive policies that address digital inequalities.

Keywords: Artificial Intelligence, University Students, Digital Literacy.

(118)

Technology and Neuropedagogy: Leveraging Educational Technologies for Brain-Friendly Learning

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The digital revolution has brought about a fundamental transformation in education, necessitating a reassessment of traditional teaching and learning practices from a neuroscientific perspective. This study examines the interaction between neuropedagogy and educational technologies, investigating how learning processes in the digital age can be restructured through brain-friendly approaches. Drawing on neuropedagogical principles such as brain plasticity, multisensory integration, and individualized learning, the study discusses how technology can support attention, memory, motivation, and emotional learning. Emphasis is placed on the potential of digital tools to create rich learning environments tailored to developmental needs. In particular, AI-powered adaptive systems and data-driven learning analytics approaches are examined in terms of their capacity to offer personalized learning experiences that account for individual learner differences. Current research indicates that neuropedagogical design principles significantly enhance the effectiveness of digital learning environments. The importance of teachers possessing neuropedagogical knowledge and being able to consciously integrate technology within this framework is also underscored. In conclusion, the study discusses how inclusive, individualized, and developmentally appropriate digital learning experiences — created through the collaboration of neuroscience and technology — may be reflected in future educational practices.

Keywords: Neuroeducation, Educational Technologies, Brain-Based Learning, Adaptive Learning Systems, Artificial Intelligence in Education

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Using Generative AI Models to Create Visualized Educational Content

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The development of Artificial Intelligence (AI) technologies and their widespread application across various fields of science and technology contributes to the enhancement of other digital solutions, making them more precise, accessible, and personalised. One of the promising and complex areas of artificial intelligence (AI) is the creation of visual objects based on machine learning. In this regard, AI-based technologies enable the creation of realistic scenes with high-tech graphics and convincing simulations featuring various characters and avatars.

The aim of the study is to analyse the application of generative AI models, based on the preparation of visualised educational content through the use of 3D spatial AI and immersive reality technologies (VR/AR/MR/XR) in the educational process.

The methodological basis of the research is a conceptual and analytical review of modern approaches to spatial AI and intelligent reality, considered as a combination of AI, ML, computer vision, and spatial computing methods. Particular attention is paid to exploring the capabilities of generative tools such as Stable Diffusion, SkyBox AI, and Point-E, as well as additional programming tools like ChatGPT and GitHub Copilot, for creating virtual educational environments and 3D objects.

The research concluded that AI generative models, by enabling the creation of virtual environments and objects based on textual descriptions and the scanning of real-world scenes, it was determined that AI generative models enable a significant reduction in the time and financial costs of developing high-quality VR educational content. In analysing the research findings, three key directions for AI and VR in education were identified: the development of intelligent avatars with natural language capabilities, the creation of an automated personalised learning environment and scenario, and the creation of a customised educational environment based on the learner's achievements. These directions contribute to enhancing the levels of interactivity, engagement and personalisation in both traditional and distance learning formats.

The results indicate that the convergence of generative AI and immersive reality technologies represents a significant technological advancement in accessible and high-quality education for the 21st century.

Keywords: Generative AI, Spatial AI, VR, Immersive Learning, Educational Technologies, Personalized Learning, Intelligent Avatars

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ICT as inclusive tools in the response to autistic neurodiversity

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Information and Communication Technologies (ICT) can be used as inclusive teaching tools to improve the quality of education and support for neurodivergent students with autism. As such, they are powerful tools for carrying out tasks across a wide range of areas and contexts, playing a key role in today's educational landscape. The adoption of ICT applied to educational inclusion is clearly linked to the promotion of a social model of inclusion and respect for autistic neurodiversity as the cornerstones of a paradigm, the paradigm of inclusive neurodiversity, the consolidation of which can redirect or, where appropriate, mitigate and/or eliminate those educational practices rooted in a deficit model, clearly linked to a culture of labelling and stigmatisation. Undoubtedly, the possibilities offered by ICT for the development of methodologies that are fully accessible, empathetic and respectful of diverse learning profiles are undeniable. We are referring to a wide range of applications which, through the incorporation of devices featuring immersive technologies such as Virtual Reality or Augmented Reality, as well as others incorporating generative, predictive and conversational Artificial Intelligence (AI), offer greater guarantees of access to a quality educational experience for all students without exception. For this reason, we wish to focus our pedagogical attention on children and young people with neurodivergent autism, and, of course, on the educational contexts where transformative practices can be developed in the interests of genuine educational inclusion. The aim is to analyse the findings of the latest studies and research highlighting the importance of implementing these digital tools to optimise the academic and personal trajectories of these young people with neurodivergent autism. Understanding this scientific evidence can help us analyse and comprehend the impact of ICT in terms of academic success and socio-emotional well-being among those with autism spectrum disorder, fostering pedagogical spaces for reflection to explore further and more effectively aspects linked to personal, social and communicative development within increasingly empathetic and dynamic learning environments. To this end, we will undertake a review of the pedagogical literature available in various academic repositories and databases, from which a series of studies have been selected that capture narratives of neurodivergent students and examples of good practice involving ICT with such students. A key finding is that the use of ICT has a significant impact on the holistic development of students with autism spectrum disorder. Notwithstanding this, their accessibility and usability remain limited due to the barriers that still exist in accessing them. Finally, another element of particular interest for future research is the role played by teacher training in the effective implementation of inclusive pedagogical approaches.

Keywords: Autism Spectrum Disorder, ICT, Personalised Learning, Inclusive Education, Best Educational Practices.

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Analysis of Primary School Students' Use of Digital Technologies in the Process of Learning Mathematics

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Artificial intelligence tools, augmented and virtual reality and 3D printers reflect the speedy development of a digital technology (Drijvers et al., 2010). There are studies which show that these developments have positive effects on primary school students' learning mathematics (Karabay, 2020; Öztürk and Gökdaş, 2020; Karadağ, 2019; Fokides, 2018; Volk et al., 2017; Çekirdekci et al., 2016; Kyriakides et al., 2016; Yiğit and İpek, 2015; Al-Mashaqbeh and Al Dweri, 2014; Karakış, 2014). However, it is considered that it is important to analyze how and how often students use digital tools while learning mathematics outside the classroom in our digitalized world. In this respect, this study aims at analyzing 4th grade students' use of digital technology in the process of learning mathematics according to different variables. In line with this purpose, the cross-sectional survey method was used among the quantitative research methods. The stratified sampling method was used to determine the study group. The primary schools in Bartın have been separated into three categories as central, district and village schools. The participants were selected from these categories. According to this selection, the central category constitutes 53%, the district category constitutes 9% and the village category constitutes 38% of the total students. The sample number which was calculated in terms of percentage value is 630 students in the central, 18 students in the district and 322 students in the village categories. Therefore, a total of 970 students participated in the study group. The data were collected through the Personal Information Form and Use of Digital Technology in Learning Mathematics Scale. The Personal Information Form consists of questions related to gender, age, parents' educational status, owning a digital tool or not, the daily frequency of using digital tools and the duration of studying for mathematics lessons every day. Use of Digital Technology in Learning Mathematics Scale has been developed Öztop and Buluç (2022) and consists of four dimensions and 20 items. The scale was developed in the manner of a four point Likert scale. The Cronbach Alpha reliability coefficient of the scale was calculated as .885. As a result of the study, it is considered that students' levels of digital technology use can vary in line with certain variables. Since students who receive education in particular in the central primary schools have more access to technology, their level of using digital tools is expected to be higher. Chen et al. (2026) have reported that female students received higher scores in digital tasks. This points out that female and male students' manner of using digital tools may vary. Therefore, it is expected to see some significant differences in terms of gender in some of the dimensions of digital technology use.

Keywords: Digital Technologies, Mathematics, Primary School Students

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Artificial Intelligence Readiness Among Pre-service Teachers: An Investigation of Technological and Ethical Dimensions

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The purpose of this research is to examine the artificial intelligence (AI) readiness levels of pre-service teachers in terms of various variables and to reveal the relationship between technological self-efficacy and ethical awareness. The sample of the study, which was designed as a survey model within quantitative research methods, consists of 246 pre-service teachers studying at the faculty of education of a state university. Descriptive statistics, independent samples t-test, one-way analysis of variance (ANOVA), and Pearson correlation coefficient were used in data analysis.

Research findings indicate that an asymmetrical structure prevails in the AI readiness levels of pre-service teachers. It was determined that the ethical awareness levels of the candidates ($\bar{X}$ = 3.64) were significantly higher than their technological self-efficacy perceptions ($\bar{X}$ = 3.07); and self-efficacy remained at the lowest level ($\bar{X}$ = 2.42), particularly in subjects requiring technical depth such as programming and problem-solving. The analyses revealed that readiness levels did not show a statistically significant difference according to gender, score type, and grade level variables ($p > .05$). The developmental stagnation exhibited by upper-grade candidates, whose readiness scores remained at similar levels to lower grades, suggests that the current curriculum is insufficient in imparting AI competency. Furthermore, the weak positive correlation ($r = .280$; $p < .01$) detected between technological self-efficacy and ethical awareness confirms that candidates are ready to assume the ethical responsibility of a technology they cannot technically manage, thereby validating the technical-ethical disconnect defined in the literature.

In conclusion, it was determined that pre-service teachers exhibit a well-intentioned yet technically inadequate profile regarding AI technologies. This situation highlights the risk that the education system may encounter a teacher profile with high ethical sensitivity but limited technical intervention capacity in the future. Accordingly, it is recommended to implement Intelligent-TPACK focused curriculum updates in teacher training programs where technical and ethical dimensions are integrated, and to monitor candidates' readiness through dynamic learner modeling processes.

Keywords: AI Readiness, Technical-Ethical Disconnect, Teacher Candidates, Technological Self-Efficacy, Ethical Awareness

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The Adaptation of the Readiness and Intention to Teach Artificial Intelligence Scale for Teachers to the Turkish Sample: An Exploratory Factor Analysis Study

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The rapid integration of artificial intelligence technologies into educational environments necessitates determining the intentions and readiness levels of current and future teachers to utilize these technologies within pedagogical processes. Although there are instruments in the literature measuring students' attitudes toward artificial intelligence, a Turkish measurement tool that multi-dimensionally examines teachers' intentions to integrate artificial intelligence into instructional processes has not been found. The purpose of this study is to adapt the Readiness and Intention to Teach Artificial Intelligence Scale, developed by Ayanwale et al. (2022) for K-12 teachers, into Turkish and to examine its psychometric properties within the Turkish context through a pioneering Exploratory Factor Analysis study. While the target population of the scale consists of in-service teachers, the preliminary data for the adaptation study were collected from 338 pre-service teachers studying in various departments of a faculty of education, selected via a convenience sampling method. Following the completion of translation and back-translation procedures for the scale, which comprises eight factors and 33 items in its original form, expert opinions were consulted to ensure linguistic and conceptual equivalence. To test the construct validity of the data, the Maximum Likelihood factor extraction method and Promax oblique rotation technique were employed using SPSS software. During the analysis process, four items exhibiting insufficient factor loadings or cross-loading issues were removed from the dataset. The analysis conducted with the remaining 29 items revealed that the dataset exhibited an eight-factor structure (Artificial Intelligence Anxiety, Perceived Usefulness, Social Good, Attitude, Self-Confidence, Relevance, Readiness, and Behavioral Intention), consistent with the theoretical framework of the original study. The derived structure accounted for 57.34% of the total variance, and the factor loadings of the items were observed to be above acceptable thresholds. The internal consistency coefficients (Cronbach's Alpha) calculated for the sub-dimensions of the scale ranged from .80 to .93, providing high levels of reliability evidence. Consequently, it was determined that the adapted scale presents a valid and reliable preliminary structure for measuring the readiness and intentions of teachers in Turkey regarding teaching artificial intelligence.

Keywords: Artificial Intelligence, Readiness, Behavioral Intention, Scale Adaptation, Exploratory Factor Analysis, Teacher Candidates.

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Selection of ICT for Teaching Mathematics at the Upper Secondary Education Level

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The constant evolution of Information and Communication Technologies (ICT) and their application in everyday activities have transformed human practices across all social contexts. In education, teachers and students are increasingly involved with technology, which has become an essential component of the teaching-learning process. This study focuses on analyzing how teachers select the use of ICT for teaching mathematics at the upper secondary education level. According to various authors, decision-making is shaped by internal and external factors that influence individuals' motivation when choosing what to do and what not to do. Regarding the use of ICT, teachers are required to make significant decisions concerning its implementation, particularly in terms of which tools to use and at what point in the instructional process they should be introduced in order to foster learning. To analyze how mathematics teachers at the upper secondary education level determine the use of ICT in their teaching practice. A mixed-methods exploratory-descriptive approach was adopted. Data collection techniques included document analysis and survey administration. The study considered 16 teachers who teach or have taught mathematics-related subjects. The views expressed by the sixteen teachers surveyed were positive regarding the inclusion of ICT in the teaching process. The study found that there are collegial meetings made up of teachers from related subject areas, where collaborative work is carried out to analyze and discuss elements such as activity planning processes, appropriate pedagogical strategies, teaching materials, and supporting resources. Regarding how decisions are made about the use of ICT tools, all teachers gave similar responses, stating that there is no collective decision-making process and that the objectives of the topic, as well as the complexity of the content, are fundamental factors in determining which technology to use. During academic meetings, the strategies implemented in previous semesters are reviewed and analyzed; however, each teacher ultimately decides individually which of these strategies may be applied in the classroom. All participants stated that a teaching strategy should "always" be defined before selecting ICT tools. The research findings are consistent with Bourdieu's theory of action, which explains social practice through the concepts of habitus, field, and capital, thereby moving beyond the dichotomy between structure and agency. The decision to use ICT in mathematics teaching is made by the teacher on an individual basis, while considering collegial work and the technological resources available at the school. Teacher motivation also plays a significant role in decision-making regarding the use of ICT in teaching.

Keywords: Teaching, Teachers, ICT.

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A Comparative Analysis of Digital Competency Frameworks: DIGCOMPEDU, UNESCO ICT CFT, ISTE Standards And TPACK

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This study examines four key frameworks related to teachers' digital competence from a comparative perspective. These frameworks are: the European Framework for the Digital Competence of Educators (DigCompEdu), the UNESCO ICT Competency Framework for Teachers (ICT CFT), the ISTE Standards for Educators and the Technological Pedagogical Content Knowledge model (TPACK). Using a qualitative document analysis method, the study draws on the foundational and current publications of each framework. The comparative analysis is structured around six criteria frequently used in comparative studies in the literature: theoretical basis, target audience, structural components, assessment and measurement tools, cultural appropriateness, and revision processes. The analysis has yielded a number of significant findings. DigCompEdu offers a framework for professional development programs due to its pedagogical structure and its capacity to track teachers' progress across six competency levels. However, it is difficult to adapt outside the European context and does not sufficiently address discipline-specific requirements. UNESCO ICT CFT is particularly suitable for shaping educational policies and guiding curricula in developing countries. However, the framework was developed using broad and generalized language and lacks standardized assessment tools, which leads to significant challenges in implementation. The ISTE Standards are among the most practically accessible frameworks due to their broad applicability across numerous educational stakeholders and the inclusion of implementation examples for each standard. However, they have been criticized for being difficult to apply in different countries because they were developed based on the U.S. education system, and for some standards prioritizing technology over pedagogy. TPACK offers a theoretically robust framework that emphasizes the integrated consideration of technology, pedagogy, and content knowledge. However, the model's abstract structure, the lack of widely validated and accepted measurement tools, and insufficient attention to current issues such as digital ethics create limitations that cannot be overlooked. The findings indicate that none of the examined frameworks fully reflect all dimensions of teachers' digital competencies. A lack of sufficient sensitivity to cultural context, weak alignment with learning outcomes, and the inability to incorporate emerging competencies such as artificial intelligence and critical digital literacy stand out as common shortcomings across all frameworks. Accordingly, rather than adopting a single framework, integrating multiple frameworks in a context-sensitive manner would be a more robust approach when developing digital competency policies.

Keywords: Digital Competence, DigCompEdu, UNESCO ICT CFT, ISTE Standards, TPACK, Teacher Competencies, Technology in Education

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Educational Technology in Chemistry Education Research: A Bibliometric Analysis of Papers Published

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The commonality of abstract concepts in chemistry education frequently poses a significant challenge in providing adequate support to students in comprehending these concepts. The utilization of educational technologies facilitates development and use of visual representations in chemistry teaching. Identifying the trends in the literature may guide the use of appropriate educational technology in chemistry education. The identification of recent studies on the integration of educational technologies for the instruction of chemistry will be beneficial for the enhancement of chemistry instruction in terms of efficiency, efficacy, and engagement. The aim of this study is to identify trends in papers published in Web of Science (WoS) journals related to educational technology use in chemistry education over the past 20 years, including chemistry topics, technologies utilized, target groups, pedagogies, leading countries, journals, organizations, and authors.

In this study, a bibliometric analysis was conducted on 802 articles obtained from the WoS database. The data were obtained from an analysis of research articles published over the past 20 years. The search was limited with the keywords and the strings as given: ("chemi education*" AND (technolog* or "virtual lab*" OR "simulation*" OR "artificial intelligence" OR "augmented reality" Or "virtual reality" or animation* or video)) (Topic) and Article or Review Article (Document Types) and 2026 or 2025 or 2024 or 2023 or 2022 or 2021 or 2020 or 2019 or 2018 or 2017 or 2016 or 2015 or 2014 or 2013 or 2012 or 2011 or 2010 or 2009 or 2008 or 2007 or 2006 (Publication Years). The data were analyzed using VosViewer and R-Studio software. Following a thorough analysis, it was determined that laboratory instruction and organic chemistry are the most frequently addressed topics in the context of chemistry education. Computer-based learning has been identified as the most widely utilized educational technology, with recent advancements in artificial intelligence and augmented reality emerging as prominent topics. Additionally, the USA, Germany, and China have been identified as countries that have most frequently published in the spotlight. The following journals have the most of the papers published: Journal of Chemical Education, Chemistry Education Research and Practice, and Journal of Science Education and Technology. The most prolific authors are Ron Blonder, Ingo Eilks and Johannes Huwer.

Keywords: Chemistry Education, Educational Technology, Bibliometric Analysis

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Navigating the Skill Space: AI-Supported Language Learning Through Structural-Visual Method

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The acquisition of oral language skills in adults remains a persistent challenge. Traditional grammar-translation methods produce declarative knowledge but fail to enable fluent speech, while communicative approaches often sacrifice structural understanding. Only 5–10% of adult language learners achieve fluency. AI in language learning has largely digitized textbook logic—gamified flashcards, rule-based chatbots—without rethinking cognitive architecture. A theoretical gap remains: no adequate framework exists for oral skill formation when AI acts as an active agent. This paper introduces an AI-supported adaptive system based on the Structural-Visual Method (SVM), which externalizes grammar through visual models. The goal: reconceptualize acquisition as navigation through a formalized skill space, using AI to manage learning trajectories while preserving learner agency. SVM rests on three foundations. First, the Dynamics of the Elementary Process (from activity theory, neurophysiology, cybernetics) identifies four stages of any action: intention, execution, result, completion. Second, Lingvomaps translate these dynamics into color-coded schemas of sentence construction. Third, the system formalizes sentence parameters (person, tense, voice, modality, type) as independent dimensions, each with a measurable automation level (0–1). Together they form a skill vector—the learner's position in a multidimensional space. An AI dispatcher tracks this vector in real time, generates content by the Zone of Proximal Development (ZPD), and proposes adaptive trajectories. The learner chooses direction; AI handles content and trajectory management. The Minimum Viable Product has been developed over sixteen years. Paper-based Lingvomaps and a desktop prototype confirm that visual scaffolding accelerates skill automation. Testing shows SVM reduces error rates and required repetitions versus traditional instruction. The skill space formalization makes the system both a learning tool and a research instrument, generating data on optimal trajectories across learner profiles. SVM reframes acquisition as navigation through a skill space rather than a linear curriculum. The AI dispatcher operationalizes the ZPD at scale, offering personalized trajectories previously impossible in group instruction. This approach embodies "resilience": a flexible, scalable model adapting to diverse starting points, paces, and professional contexts. Implementation requires four stages: AI content generation for targeted situation sets, continuous skill vector measurement with speech recognition, an AI dispatcher for dynamic trajectory building, and integration with existing platforms via xAPI/SCORM. Collaboration is invited from researchers in collaborative learning systems and mobile development to advance shared visual models for AI-supported language education.

Keywords: Adaptive Learning Systems, Artificial Intelligence in Education, Human-computer Interaction, Language Acquisition, Structural-visual Method, Visual Models

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An Exploration of Artificial Intelligence Use and Research Ethics among Moroccan Researchers: A Qualitative Analysis

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Research on artificial intelligence (AI) technologies has indicated that these tools are increasingly reshaping academic research practices, posing ethical questions regarding research practices, including authorship, originality, academic integrity, transparency, and accountability. This qualitative study explores Moroccan researchers' perceptions of AI use in academic contexts, with a focus on ethical opportunities and challenges. Grounded in the constructivist grounded theory approach, the study draws on 20 semi-structured interviews conducted with university professors, researchers, and doctoral students from various disciplines at Chouaib Doukkali University. The grounded theory methodology enabled the researchers to generate themes inductively from participants' lived experiences and evolving perspectives. Data analysis was conducted through open coding, and constant comparison, leading to the emergence of a conceptual understanding of how researchers engage with AI in ethically complex environments. Findings revealed a dual perception among Moroccan researchers; while many view AI as a powerful tool to enhance productivity, innovation, and access to knowledge, significant concerns about plagiarism, misuse of AI-generated content, and the absence of institutional policies or training were reported. Some participants also expressed confusion about the boundary between acceptable support and academic misconduct. The study concludes that there is a pressing need for culturally and contextually informed and clear institutional guidelines that address the unique realities of AI use in Moroccan academia. The study also emphasizes the need for training programs to help Moroccan researchers use AI in research ethically. The study contributes to broader discussions on responsible AI integration in research and offer a culturally grounded framework for ethical decision-making in academic contexts.

Keywords: Artificial Intelligence, Grounded Theory, Moroccan Researchers, Ethical Practices, Research Integrity, AI Tools;

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Students' Translanguaging Practices and Agency in AI-Mediated Learning Environments

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This study investigates how multilingual learners employ translanguaging practices when interacting with AI chatbots, and how these practices support resilient meaning-making in increasingly uncertain educational environments. Semi-structured interviews exploring participants' real-time linguistic choices during AI-mediated learning tasks with thirty high-school and university students were gathered and thematically analyzed. The findings show that students flexibly mix and switch languages to manage lexical gaps, repair AI misunderstandings, and clarify complex concepts across linguistic systems. Motivations for switching include cognitive needs, metacognitive checks, and spontaneous multilingual habits. Learners reported improved comprehension and academic performance when contrasting explanations across languages, though challenges remained with idioms and low-resource varieties such as Darija. The study highlights how translanguaging in AI-mediated learning fosters resilience, agency, and adaptive meaning-making, aligning with emerging educational demands in uncertain digital futures. These findings imply the need for pedagogical frameworks that recognize multilingual AI interaction as a legitimate literacy practice, encourage responsible cross-linguistic inquiry, and promote equitable access to AI tools capable of supporting diverse linguistic repertoires.

Keywords: Translanguaging; AI-mediated Learning; Multilingual Learners; Language Switching; Epistemic Resilience; Learner Agency; Digital Education; Multilingual Literacy Practices

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Audiovisual Narrative Generated with Artificial Intelligence as a Teaching Resource for Interdisciplinary Learning in Primary Education

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Artificial intelligence has revolutionised lesson planning to streamline bureaucratic processes. It also represents an advancement in gamified digital content where authors, composers, and artists come to life to narrate their stories to pupils. The classroom becomes a vehicle to the past, connecting with genres and styles to make them comprehensible. AI creates narrative audiovisual content and comprehension activities that motivate pupils. Evidence of learning is exchanged through oral interaction, developing social and emotional competencies. The impact of this practice has not been evaluated in depth in Primary Education. This proposal improves classroom climate and reduces conflicts. This work evaluates the impact on pupils' perceptions of social, emotional, and conflict-resolution skills developed through AI educational content. There is a lack of studies evaluating learning acquired by pupils coexisting with digital intelligence in immersive environments. This work presents a review of high-impact literature related to AI in Primary Education, gamification, and educational technology. It aims to provide data and analyse comparisons between contexts, specific centres, educational levels, and special education pupils. The schools are public institutions in Andalusia with experienced teachers using gamification in STEAM fields. The study followed a quasi-experimental, ex post facto design, with pre-test and post-test measures. Findings include the creation of a training network for teachers to establish a common framework for lesson planning. This work evidences improved reading comprehension, creativity, critical thinking, problem-solving, and digital literacy. Similarly, there was an improvement in classroom climate and social-emotional relationships. This study intends to lay foundations for future research on learning technologies developed with AI for cognitive and emotional development. Future work should include longitudinal studies on personalised learning that addresses diversity.

Keywords: Artificial Intelligence, Educational Technology, Gamification

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Exploring the Link Between University Students' AI Anxiety and Their Intentions to Learn AI

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Artificial intelligence (AI) technologies have been increasingly integrated into various fields in recent years, including education, healthcare, industry, and daily life. The inclusion of AI tools in learning processes within higher education institutions facilitates students' access to information and provides personalized learning experiences. However, the rapid development of AI technologies has also led to various concerns and anxieties among students. In particular, factors such as the potential impact of AI on the job market, its possible effects on human cognitive skills, and the risk of technologies becoming uncontrollable can influence students' attitudes towards AI. The aim of this study is to examine the relationship between AI anxiety and AI learning intentions among university students. A quantitative research method was applied using the AI Anxiety Scale and the University Students' AI Learning Intentions Scale as data collection tools. The study sample consisted of 300 university students aged between 18 and 24 years (mean = 21.18). Data were analyzed using descriptive statistics, correlation analysis, and regression analysis. The findings demonstrate a significant negative correlation between students' AI anxiety and their intentions to learn AI. Specifically, concerns about job loss and socio-technical risks were found to negatively impact students' intentions to participate in AI learning. Among the sub-dimensions of anxiety, job loss concerns and socio-technical risk perceptions were the strongest negative predictors of intention to learn AI. Furthermore, the findings highlight the need for AI education programs that go beyond technical skill development and include ethical awareness, social responsibility, and critical evaluation skills. Conversely, students with higher awareness of the ethical use and social benefits of AI showed a stronger intention to learn AI. These results contribute to the growing literature on AI literacy and provide insights into the design of student-centered AI curricula in higher education. In conclusion, enhancing university students' motivation to learn AI requires not only technical training but also the development of ethical, social, and critical evaluation skills. This study contributes to the broader literature on AI literacy by highlighting the psychological determinants of students engagements with emerging technologies.

Keywords: AI Anxiety, AI Learning Intention, University Students, AI Education, Technology Anxiety

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Modeling the Interplay Between 21st Century Skills, Learned Helplessness, and AI Anxiety: A Comparative Study of Engineering and Business Management Students

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The rapid integration of artificial intelligence (AI) into academic and professional environments has heightened the need to understand students' psychological and cognitive readiness for an AI driven future. This quantitative study investigates the relationships among 21st century skills (critical thinking, problem solving, collaboration, and digital literacy), learned helplessness, and AI anxiety in a sample of 120 undergraduate students (80 engineering and 40 business management majors) enrolled at a private university. Data were collected through validated scales measuring 21st century skill competencies, learned helplessness tendencies, and anxiety related to AI technologies.

Structural equation modeling (SEM) was employed to examine whether learned helplessness mediates the relationship between 21st century skills and AI anxiety. Results indicated that higher levels of 21st century skills significantly predicted lower learned helplessness and reduced AI anxiety. Engineering students demonstrated significantly stronger problem solving and digital literacy scores, while business management students exhibited higher levels of AI anxiety. Learned helplessness partially mediated the relationship between 21st century skills and AI anxiety, suggesting that students with insufficient cognitive and self regulatory skillsets are more vulnerable to technology related anxiety. The findings underscore the importance of strengthening 21st century competencies as a preventive factor against maladaptive psychological responses to emerging AI technologies. Implications for curriculum design, instructional strategies, and student support services are discussed.

Keywords: Key Words: 21st Century Skills, learned Helplessness-AI Anxiety, Structural Equation Modeling, Critical Thinking, Technology Related Anxiety

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Analysis of the Reflection of Primary School Students' Artificial Intelligence Attitudes on their Perception

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Students who are the digital natives of our age (Prensky, 2004) interact with artificial intelligence starting from early ages. This early interaction plays a significant role in forming their attitudes towards artificial intelligence (Garg et al., 2022). In fact, these attitudes are shaped by both their curiosity towards technology and their knowledge level on artificial intelligence (Oruç et al., 2025). The artificial intelligence programs developed for this reason aim at helping children understand this technology better and use it consciously (Yang, 2022). However, when the literature was reviewed, it was seen that the findings on to what extent students' attitudes toward artificial intelligence influence their perception of this technology are limited. Therefore, it is aimed in this study to determine how perceptions of 4th grade primary school students, who are considered to have different artificial intelligence attitude scores, of artificial intelligence can differ. The mixed method approach was adopted in the study. The survey research method in the quantitative dimension and the basic qualitative research method in the qualitative dimension will be used. The sample of the study will consist of 4th grade students receiving education in a state primary school in the eastern part of Türkiye. The sample will be determined through the convenience sampling method. In this study, which is planned to be carried out in two stages, the quantitative data will be obtained through the Artificial Intelligence Attitude Scale, whereas the qualitative data will be obtained through the draw ,write and tell technique. This scale has been developed by Oruç et al. (2025) and consists of 4 factors and 20 items. The general Cronbach Alpha reliability coefficient was calculated as 0.80. This scale will be applied to the students in the first stage of the study and the obtained data will be analyzed with the SPSS software. As a result of these analyses, the students will be separated to three groups according to their attitude scores as low, medium and high. In the second stage, the students in each attitude group will be applied the draw, write and tell technique. Within this scope, the students will be asked to draw what comes to their minds when they hear the "artificial intelligence" concept and write short texts which explain these drawings. Then, semi-structured interviews will be conducted with the students and allow them to explain their drawings and written statements in a more detailed manner. The obtained qualitative data will be analyzed with the content analysis method and the students' perception of artificial intelligence will be interpreted in association with their attitude levels. Through this two stage mixed method, it will be attempted to present how students' attitudes towards artificial intelligence affect their perception.

Keywords: Artificial Intelligence, Attitude, Perception, Primary School Students

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Preservice Computer Science Teachers' Use of Generative Artificial Intelligence, Their Attitudes, and Their Metaphors

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The phenomenon known as "shiny object syndrome" has become increasingly prominent in recent times, particularly in regard to the field of artificial intelligence (AI). This trend necessitates rigorous scientific research and development aimed at leveraging artificial intelligence for the benefit of humanity. Rapid developments in generative artificial intelligence (GAI) technologies have garnered significant attention in education as well. We believe that the effectiveness and acceptance of GAI in education depends on the perspectives, knowledge and usage of future educators who make use of GAI in teaching. Thus, this study examines the use of, attitudes toward, and metaphors associated with GAI among Turkish pre-service computer science teachers. The sample includes 61 pre-service teachers (25 female and 36 male) from a state university in western Türkiye. While most students had not taken a course on AI previously, they reported high self-efficacy regarding GAI knowledge and usage (80.3%), primarily with ChatGPT. Additionally, most of the students use GAI for self-study (82%) and daily learning activities (79%). They posit the need for GAI integration in education (70.5%), but not as a replacement for teachers. Although they are concerned about the unethical use of AI, they generally have positive attitudes. Finally, they produced positive metaphors for AI, such as "personal teacher," "assistant," "Superman," "brain," “treasure,” “guide,” “tool,” “encyclopedia,” and so on, while a few of them described AI as a "fish," that requires water to survive, "black hole," that swallows everything, "sugar," and "medicine," both as a sweet or remedy and a harmful substance. In conclusion, future teachers' perceptions of GAI in education are generally positive, though there are some concerns about ethics, over-reliance on AI, bias and mistakes. It is considered that responsible GAI integration in teacher education requires careful research-oriented planning in accordance with national and international AI in education policies.

Keywords: Generative AI Use, Generative AI Attitude, AI Metaphor, Teacher Education.

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Digital Learning Material Development Self-Efficacy: A Scale Development Study

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Digital learning materials facilitate comprehension of concepts that students find challenging, promote collaborative work, and enhance academic performance. Given the rapid advancements in artificial intelligence and web technologies that are increasingly shaping learning environments and materials, it is imperative to enhance teachers' competencies in the development and utilization of these materials. In this context, it is also imperative to address teachers' self-efficacy levels, particularly in the development and utilization of digital teaching materials. The objective of this study is to develop a valid and reliable scale, designated as the Digital Learning Material Development Self-Efficacy Scale (DLMDSES), to assess preservice teachers' self-efficacy in developing digital learning materials. In the initial phase of the study, a thorough literature review was conducted to establish an item pool, which was subsequently evaluated by 13 experts. An exploratory factor analysis (EFA) was conducted on data collected from 277 preservice teachers studying at a public university in western Türkiye to examine the construct validity of the draft scale. The findings indicated that the DLMDSES is composed of a single-factor structure with 26 items. In the subsequent phase, confirmatory factor analysis (CFA) was conducted with a new sample of 300 preservice teachers from the same institution. The results of the Confirmatory Factor Analysis (CFA) indicated that the model exhibited satisfactory fit indices, thereby substantiating the single-factor structure. The reliability coefficient of the scale was calculated to be .97. Consequently, the developed scale is regarded as a valid and reliable instrument for assessing preservice teachers' self-efficacy in the development of digital learning materials. It is anticipated that this scale will contribute to researchers and practitioners engaged in instructional design processes.

Keywords: Digital Learning Material; Self-efficacy; Scale Development; Teacher Education

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A Comparative Study of Psychological and Physical Health Parameters Among Female Students in Conventional and ODL Institutions

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The increasing diversity of higher education through Open and Distance Learning (ODL) systems has transformed the students' academic experiences by affecting their physical health parameters and their psychological well-being. This research is focused on the Biopsychosocial Model; it aims to examine the relationship between physical health indicators and psychological well-being among female students. Its focus is to evaluate the differences in this relationship between conventional/regular college students and those enrolled in ODL programs.

The research uses correlational methodology to focus on female undergraduate students studying in an unconventional/regular college and an ODL institution. It captures the physical health parameters of the students by taking into account their height, weight, blood pressure, BMI, waist circumference, menstruation markers, etc., along with standardised assessments to measure psychological well-being and stress parameters.

It is hypothesised that heightened levels of stress and low psychological well-being will be associated with adverse physical health outcomes, and that the nature and magnitude of this relationship will vary across educational contexts. Students in Open and Distance Learning (ODL) environments may undergo various stressors arising from a lack of social connectivity, unstructured schedules, and increased self-regulation demands, in contrast to conventional/regular college students who experience systematic academic pressures and more fluid daily routines with ample social connectivity.

The results are expected to contribute to the ongoing discourse on learner well-being in distance, online, and remote education by highlighting the interplay between physical and mental health among female students. The study understands the importance of integrating support systems within ODL frameworks that address both mental health and lifestyle-related physical health challenges, thereby promoting holistic student development.

Keywords: Anthropometric Measures, Psychological Well-Being, Stress, Physical Health, ODL Students, Conventional Institutions

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Self-Organized Criticality as a Design Framework for Human-AI Learning Systems

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Adaptive learning systems typically assume that learning gains scale proportionally with intervention intensity. That is, more tutoring, more feedback, and more AI engagement yield better outcomes. However, emerging evidence suggests learning in classrooms involves cascade-like phenomena and non-linear threshold effects, where timing and systemic readiness may matter more than intensity. This paper proposes conceptualizing human-AI collaborative learning as a dynamical system operating near a critical state, drawing on Self-Organized Criticality (SOC) theory. SOC offers an apt framework because learning, like critical systems, exhibits scale-invariant cascades, self-organization toward efficiency, and leverage points where small, precisely timed interventions produce disproportionate system-wide changes. We hypothesize that pedagogical systems optimized for criticality, rather than maximum intensity, could achieve greater learning efficiency. This is particularly relevant in resource-constrained educational settings where intervention capacity is limited.

Self-organized criticality, initially described by Bak, Tang, and Wiesenfeld (1987) through sandpile models, explains how systems evolve to critical thresholds without external control. Learning systems likely exhibit analogous characteristics, such as power-law distributed learning cascades, scale-invariant fluctuations, and non-monotonic responses to interventions. Unlike linear adaptive models that assume proportional gains from intervention intensity, criticality-based systems predict that optimal learning emerges near phase transitions, where leverage effects are maximal.

Our framework introduces a readiness state vector, $\sigma(t)$, for individual students and describes system-level understanding, $U(t)$, across multiple dimensions (prior knowledge, attention, conceptual coherence, motivation). The system-level understanding emerges from coupled nonlinear dynamics in which students near the critical threshold are most responsive to AI, intervention timing relative to readiness fluctuations governs effectiveness, and peer network structure amplifies or limits learning cascades.

The framework is operationalizable and falsifiable. We specify how to measure readiness states through learning analytics and behavioral indicators, quantify system-level understanding across dimensions, and detect criticality using statistical patterns of power-law distributions. The study outlines experimental conditions comparing AI interventions timed to criticality signals against standard adaptive approaches, with metrics for learning gains and cascade effects. Whether learning systems operate at critical states and whether criticality-aligned interventions outperform conventional approaches remains empirically open. This paper provides the theoretical foundation and research design for future classroom studies to investigate it.

Keywords: Self-organized Criticality, Human-AI Learning Systems, Critical Phenomena in Education, Adaptive Pedagogical Intervention

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Moroccan EFL Students' Attitudes towards the Integration of AI Chatbots into Debating Classrooms

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In the contemporary educational landscape, characterized by rapid technological innovation, Artificial Intelligence (AI) has emerged as a tool with great potential to transform pedagogical practices. The rise of Artificial Intelligence (AI) in education has unlocked new pathways for developing students' critical thinking and communication skills. Debate pedagogy, which relies heavily on argumentation, rebuttal, and logical reasoning, presents a promising context for the integration of AI chatbots. This study adopted a mixed-methods design. A quasi-experimental model was applied to two groups of undergraduate students (n = 64) enrolled in a debate and public speaking course. The experimental group engaged with an AI chatbot to practice argument construction, rebuttals, and cross-examination, while the control group received traditional instructor-led training. In addition, semi-structured interviews with students provided qualitative insights. Findings revealed a statistically significant improvement ($p < .05$) in the experimental group across all assessment categories. Students reported greater engagement, confidence in formulating counter arguments, and an improved ability to detect logical fallacies. Students highlighted the chatbot's capacity to provide immediate feedback and foster independent learning. The main challenge was the risk of over-reliance on AI-generated prompts. In sum, AI chatbots demonstrate strong potential as supplementary tools in debate education, promoting self-directed learning, critical thinking, and active participation. Future research should examine longitudinal effects, cultural adaptability, and ethical implications of AI-mediated argumentation training.

Keywords: AI Chatbots, Debating Pedagogy, Critical Thinking, Autonomous Learning, Educational Technology

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Agent-Friendly: Constructing a New AI Governance Design Paradigm Beyond User-Friendly in a Matrix-Like World of Agents

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Human-computer interaction (HCI) has embraced "user-friendly" as the foundational paradigm of interface design for half a century. However, generative AI (GenAI) applications achieving autonomous task execution through agent modes have fundamentally transformed interfaces. Much like in the Matrix universe, interfaces are evolving into dual-layer structures that AI agents also read, interpret, and operate upon. This transformation is particularly evident in educational technology environments such as learning management systems and adaptive learning platforms. User-friendly principles alone are insufficient to govern this dual-layer architecture; although "agent-friendly" exists in technical discourse, the core attributes remain systematically undefined. This study addresses this gap through three contributions. First, design principles have been derived by adapting Nielsen's heuristic principles (H1-H10) to agent cognition: structural transparency, machine-readability, deterministic navigation, and atomic interaction sequences. Second, these principles have been operationalized within an "Agent Mode" framework standardizing task flows, tool-calling protocols, and error recovery. Third, a complementary concept, "friendly agent," is proposed: AI systems operating within ethical oversight, grounded in Asimov's laws, IEEE Ethically Aligned Design (transparency, accountability, human well-being), and the EU AI Act's risk-based oversight. These normative anchors guided the design of authentication, authorization, auditability, and human-in-the-loop mechanisms. Keeping the human in the decision loop at decisive points constitutes the central tenet. The research adopts Walker and Avant's eight-step concept analysis: (1) concept selection: agent-friendly as the core interface challenge of the GenAI era; (2) purpose: delineating boundaries with user-friendly and friendly agent; (3) surveying uses: agentic AI studies, technical documents, and accessibility standards; (4) defining attributes: interpretability, navigability, and auditability; (5) model case: agent completing a task on an ARIA-labeled interface (Accessible Rich Internet Applications); (6) borderline and contrary cases: API-only agent, bot-blocking CAPTCHA; (7) antecedents and consequences: agent mode and semantic web as antecedents, increased agent success and safe automation as consequences; (8) empirical referents: DOM readability score, ARIA coverage ratio, task completion time. Intercoder reliability was .87 (Miles and Huberman). Content validity was verified by three experts (Lawshe CVR = 1.00; S-CVI/Ave = .93). The framework clarifies the boundary: agent-friendly denotes interfaces readable and processable by agents, whereas friendly agent denotes agents operating within ethical boundaries. The framework applies across distance education, health informatics and e-commerce empirical testing and integrating friendly agent principles into AI governance are identified as priorities.

Keywords: Agent-friendly Design, Friendly Agent, User-friendly, Human-in-the-loop, Generative AI, Educational Technology, Human-computer Interaction

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Language Learning Agents: Investigating on User Experience Patterns in an AI-based Platform

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In today's context, where AI-based language-learning agents are playing an increasingly decisive role in educational technology, a deep understanding of the user experience dimension of these applications is critically important for both Human Computer Interaction (HCI) research and applied educational technology design. However, studies that systematically address organically generated user feedback in a natural context and examine a fully AI-integrated application from a HCI perspective constitute a gap in the literature. This study aims to reveal user experience patterns and the focus of interaction breakdown by focusing on the Praktika AI agent, which offers language practice with three-dimensional virtual AI avatar. A case study was adopted in the research; 657 Google Play reviews from September 2025 to March 2026 were examined within the framework of a reflective thematic analysis, with VADER-based sentiment analysis and keyword frequency coding integrated as a quantitative layer. The analysis focused on AI feedback reliability, interaction breakdowns, human-AI expectations, personalization, gamification, platform usability, monetization, and tutor-platform dynamics, using a 471-term codebook organized into eight thematic categories. The findings reveal a pattern that deviates significantly from common expectations in the literature. The theme of the quality of instructional feedback from AI was present in only 6.9% of negative reviews, while the theme of subscription management and user trust dominated with 52.1%. In this context, the initial study introduces a unique pattern to the literature, conceptualized as "shift in focus of interaction breakdown." Users find the systemic elements surrounding the application, namely pricing transparency, subscription management, and corporate responsiveness, problematic, rather than the learning interaction with AI itself. VADER analysis produced a negative composite mean score across the entire dataset, with negative reviews significantly longer than positive reviews. Therefore, it can be said that user satisfaction in fully integrated AI language learning environments depends not only on the pedagogical competence of the AI but also on the reliability of the business model and the platform's corporate design. This situation points to a new research agenda for future studies, suggesting comparative studies among different AI-based language learning platforms.

Keywords: AI-agents, Language Learning, User Experience, Human-Computer Interaction, App Store Reviews, Thematic Analysis, Case Study, VADER-based Sentiment Analysis

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The Effect Of The Sci-Tutor Mobile App on Achievement in Science Classes

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Students with visual impairments are expected to learn the same topics, learning outcomes and concepts as their typically developing peers. In this context, Unit 1 of the Year 5 Science course, 'Our Neighbours in the Sky and Us', covers 'The structure of the Sun', 'The Sun's rotation', 'The Moon's characteristics', 'The Moon's rotation and orbital motion', 'The Moon's phases', 'The volumetric sizes of the Sun, Earth and Moon' and 'The relative motions of the Sun, Earth and Moon' are intended to be taught to students. A student without a visual impairment can acquire some of these learning outcomes through observation and others individually using supplementary materials outside of lessons. However, for students with visual impairments to acquire these learning outcomes, specialist staff, appropriate materials and suitable environments are required. Students with visual impairments should also be able to develop individually outside of school, just like their sighted peers. Supplementary learning materials play a significant role in the academic and individual development of students with visual impairments.

As part of this project, a tactile book supported by the Scı-Tutor mobile app has been developed under the "Science Extracurricular Support Material: Touch-Feel-Learn Model" for Year 5 pupils. Two-dimensional illustrations were created in Figma for the tactile book, targeting the learning outcomes mentioned above. QR codes were placed in the top-left corner of the illustrated pages to integrate with the Scı-Tutor mobile app. By scanning these QR codes with the Scı-Tutor app downloaded onto a tablet or phone, users can access audio descriptions. These audio descriptions provide a general summary of the page and detailed information about the illustrations.

The information contained in the Sci-tutor mobile app and tactile book was tested on visually impaired 5th-grade students to examine its impact on academic achievement. The study group consisted of six visually impaired students. Achievement tests were administered to the students before and after using the app. When the total scores from the pre-tests and post-tests were compared, it was observed that the tactile book supported by the Sci-tutor mobile app had a positive effect on the students' science achievement.

This study is being carried out as part of TÜBİTAK project no. #323K332, and we would like to thank TÜBİTAK.

Keywords: Visually Impaired, Sci-tutor, Tactile Book.

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Resilient Digital Skills: Role of ODL Institutions for Women Empowerment in India

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In the present digital age, there is a close relationship between the acquisition of digital skills and employability. Today's job-market requires the use of computers and demands a highly skilled and 'specialized' workforce. This demand is growing day by day. On the other hand, in a developing country like India, 'employability' is a major marker of economic empowerment. So, to increase employability, every job-seeker has to acquire basic digital as well as technical skills. The most effective way to learn these skills is through education. Hence, the educational institutions, particularly the higher education institutions, need to focus on developing the basic knowledge and skills of using digital devices. Besides, the process of skilling, reskilling and up-skilling is also the basic means for having a required employability. In this context, apart from the conventional learning system, Open and Distance Learning is very crucial as it could play a pivotal role not only in providing educational opportunities to the deprived sections but also in providing a greater scope for skilling the people in their chosen field in a more self-paced and flexible way. Therefore, every learner will need to update his or her knowledge and skills, which is required to lead a meaningful life in society. It is also being noted that in the Indian context, women are more underprivileged and relatively deprived in accessing their educational, economic, and social rights compared to their male counterparts. Therefore, it is pertinent to discuss to what extent, education in general and ODL in particular, can play a vital role in making women learners competent with basic digital skills besides making them fit in the present AI (Artificial Intelligence) based or technology-based society and the job market. So, this paper intends to explore to what extent the various ODL courses have enabled women learners to gain basic digital skills to increase their employability. For the study, this paper examined the post-graduate women learners of the ODL institutes in India. Descriptive Survey Study method is used in this study. Purposive sampling technique is applied to select women learners who have completed Master's Degree courses, namely, MA, MBA, MCA, MMC and MSW in the years 2025 from Krishna Kanta Handiqui State Open University (KKHSOU), Assam, Regional Centre, Indira Gandhi National Open University (RC, IGNOU), Guwahati and Institute of Distance and Open Learning, Gauhati University (IDOL, GU).

Keywords: Digital Skill, ICT, Employability, Open And Distance Learning Courses, Women Learners

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In-Service Science Teachers' 21st Century Skills: An Analysis of Teacher Motivation and Attitudes Towards Educational Research as Predictors

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This study aimed to investigate the role of in-service science teachers' attitudes toward educational research and their teacher motivation in predicting 21st-century skills. For this purpose, a quantitative study was conducted based on correlational research methodology. Within the scope of the research, data was collected via Google Forms from 256 in-service science teachers (164 females, 92 males) working in 49 different cities of Türkiye. The data were collected using the "21st Century Skills Self-Efficacy Perception Scale", "Teachers Attitude Scale Towards Educational Research " and "Teacher Motivation Scale". The mean age of the participants was calculated as 38.04 (SD = 7.38). Within the scope of data analyses, descriptive statistics were used to examine the level of interested variables and correlation analyses were used to determine the relationship among them. Finally, three separate multiple linear regression analyses were conducted for each sub-dimension of 21st-century skills to test the role of attitudes toward educational research and motivation towards the teaching profession.

When the means for twenty-first skills were found to be at a high level for "learning and innovation" skills and at a very high level for "life and career" and "information, media, and technology skills". As for teachers' attitudes toward educational research, it was found that participants' attitudes towards the "necessity of educational research" were high, "valuing educational research" sub-dimension was very high, and the "applicability of educational research" sub-dimension was at a medium level. Finally, the mean values for teacher motivation were found to be high for all three sub-dimensions (intrinsic, extrinsic, and managerial factors). When the correlations between the sub-dimensions of 21st-century skills and the sub-dimensions of predictors were examined, it was found that all of them were positive, the highest relationship was observed with the necessity of educational research, and the lowest relationship was with the applicability of educational research. Finally, as a result of the multiple linear regression analysis, the necessity of educational research, internal factors, and external factors were found to be significant predictors of all three 21st century skills (learning and innovation skills, life and career skills, information, media and technology skills), and managerial factors only predicted life and career skills. All variables except extrinsic factors explained the relevant variables positively. Consequently, 21st-century skills are more highly developed among science teachers who believe that educational research supports curriculum renewal, solves instructional problems, guides teaching methods, and who find research seminars beneficial. Furthermore, these advanced skills are evident in teachers who believe the profession offers both material and intrinsic rewards, fosters skill development, and aligns with their career goals.

Keywords: 21st Century Skills, Attitude, Attitude Towards Educational Research, Motivation, Teacher Motivation, Science Education, Science Teachers

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The Impact of ChatGPT on Academic Writing Development in Social Sciences and Humanities Education

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In Social Sciences and Humanities education, academic writing is a core skill for students as it requires critical thinking, generating ideas, and a clear structure of sentences. But technology, especially ChatGPT, is being used by students in this regard. Despite its effectiveness, students face some challenges, like sometimes ChatGPT produces incorrect information and gives the same response again and again. Moreover, sometimes they copy responses from ChatGPT without understanding the concept, which affects their long-term learning. This study aims to investigate students' perceptions of the effectiveness and challenges of using ChatGPT in academic writing. It employs mixed-method approaches using semi-structured interviews and an online survey. This study finds that most of the students use ChatGPT to support their academic writing skills for correcting grammar, brainstorming ideas, understanding difficult academic concepts, summarizing, and paraphrasing. This study suggests that ChatGPT can be a helpful learning tool, but students need guidance from teachers and institutions on using ChatGPT, and instead of copying answers, they should understand the concept and verify the answers before writing.

Keywords: Academic Writing, ChatGPT, Effectiveness, Challenges

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Effects of Social Media on English Vocabulary Development of Tertiary Level Students

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Nowadays, social media has become one of the primary modes of daily communication for learners, which has also impacted their learning habits. Hence, learners' vocabulary acquisition has been affected both positively and negatively by exposure to social media platforms like Facebook, Instagram, and TikTok, with significant English content consumption. The main objective of this research paper is to examine the contribution of social media use among tertiary-level students and to understand learners' perceptions of this influence. The study will use a mixed-methods approach, collecting data from tertiary-level students through surveys and vocabulary-related questionnaires. The survey will be heavily focused on how frequently learners use social media, the kinds of applications they use, and how they use social media to help them learn new vocabulary. The findings of this research indicate that social media plays a crucial role in intensifying informal vocabulary learning. The learners revealed learning new words, slang, and expressions through daily online exposure. Nevertheless, constant usage of social media may negatively impact the use of standard English in academic contexts. Overall, the research suggests that social media can be an additional tool for vocabulary development when used in a balanced and guided manner.

Keywords: Vocabulary, Social Media, Tertiary Level

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A Turkish grammar-aware approach to introductory programming

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Introductory programming is often challenging for novice learners because it requires them to understand new computational concepts while also interpreting foreign-language terminology and syntax. This challenge is particularly significant for learners whose native language is not English, for individuals unfamiliar with technical vocabulary, and for younger learners at the beginning of programming education. In the Turkish context, previous attempts to create Turkish programming languages have often focused mainly on translating keywords into Turkish while preserving the syntactic and grammatical structure of mainstream programming languages. As a result, the linguistic barrier has remained only partially addressed, and the potential of a fully native-language, grammar-aware programming environment has not been sufficiently explored. The purpose of this study is to introduce and theoretically frame a fully Turkish, grammar-aware introductory programming language designed as a pedagogical bridge for novice learners, and to present a prototype developed in line with this aim. The study is grounded in the view that beginning programming in one's native language may support early conceptual understanding and facilitate later transition to mainstream programming languages. The study employs a design-and-development approach supported by a conceptual framework. During development, a prototype of a Turkish programming language was designed with attention to Turkish keywords, grammar, word order, and syntax. The design was informed by sociocultural theory, Cognitive Load Theory, scaffolding and transfer, and the concepts of notional machine and threshold concepts in computing education. These perspectives guided both the rationale for the language and the principles underlying the prototype design. The study suggests that the prototype offers a different approach from earlier Turkish programming language attempts by treating Turkish not merely as a translated interface layer but as a structuring component of syntax design. In this respect, the prototype may reduce extraneous linguistic load, support concept formation through familiar language patterns, and function as a transitional scaffold between native-language reasoning and mainstream programming languages. In conclusion, the study argues that mother-tongue programming language design should be approached as both a pedagogical and a structural design problem rather than as a simple vocabulary translation task. The prototype presented in this study demonstrates the feasibility of this approach in the Turkish context. It is recommended that future research evaluate the prototype empirically with novice learners, particularly children and learners with limited English proficiency, and examine its effects on comprehension, motivation, and transfer to widely used programming languages.

Keywords: Introductory Programming, Programming Language, Mother-tongue Programming, Computing Education, Prototype Development

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Green Skills and Transnational Peer Training: A Case Study in Student Mobility

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Developing sustainable mindsets requires more than classroom instruction; it requires active collaboration and the exchange of ideas across borders. As environmental challenges grow increasingly complex, educational initiatives must move beyond traditional pedagogies and embrace interdisciplinary, cross-cultural approaches that prepare students for real-world problem-solving. This sutdy analyzes the peer training model developed within the EcoAI EduNetwork Initiative (EAIEN), an Erasmus+ KA220-SCH cooperation partnership that brings together schools and institutions from Türkiye, Romania, and Greece. By connecting students from diverse educational and cultural backgrounds, the project creates a "living laboratory" for environmental and digital skill acquisition through both physical and virtual mobility activities. The core of this study is the evaluation of two mobility events held in Eskişehir, Türkiye and Santana, Romania, where students engaged in hands-on training focused on ecological challenges and AI-based solutions. During these events, participants collaborated in mixed international teams to explore sustainability topics and the application of artificial intelligence tools to create open educational resources to train their peers and raise awareness in the local community. Using a mix of qualitative feedback and quantitative surveys collected before and after each mobility, we examine how the peer-training methodology affects student confidence, cultural awareness, and environmental stewardship. Preliminary findings suggest that the combination of cross-border interaction and project-based tasks contributes meaningfully to both attitudinal shifts and skill development among participants. The study highlights the importance of "Green Skills" not just as technical knowledge, but as a holistic competency encompassing critical thinking, civic responsibility, and adaptability for a circular economy and how these are best fostered through collaborative, problem-based learning in authentic settings. We argue that peer training, in which students teach and learn from one another, serves as a particularly effective mechanism for internalizing these competencies. This case study offers valuable insights for educators and policy-makers interested in the practicalities of designing and managing transnational Erasmus+ mobility programs that combine social inclusion objectives with high-tech learning goals in the service of environmental sustainability.

Keywords: Peer Training, Student Mobility, Green Skills, Intercultural Learning, Erasmus+

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Empowering Learners through Open Educational Resources: The EAIEN Digital Learning Ecosystem

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In the era of digital transformation, Open Educational Resources (OER) play a pivotal role in democratizing access to high-quality learning materials. The EcoAI EduNetwork Initiative (EAIEN) leverages digital technology to create an innovative learning ecosystem focused on AI literacy and environmental sustainability. This presentation examines the design and implementation of the EAIEN digital platform, which serves as both a repository for student-created content and a collaborative workspace for peer-to-peer training. The study focuses on the pedagogical transition from passive consumption to active content creation. Within the EAIEN framework, students are not only learners but also "knowledge producers," developing OERs that integrate AI-driven environmental solutions. This approach utilizes a "Peer Training Exchange" model, where digital tools facilitate cross-border mentorship and knowledge sharing among high schools and universities. We discuss the technical challenges of maintaining an open-access platform that adheres to the project's strict ethical and quality assurance guidelines, including data privacy and inclusivity. Results from the early implementation phases suggest that the use of localized yet digitally shared resources enhances student motivation and technological self-efficacy. This presentation will demonstrate the platform’s features and discuss how the integration of AI tools within OERs can foster a more resilient and tech-savvy generation of European students.

Keywords: Open Educational Resources (OER), Digital Learning, AI in Education, Student-Led Learning, Educational Technology.

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A Cross-Disciplinary Perspective: Metaphorical Perceptions of Graduate Students on Generative Artificial Intelligence in Education

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This study aims to comparatively examine the metaphorical perceptions of graduate students from science and social science disciplines regarding generative artificial intelligence in education. The research is designed within the framework of phenomenology, one of the qualitative research approaches. The study group consists of 20 graduate students selected based on disciplinary diversity. Half of the participants are teachers enrolled in a mathematics education graduate program within the institute of science, while the other half are teachers enrolled in a curriculum and instruction graduate program within the institute of social sciences. This structure enables the exploration of cross-disciplinary differences in how generative artificial intelligence is perceived.

A review of the literature indicates that most metaphor studies rely on a single open-ended question and are often not grounded in a clear theoretical framework. Addressing this gap, the present study integrates the metaphor elicitation process with established theoretical perspectives. Accordingly, the metaphor prompts were developed based on the Diffusion of Innovations Theory (DIT), the Technology Acceptance Model (TAM), the Uses and Gratifications Theory (UGT), Actor-Network Theory, and the Extended Mind Theory. Participants were asked to generate metaphorical expressions reflecting the role of artificial intelligence in academic work, access to information, and everyday life.

Content analysis was employed in the data analysis process, including the classification of metaphors, the analysis of underlying rationales, and the development of theory-driven categories. The findings are expected to reveal how generative artificial intelligence is conceptualized across different disciplines and to highlight the theoretical dimensions underlying these perceptions. Furthermore, the study aims to contribute methodologically to the literature by proposing a theory-informed approach to metaphor analysis and to support the development of more nuanced and context-sensitive interpretations of artificial intelligence in education.

Keywords: Artificial Intelligence in Education, Metaphorical Perception, Graduate Students, Cross-disciplinary Comparison.

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The educational pathways of Unaccompanied Minors through identity, school, and the new educational frontiers of Artificial Intelligence

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This theoretical paper aims to reflect on the journey of unaccompanied minors, focusing on three particularly significant aspects: the identity construction, the role of school as a positive support network, and the educational potential of Artificial Intelligence (AI). The issue of unaccompanied continues to represent a highly sensitive educational and social challenge, as it concerns young people who often find themselves living in conditions of extreme vulnerability, marked by disruptions in their life stories, emotional discontinuity, and fragility in the processes of recognition. From this perspective, this paper aims to highlight how these young people's identity pathways cannot be interpreted in a linear manner, but instead take the form of complex processes, marked by transitions, redefinitions, and a strong need for recognition. Within this framework, school is viewed as an educational and relational space capable of having a tangible impact on their development, rather than merely a place of instruction. In particular, for unaccompanied minors, who often cannot rely on family or social support networks, the school experience can represent a fundamental context for building meaningful bonds, for experimenting with forms of belonging, for feeling welcomed, for accessing real opportunities for participation, and for preventing isolation and marginalisation.

Within this same framework lies the consideration of AI, viewed here not merely as a digital technological tool, but as a potential educational resource. Indeed, when used responsibly and critically, it can facilitate language mediation, support the personalisation of learning pathways, and offer opportunities for social interaction. Used in this way, AI can help strengthen inclusion processes by providing innovative tools for the narrative reconstruction of the self. By allowing minors to organize and re-elaborate their life stories through digital languages, AI supports them in building identity, connections and opportunities for participation. At the same time, it is important to avoid simplistic interpretations or uncritical positive or negative views of technology, and instead frame its use within a pedagogical perspective attentive to individual experiences and contexts. From this perspective, intercultural education can provide the framework within which schools and digital technologies are reinterpreted not as separate elements, but as resources which, if pedagogically guided, can support processes of recognition, inclusion and participation among unaccompanied minors.

Keywords: Unaccompanied Minors, Identity Construction, Intercultural Education, School Support Network, Artificial Intelligence.

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A Taxonomy for Data Ownership and Instructor and Student Rights in Digital Learning Platforms

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Digital learning platforms are part of the everyday lives of millions of students and instructors. These platforms can collect and process data from students' interactions and the content created by instructors. Nevertheless, the rights to their own data afforded to these stakeholders remain opaque. As educational institutions increasingly depend on third-party platforms, questions of trust, responsibility, and data governance become central to building resilient and equitable digital learning ecosystems. This study aims to understand how digital learning platforms define and distribute data ownership and control, especially of instructor-created activities.

To fulfill this objective, this study selects 40 digital learning platforms that support instructor-created activities across three categories: Learning Management Systems (LMS), MOOCs, and adaptive learning platforms. First, the governance documents are systematically collected, then an Inductive Thematic Analysis is applied to construct a taxonomy of data ownership and control. Finally, the taxonomy is applied across the platforms to measure surface patterns and disparities in how data rights are allocated across platform types.

At the current stage, this research aims to offer a conceptual foundation for evaluating digital learning platforms through a rights-centered lens. The study anticipates revealing disparities in how platforms recognize the data rights of students and instructors, with governance documents likely favoring platform interests over stakeholder autonomy. The findings may be relevant for educators, institutions, and policymakers committed to building trustworthy digital learning ecosystems

Keywords: Trust, Privacy, Responsible Education, Digital Learning Platforms, Data Governance

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Multi-Level Study of Teacher Readiness for Mobile Ed-Tech in Brazilian Public Schools

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[1] Science Voices

Mobile educational technology platforms have proliferated globally, promising personalized and ubiquitous learning experiences. Yet the design assumptions embedded in leading platforms, including minimum device specifications, stable internet connectivity, and baseline digital literacy, often reflect the realities of well-resourced institutions rather than those of public schools in developing nations. Brazil, despite being one of the largest ed-tech markets in Latin America, exhibits such internal disparities.

As responsibility for equitable digital education shifts increasingly toward platform design and institutional policy, understanding the ground-level readiness of teachers becomes essential for building inclusive and sustainable mobile learning ecosystems.

This study aims to produce a multi-level baseline profile of teacher readiness for mobile ed-tech adoption across elementary, middle, and high school levels in Brazilian public schools, and to assess how far current platform assumptions diverge from classroom reality. To fulfill this objective, surveys will be conducted with teachers across school levels using a structured questionnaire covering device ownership, internet access quality at school and at home, prior experience with digital platforms, self-assessed digital confidence, and perceived barriers to adoption.

Survey findings will be compared with Brazilian Ministry of Education and current leading ed-tech platforms data. This research anticipates revealing a systematic gap between the infrastructure assumptions of leading ed-tech platforms and the material conditions experienced by Brazilian public school teachers, with disparities compounding across school levels and geographic contexts. It further expects that teacher readiness is constrained not only by device or connectivity availability, but by unaddressed confidence deficits and the absence of locally adapted digital tools. The resulting baseline profile is intended as foundational data for researchers, platform designers, and educational policy makers working toward mobile learning solutions that are genuinely inclusive, contextually grounded, and resilient to infrastructural uncertainty.

Keywords: Teacher Readiness, Mobile Learning, Digital Divide, Ed-tech Adoption, Brazil, Public Schools, Human-computer Interaction, Inclusive Design

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An Examination of Cyberbullying Victimisation and the Use of Artificial Intelligence Among University Students in Terms of Various Psychosocial Variables

Abdullah Tunç

Samsun University

This study aims to examine the distribution of university students' purposes for using social media and to reveal the relationships between cyberbullying victimisation, loneliness, the fulfilment of basic psychological needs through the use of artificial intelligence, and social anxiety. The research was conducted within the framework of a correlational survey model, and analyses were performed using data obtained from university students aged 18 and over. In this context, the chi-square analysis results regarding students' purposes of social media use and the correlation findings illustrating the relationships between the key variables were examined.

According to the chi-square analysis results, it was determined that the distribution of students' purposes for using social media differed at a statistically significant level (χ^2=30.82, $p<.05$). The findings indicate that students use social media most frequently for social communication and entertainment purposes, whereas usage for information-seeking and academic/work-related purposes remained at a lower level than expected. This suggests that social media is used by students primarily as a means of interaction and relaxation.

When examining the relationships between variables, significant and positive correlations were found between loneliness and social anxiety. In particular, it was observed that an increase in loneliness levels raises individuals' fear of negative evaluation and their general levels of social anxiety. However, weak negative correlations were found between loneliness and cyberbullying victimisation. This finding suggests that more lonely individuals may be less likely to be exposed to cyberbullying due to their reduced engagement in online environments.

Weak positive correlations were identified between the fulfilment of basic psychological needs through the use of artificial intelligence and social anxiety. This suggests that individuals experiencing anxiety in social settings may be inclined to turn to AI-based tools to meet their psychological needs. Furthermore, it is considered that interactions with AI could serve as a means of compensating for deficiencies in an individual's social relationships.

In conclusion, it is observed that students' purposes for using social media are predominantly social and entertainment-oriented; that loneliness and social anxiety are interrelated; and that the use of artificial intelligence may play an alternative role in meeting psychological needs. In this regard, it is recommended that the psychosocial effects of university students' digital environment usage habits be taken into account and that awareness-raising initiatives be undertaken in these areas.

Keywords: Cyberbullying Victimisation, Social Media Use, Loneliness, Social Anxiety, Artificial Intelligence

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Basic Psychological Needs and the Predictive Role of Self-Esteem in Interpersonal Dependency

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In this study, the relationships between interpersonal dependency and basic psychological needs (autonomy, competence, relatedness) and self-esteem in adults were examined; furthermore, the predictive power of these variables for interpersonal dependency was assessed using regression analysis. The research aims to elucidate the role of the fulfilment levels of individuals' psychological needs and their self-esteem in influencing tendencies towards dependency in interpersonal relationships.

Upon examining the correlation findings, a significant and negative relationship was observed between interpersonal dependency and self-esteem ($r = -.35$, $p < .001$). Similarly, negative correlations were found between interpersonal dependency and the needs for autonomy ($r = -.38$, $p < .001$) and competence ($r = -.21$, $p < .001$). In contrast, no significant relationship was found between the need for relatedness and interpersonal dependence ($r = .02$, $p > .05$). Furthermore, it was determined that self-esteem exhibits positive and significant relationships with the needs for autonomy, competence and relatedness. These findings indicate that an individual's sense of adequacy and worth is closely linked to the fulfilment of their psychological needs.

The results of the regression analysis indicate that the model is significant ($R = .48$, $R^2 = .23$, $F(4,317) = 24.28$, $p < .001$). The model explains approximately 23% of the variance in interpersonal dependence. Upon examining the predictor variables, it is observed that autonomy ($\beta = -.46$, $p < .001$) and self-esteem ($\beta = -.20$, $p = .004$) significantly and negatively predict interpersonal dependence. These findings suggest that as an individual's perception of independence and positive self-evaluation increase, the level of interpersonal dependence decreases.

Conversely, it was determined that the need for relatedness predicts interpersonal dependence in a positive and significant manner ($\beta = .32$, $p < .001$). This suggests that an increased need to form social bonds may, in certain situations, also increase interpersonal dependence. It was found that the need for competence is not a significant predictor of interpersonal dependence ($p > .05$).

In conclusion, whilst the findings reveal that autonomy and self-esteem are significant variables that reduce interpersonal dependence, they also demonstrate that the need for relatedness has a bidirectional and more complex effect. These findings suggest that meeting individuals' psychological needs in a balanced manner and strengthening self-esteem may contribute to the development of healthier and more independent interpersonal relationships.

Keywords: Interpersonal Dependence, Self-esteem, Psychological Needs, Autonomy, Competence, Connectedness

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Ethical and Responsible Use of Generative Artificial Intelligence in Education: A Cross-Sectional Study with University Students

Ali Orhan

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Today, the rapid advancement of generative artificial intelligence (GenAI) technologies is reshaping multiple domains including education. This transformation extends beyond technological innovation to encompass ethical, social, and human considerations. Within educational settings, the ethical implications of GenAI have attracted increasing attention as both students and instructors rely more frequently on GenAI-generated outputs in learning and assessment processes. Ethical awareness plays a critical role in how learners evaluate GenAI-generated content, the extent to which they use such tools responsibly, and their ability to address issues related to authorship, data use, and academic integrity. These developments highlight the growing need for systematic investigation of ethical awareness and responsible use in GenAI-supported learning environments. Despite this emerging importance, empirical research focusing specifically on ethical awareness and responsibility in relation to GenAI within educational contexts remains limited. Accordingly, the present study aims to examine university students' levels of ethical awareness and responsible use of GenAI as well as the potential influence of selected variables, including gender, grade level, age, perceived GenAI knowledge, and daily internet use (in hours). The study was conducted with 515 university students (211 males and 304 females), and data were collected using the Generative Artificial Intelligence Ethical Awareness and Responsibility Scale (GenAI-EARS) developed by Çınar Yağcı et al. (2026). The instrument comprises 18 items across four dimensions: autonomy, transparency, privacy, and fairness. In the original scale development study, reliability coefficients for the sub-dimensions ranged from 0.75 to 0.89, with an overall reliability of 0.91 for the total scale; in the present study, the total scale reliability was calculated as 0.90. The findings indicated that participants demonstrate a high level of ethical awareness and responsible use of GenAI ($M = 4.15$, $SD = 0.58$). Inferential analyses revealed that neither gender ($t(515) = 1.504$, $p > 0.05$) nor grade level ($F(515) = 2.445$, $p > 0.05$) had a statistically significant effect on GenAI-EARS total scores. However, moderate but significant positive correlations were observed between GenAI-EARS total scores and perceived GenAI knowledge ($r = 0.407$, $p < 0.01$) while there was a significant, small and positive relationship between GenAI-EARS total scores and daily internet use ($r = 0.127$, $p < 0.01$). In contrast, age was negatively correlated with ethical awareness and responsible use ($r = -0.107$, $p < 0.05$). These results suggest that familiarity with GenAI and digital engagement may be associated with higher levels of ethical awareness and responsible use whereas older students may exhibit slightly lower levels in this regard.

Keywords: Generative Artificial Intelligence, Ethical Awareness, Responsible Use, University Students

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Ethical Decision-Making Processes of Students When Using Artificial Intelligence: A Qualitative Study

Bünyami Kayalı

Bayburt University

The rapid integration of artificial intelligence tools into academic settings is also raising a host of ethical issues for students. Whilst AI-assisted assignments and presentations are becoming increasingly common, there is a lack of research into how students interpret and resolve the ethical dilemmas they encounter in these processes. In particular, the use of fabricated sources, misleading content, and AI outputs without subjecting them to critical scrutiny raises serious concerns regarding academic integrity. This study aims to examine in depth, using the case study method, the ethical dilemmas students encounter when preparing presentations with AI tools as part of a course, and the solutions they develop to address them. The research examines students' ethical awareness, perceptions of responsibility and risk, and behavioural responses.

A qualitative research approach was adopted in the study. A case study design was used as the research method. The study focused on the process by which students prepared presentations using AI tools as part of a university course. Participants were selected on a voluntary basis from students enrolled in the course in question. Within this scope, the sample was determined using purposive sampling. Data were collected using two different data collection tools. The first consisted of semi-structured interview forms used in individual interviews conducted with each student after the presentation process was completed. The form included questions about students' experiences with AI, the ethical dilemmas they encountered, and their responses to these situations. Secondly, the reflective notes students kept during the presentation preparation process were analysed. The data were analysed using thematic analysis. Initial analyses identified four themes: awareness, ethical decision-making, emotional responses, and behavioural strategies.

It was also observed that students tend to accept AI outputs without sufficient critical evaluation during the presentation preparation process, but that their level of scrutiny increases as the presentation approaches. Furthermore, interviews revealed that the ethical concerns most frequently raised by students were the use of fabricated sources and the fear of being forced to present information whose accuracy they could not verify. Finally, it was found that students with high ethical awareness developed more systematic strategies, such as verifying sources and revising content.

The findings reveal that the experience of giving a presentation provides a powerful context for enhancing students' ethical awareness. Rather than engaging in abstract ethical debates, students have explored the ethical dimensions of AI use in greater depth through concrete processes they have personally experienced.

Keywords: Ethics of Artificial Intelligence, Academic Integrity, Ethical Decision-making

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The Use of Artificial Intelligence Tools During the Preparatory Stage of Research: Results of a Survey of University Lecturers in Ukraine

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This study examines the use of artificial intelligence (AI) tools by university faculty in Ukraine at the preparatory stage of scientific research, a phase that includes idea generation, initial review of the research problem, literature search, analysis of scientific publications, formulation of goals and hypotheses, research structuring, and selection of methodology. This stage is cognitively demanding and plays a decisive role in determining the quality and rigor of subsequent research outcomes.

The empirical basis of the study is an online survey conducted among 227 faculty members from universities across different regions of Ukraine between November 2024 and January 2025. The research represents the second wave of a longitudinal investigation and extends the authors' earlier study conducted in 2024 (n = 205). The questionnaire comprised 32 items grouped into four blocks: demographic and professional characteristics; general use of AI in everyday life; use of AI tools across seven preparatory research tasks; and perceived barriers and training needs. The results demonstrate a substantial increase in AI adoption. Overall, 94.3% of respondents report some level of AI use in daily life, including 19.8% who use AI daily. The proportion of non-users declined sharply from 30.4% in 2024 to 5.7% in the second wave. With regard to the preparatory stage of research, AI is most frequently used for the initial review of the research problem and for literature search, each reported by 65.2% of respondents. These are followed by idea generation (54.6%) and analysis of scientific publications (52.0%). Lower levels of use are observed for research structuring (48.5%) and formulation of goals and hypotheses (45.8%), while the choice of research methodology remains the least delegated task (36.2%). Statistical analysis using contingency tables and χ^2 Pearson's test reveals a significant association between respondents' general attitudes toward AI and the frequency of its use across all preparatory research tasks ($p < 0.001$). The strength of this relationship, measured by Cramér's V, ranges from 0.233 to 0.325, with the strongest associations observed for the initial review of the research problem, idea generation, and literature search. In contrast, correlation analysis using Spearman's ρ indicates no statistically significant relationship between AI usage intensity and either years of teaching experience or academic degree ($p > 0.05$).

The analysis of the tool landscape shows that across all preparatory tasks, ChatGPT (OpenAI) is the dominant AI tool, used by approximately 60-75% of active users depending on the task. Gemini (Google) ranks second (about 40-55%), while Copilot, Claude, DeepSeek, and Perplexity AI are used less frequently, though several of these tools show notable growth compared to 2024.

Keywords: Artificial Intelligence, Generative AI, Preparatory Research Stage, Ukrainian Universities, ChatGPT, Scientific Activity, Academic Integrity, Digital Competence.

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Academic Integrity in Higher Education Students' Use of Artificial Intelligence: A Systematic Review Based on Thematic Analysis and Topic Modeling

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The rapid integration of artificial intelligence (AI) tools into higher education environments brings new and complex issues in the field of academic integrity. The increasing ease of AI-supported content generation necessitates the redefinition of the concepts of plagiarism, cheating, and academic misconduct. In this transformation process, there is a need for a comprehensive literature mapping study on how academic integrity is addressed in students' AI use experiences. In this regard, the study aims to systematically examine the international literature addressing the issue of academic integrity in higher education students' experiences of artificial intelligence use. By using thematic analysis and topic modeling (LDA) methods together, dominant thematic patterns, topic clusters, and trends of change over the years in the literature are revealed. In the study, a dataset of 1,009 articles published between 2022 and 2026 was obtained as a result of a systematic search conducted in the Web of Science database. As a result of the screening process conducted within the framework of the PRISMA protocol, the abstract texts of 986 articles included in the analysis were analyzed using two parallel methods. The first is thematic analysis conducted under seven main thematic categories based on conceptual search patterns. The second is topic modeling, in which six topic clusters were automatically extracted using the Latent Dirichlet Allocation (LDA) algorithm. The findings obtained from the two methods were comparatively evaluated for the purpose of triangulation. According to the thematic analysis findings, the Academic Integrity and Plagiarism theme was found to be the most dominant topic in the literature, appearing in 87.5% of the articles. This was followed by Ethical Concerns and Policy (73.2%), Detection and Technology (70.6%), Teaching and Pedagogy (62.1%), and Student Attitudes and Perceptions (53.3%), respectively. The AI Literacy and Critical Thinking theme has received relatively limited attention (30.9%). LDA topic modeling identified six topic clusters. Student Perceptions and Critical Skills (28.95%), the topic with the highest weight, indicates that the focus of the literature is increasingly shifting toward student experience. The second most heavily weighted topic, GenAI Integration and Teaching Concerns (22.85%), indicates that concerns related to instructional design are coming to the forefront. The annual trend analysis reveals that Plagiarism and Cheating Detection was dominant during the 2022–2023 period; however, Institutional Policy and Ethical Frameworks gained strong momentum during the 2024–2026 period (trend coefficient = +highest positive value). This finding indicates that the field has matured from a simple detection focus toward policy and systemic solutions.

Keywords: Artificial Intelligence Ethics, Academic Integrity, Higher Education, Systematic Review, Thematic Analysis, Topic Modeling, LDA, ChatGPT

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Beyond Awareness: Instructional Design as the Missing Link in Competent and Equitable AI Integration for Middle School English Teachers

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As generative AI tools reshape educational landscapes, international frameworks, including UNESCO's guidelines on AI in education and the EDUCAUSE Horizon Report, consistently identify teacher preparedness as the most pressing challenge globally. Recent theoretical modeling warns that AI systems providing context-specific recommendations without human learning effort may erode collective knowledge, a phenomenon Acemoglu et al. (2026) term "knowledge collapse." This risk intensifies when AI tools enter classrooms without structured instructional design, reducing teachers to passive conduits rather than intentional architects of learning.

This study examines AI integration competencies of middle school English teachers through the ASSURE instructional design model, using the Turkish adaptation of the Teacher AI Competence Self-Efficacy Scale (TAICS; Chiu et al., 2025) within a Design-Based Research (DBR) needs analysis framework. The quantitative phase included 70 participants; 12 teachers participated in semi-structured interviews. While existing research documents general attitudes toward AI, few studies examine whether teachers possess the pedagogical design knowledge to deploy AI purposefully, equitably, and responsively. Drawing on the Technology Acceptance Model (Davis, 1989), the study investigates how perceived usefulness, ease of use, and AI-related anxiety shape teachers' integration orientations patterns that one-size-fits-all professional development consistently fails to address.

Findings reveal that years of teaching experience do not significantly predict AI integration competency, consistent with TALIS 2024 data showing Turkish middle school teachers report among the highest professional development needs in educational AI use internationally. Teachers' concerns cannot be explained by seniority alone. Prior in-service training, while insufficient to reduce anxiety, modestly contributes to perceived competency, underscoring the need for structured, sustained professional learning over one-off awareness sessions.

Situating these findings within democratic AI literacy frameworks, this paper argues that equitable AI integration demands deliberate instructional planning prioritizing fairness, differentiated instruction, and learner-centered design. Subject- and level-specific professional development rather than generic digital literacy training is essential for competency that translates into classroom practice. The ASSURE model is proposed as a replicable framework for embedding these considerations into teacher education. Implications are drawn for policy, professional development design, and the construction of inclusive, pedagogically sound AI-enhanced classrooms.

Keywords: AI Integration · Instructional Design · ASSURE Model · TAICS · Technology Acceptance Model ·; Differentiated Instruction · Democratic AI Literacy · Professional Development · Middle School English; Teachers

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The Sci-Tutor Mobile Application for Visually Impaired Students

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Visually impaired students are able to participate in the education and learning process through collaboration with staff, using materials and in environments tailored to their individual needs. The provision of a suitable environment and the process of using materials are currently facilitated by others for visually impaired students. However, when materials are designed with the individual differences of visually impaired students in mind, they can be used without the need for assistance from others. In this way, visually impaired students can continue their learning process independently, regardless of time or place.

The Scı-Tutor mobile app, developed with the individual needs of visually impaired students in mind, enables them to continue their learning process independently. The Sci-Tutor mobile app is downloaded as an APK file onto a phone and/or tablet and used online. The Scı-Tutor mobile app operates via a system that integrates QR codes placed on 2D or 3D materials into the application. The mobile app automatically uses the device's camera to detect the QR code, thereby providing users with audio description. Furthermore, when the mobile app is opened, it greets the user with AI-enhanced audio description, informing them of the direction in which to hold the phone and providing information about the app. Thanks to audio description, visually impaired individuals can use the app independently and comfortably. The device on which the mobile app is used is held steady 15–20 cm above the material to be described. To trigger audio description in the desired area on the material, the user simply needs to hold their finger in place for two to three seconds; this is sufficient for the mobile app to detect the finger and activate the audio description. It is possible to request general and/or regional descriptions for the material in question.

The Sci-Tutor mobile app has been made available to visually impaired students, and updates have been made to the interface based on feedback received. For example, whilst there was a voice guidance feature upon opening the mobile app, students did not wish to listen to the entire audio description for a specific section once they had started a regional audio description. Consequently, a feature allowing users to end the audio description by double-tapping the screen has been added to the mobile app. The Sci-Tutor mobile app continues to be updated based on feedback from users' active usage.

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Keywords: Mobile App, Sci-Tutor, Visually Impaired

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From EdTech to AI-Enhanced Equity: A Contextualized AI Capacity-Building Framework for Rural Teachers in Low-Resource Environments

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Effective integration of artificial intelligence in education (AIED) offers transformative opportunities but also presents significant equity challenges, particularly in low-resource rural contexts. This study investigates how rural educators in the Philippines engage with emerging AI-enhanced educational technologies and explores their capacity-building needs for equitable implementation. Employing a sequential explanatory mixed-methods design, data were collected from 210 K–12 public school teachers through surveys, followed by in-depth focus group discussions with 20 selected participants. Qualitative findings reveal a comprehensive set of teacher needs for effective AI integration, highlighting that while educators demonstrate positive attitudes and frequent use of basic digital tools, their readiness to implement AI-enhanced practices—such as adaptive learning, generative content creation, and intelligent feedback—is limited. Teachers report confidence in general technology use but express gaps in structured training, AI literacy, ethical awareness, and contextually appropriate pedagogical strategies. Building on these insights, the study introduces a Contextualized AI Capacity-Building Framework for rural teachers that prioritizes low- to mid-tech integration strategies, including prompt scaffolding, offline-compatible AI tools, and hybrid human–AI instructional design. By foregrounding qualitative insights into teacher experiences and needs, this research advances AIED discourse, emphasizing context-sensitive, equity-driven strategies to bridge the AI readiness gap in underserved educational systems.

Keywords: Artificial Intelligence in Education (AIED), Equity in Education, Rural Education, Digital Divide

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Designing for Responsible Generative AI Use: What Shapes Preservice Teachers' Decisions?

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Preservice teachers' (PSTs') decisions about whether and how to use generative artificial intelligence (GenAI) in assessment contexts are shaped by multiple interacting factors that remain insufficiently understood. This study examines the relationship between perceived GenAI affordances and students' decision-making, focusing on both direct effects and indirect influences through selected perceptual factors. Third-year PSTs participated in a learning design that introduced the technological, pedagogical, and social affordances of GenAI and allowed flexible integration of these tools into an assessment task. Data were collected through a post-task survey and structured reflection activities. Findings indicate that perceived GenAI affordances have a significant direct effect on students' decision-making. In addition, a significant total indirect effect was observed, suggesting that affordances influence decision-making through combined perceptual pathways. However, no individual mediation pathway—such as awareness, confidence, or acceptability—was found to be independently significant. These results suggest that students' decisions to use GenAI are shaped by the overall interplay of perceptions rather than any single dominant factor. The study highlights the importance of instructional design approaches that address multiple dimensions of GenAI use simultaneously. Implications are discussed for designing learning environments that support thoughtful, context-sensitive, and responsible integration of GenAI in education.

Keywords: Generative Artificial Intelligence (GenAI); AI Affordances; Decision-Making; Preservice Teachers; Instructional Design; Technology Integration; Higher Education

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Item Bank Management System for Educators: A Design-Based Study

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This study presents the development of an item bank management system designed to support educators in creating, analyzing, and organizing test items more efficiently. Although teachers typically accumulate extensive item pools over years of assessment practice, maintaining the validity and reliability of tests requires continuous item analysis, systematic revision of item pools, and careful construction of test forms aligned with a table of specifications. These procedures are time consuming and often under-supported by technology in educational settings, which may lead to assessments with limited validity.

Using a design-based research approach, the study aimed to design and evaluate a technology-enhanced system that addresses these challenges. In the first phase, focus group interviews with teachers and faculty members were conducted to identify user needs and functional requirements. Insights from these interviews informed the system's design, including its interface features and core modules for item writing, item analysis, and test form generation.

Based on the needs analysis, the prototype system was developed and iteratively refined through user feedback. During the testing phase, teachers and academic staff evaluated the system's usability and provided suggestions that guided further improvements. The resulting system enables educators to manage item pools more systematically and supports key processes such as generating item statistics, revising items based on analysis results, and constructing tests aligned with learning objectives.

The study concludes that the developed system reduces the workload associated with traditional test development procedures and contributes to producing more valid and reliable assessment outcomes. It also demonstrates the value of design-based research for creating practical, user-centered technological solutions in educational measurement.

Keywords: Item Bank Management System, Design-based Research, Educational Technology, Assessment Validity, Item Analysis

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A Global Analysis of Architectural Education Research: A Comparison of Developed and Developing Countries (2016–2025)

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Research into architectural education has diversified significantly over the past decade under the influence of global disruptions such as digital transformation, sustainability and the pandemic. However, how this research differs in the contexts of developed and developing countries has not been systematically elucidated. This study aims to analyse 408 peer-reviewed articles on architectural education indexed in the Web of Science (WoS) database between 2016 and 2025 using a systematic literature review method, with the aim of comparing publication trends and thematic focuses according to development level.

The findings indicate that developing countries have surpassed developed countries in total publication numbers (253 versus 236). However, it was determined that studies in developed countries primarily focus on advanced technology-based pedagogies such as digital technologies, virtual and augmented reality, and computational design; whereas in developing countries, more contextual and human-centred themes such as sustainability, studio pedagogy, pandemic adaptation, cultural heritage and student experience take centre stage.

This study examines the literature on architectural education from a comparative perspective based on levels of development, highlighting thematic differences within the field and providing a guiding framework for future research.

Keywords: Architectural Education, Global Knowledge Production, Systematic Review, Digitalisation, Sustainable Education

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Design and Implementation Framework of Mobile Game-Based Learning Models: A Comparative Structure of Traditional and Microlearning Approaches in Programming Education for Gifted Students

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This study develops a mobile game-based learning environment to teach the concept of “for loops” in the Java programming language and proposes two instructional models based on different content delivery strategies within the same game infrastructure. The first model is grounded in a traditional learning approach, in which instructional content is delivered through a comprehensive video, followed by a five-stage drag-and-drop mobile game designed to reinforce acquired knowledge. The second model is structured according to a microlearning approach, where content is segmented into short and focused video units; each unit is followed by corresponding game stages that enable learners to immediately apply the targeted learning outcomes. In both models, learning and practice are organized in a progressive, integrated, and iterative manner, with game stages sequenced from simple to complex. Student performance is evaluated using task completion time and error rates as quantitative metrics. In addition, qualitative feedback is collected and analyzed to better understand learner experiences and to support the refinement of a user-centered instructional design. Grounded in a design-based research methodology, the study focuses on both the design and development processes of the proposed models while also outlining a structured framework for their future implementation. The effectiveness of the application is planned to be examined in educational settings involving gifted students. Their advanced cognitive capacities, rapid learning characteristics, and strong problem-solving skills provide an appropriate context for analyzing instructional effectiveness. Although the implementation phase has not yet been completed, the proposed models are expected to reveal differences in learner performance, engagement, and error patterns between traditional and microlearning-based structures. In particular, the microlearning model is anticipated to support more effective knowledge retention and step-by-step skill development through its segmented and iterative design. In this context, the study is expected to provide practical implications for the design of mobile game-based learning environments and to offer guidance for educators and instructional designers in structuring programming instruction for gifted learners. In this respect, the study aims to contribute to the international literature on technology-enhanced programming education and gifted education by offering comparative and potentially generalizable insights. Furthermore, the findings are expected to inform the development of effective instructional strategies based on student performance data as well as design and implementation processes.

Keywords: Mobile Game-based Learning, Microlearning, Programming Education, Gifted Students, Instructional Design

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Transnational family dynamics: social and emotional challenges of migrants from Romania

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Migration flows are normal in any evolving society. Whether we have migration within countries on the same continent or countries on different continents, people are mobile and produce change where they decide to live for a certain period of time or where they intend to settle until retirement. In the case of Romania, we have a large migration phenomenon, after leaving the communist period. Current statistics indicate that this phenomenon has partially reduced, but we continue to be in third place in the world.

We bring to the public's attention parents with minor children who migrate from Romania to different countries in the world. We have a study based on an online questionnaire applied to a number of 526 parents who chose to go to work abroad and leave one or more of their children in their country of origin.

The main results of our study highlight the fact that women are the ones who went to work abroad in a percentage of 64.2%, aged between 35 – 44 years, in a percentage of 37.4% and, predominantly, from rural areas 61%. Guilt and sadness are the main emotions that respondents experienced when they decided to migrate. Children who remained in the country were aged between 3 – 6 years and remained in the care of the other parent or grandparents. The first three countries where migration was decided were: Italy (30.0%), Germany (23.0%) and Great Britain (13.5%). Although most respondents worked in fields such as: construction, housekeeping, services, agriculture; we were surprised to identify people who left for management positions or even their own businesses, in a percentage of 1.5%. Another category that surprised us when analyzing the data was the significantly high number of people who migrated from Romania without working in any field, 1.3%.

The emotional and social needs of children from families with parents working abroad are extensive and varied: depression, school dropout, deviant behaviors, suicidal tendencies, drug use, isolation, anxiety. The parent who remained in the country faces new challenges depending on the newly emerged context: role changes, overload, illness. The grandparents with whom the minors usually stay are overwhelmed by responsibilities or are unable to cope with them.

Social services in Romania within public and non-governmental institutions try to meet the needs of these transnational families through counseling activities, day clubs, support sessions for parents and children, etc. Our question to the public is: are these social services enough? What more can the local community do? How can we, each individual, contribute?

Keywords: Migration, Transnational Family, Social Services, Emotions, Romania.

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Virtual Reality in Inclusive Education Opportunities and Possibilities

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Students with Special Educational Needs (SEN) face various challenges in educational environments. One of the primary challenges is the lack of individualized education. Emerging technologies offer significant opportunities to address this issue. The integration of these technologies into education has created new opportunities for SEN students; however, they remain among the least benefited groups from this transformation. This Erasmus+ project proposes an innovative approach by integrating Virtual Reality (VR) into special education.

The main objective of the project is to develop an accessible and interactive VR-based learning environment that enhances the life skills, cognitive abilities, and communication competencies of students with intellectual disabilities. The project involves five institutions from Latvia, Turkey, Croatia, Poland, and Slovenia. Data were collected from 133 students and 50 teachers in special education schools.

The project methodology involves collecting data from students through simplified questionnaires and from teachers through focus group interviews. The design of the virtual reality environment was determined based on these data. The developed VR environment will first undergo internal testing with teachers. After identifying and correcting errors, the VR environment will be finalized. It will then be tested with the participation of both students and teachers.

Ultimately, this study contributes to inclusive education and digital transformation by providing a scalable and adaptable model for VR-assisted learning in special education. The project also offers policy recommendations to encourage the wider adoption of immersive technologies in European education systems.

Keywords: Virtual Reality, Inclusive Education

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Reality versus ideal: social inclusion of students with disabilities

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Students with disabilities in Romania have the opportunity to attend free courses at public universities in the country. Depending on the specialization they wish to complete, they can take the same steps to enroll, attend and graduate from courses at nationally accredited private universities.

Romanian universities have initiated steps that support students with disabilities to benefit from the same facilities on campus. The adaptation process is a long-term one and requires the involvement of all responsible actors: students with disabilities, other students, teaching staff, administrative staff, employers from the local socio-economic environment.

In this article, we bring to the public's attention an exploratory sociological analysis to which 59 people, current students and graduates with various disabilities from a public university in Romania located in the North-East of the country, responded. The main goal of our study was to identify to what extent the current facilities meet the needs of different categories of students with disabilities and what we should aim for in the medium and long term for their development or improvement.

We mention that the data analysis was carried out with SPSS and we managed to collect relevant information regarding the type of disability of the respondents: locomotor, visual, auditory, somatic – rare or chronic diseases, mental. Most disabilities are in the category of somatic disabilities – rare or chronic diseases (N=28), and the fewest respondents are in the category with visual disability (N=5).

The main results confirmed our research question: is the university inclusive? A total of 50 respondents rated the accessibility services offered by the university as "satisfactory or very satisfactory". Of the total number of respondents, only 19 people mentioned that they had stayed in the on-campus dormitory, of which 3 students are motor disabled. Two respondents rated the accessibility of the accommodation as "unsatisfactory" and that access to more ramps and elevators would be necessary. The actors involved in the training process of students with disabilities and future employees are rated as flexible and open to facilitate learning and insertion into the labor market.

The proposals for improvement, for a more inclusive university, coming from the respondents focused mainly on the social side: counseling activities, mentoring, support groups, emotional support, workshops, events involving both teachers and students with or without disabilities, job fairs, volunteering places. But the recommendations related to the physical and digital infrastructure that needs to be improved and adapted according to the requirements were not omitted.

In conclusion, it can be stated that the university analyzed in our study manages to be inclusive and has real potential to offer equal opportunities to all categories of students who choose to study and specialize here.

Keywords: Disability, Student, University, Romania

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Exploring Negative Emotions in AI-Mediated Language Classrooms: Insights from University-Based Language Teacher Educators

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Artificial Intelligence (AI) has become an increasingly indispensable component of language education; however, while much of the existing research has focused on positive emotional experiences, less attention has been paid to the negative emotions that emerge in AI-mediated classrooms. This study investigates the negative emotional experiences of five university-based language teacher educators who integrate AI tools into their teaching practices. Using narrative frames and semi-structured interviews, the study captures in-depth reflections on their experiences, and the data are analyzed through thematic analysis. The findings reveal a range of negative emotions, including anxiety, frustration, uncertainty, and concerns related to professional identity and pedagogical control. These emotions are often associated with issues such as technological limitations, ethical concerns, and shifting teacher roles in AI-supported environments. The study highlights the importance of recognizing and addressing negative emotions to foster more balanced, sustainable, and effective integration of AI in language teacher education.

Keywords: Artificial Intelligence, Language Teacher Education, Negative Emotions, AI-mediated Classrooms, Thematic Analysis,

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Design Principles for AI-Generated Instructional Materials within the Framework of Cognitive Load Theory

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With the rapid advancement of artificial intelligence technologies, their use in educational settings has become increasingly widespread. AI tools enable the development of personalized instructional content tailored to learners' individual needs and have the potential to transform teaching and learning processes. The aim of this study is to identify the design principles of instructional materials developed with AI tools within the framework of Cognitive Load Theory. A qualitative phenomenological research design was employed. Semi-structured interviews were conducted with eight participants, including educational technology experts, teachers, and instructional designers who had experience in designing instructional materials using AI tools. The participants represented different educational levels, including primary, middle, and secondary school, and different subject areas such as mathematics, science, and social sciences. The data were analyzed through descriptive analysis and content analysis. The findings revealed that the design principles were organized under three main themes: principles that reduce extraneous cognitive load, principles that regulate intrinsic cognitive load, and principles that enhance germane cognitive load. More specifically, coherence, consistency, signaling, reduction of redundancy, worked examples, segmentation, pre-training, modality, self-explanation, problem-solving practices, varied examples, reflection, social cues, and multimedia use emerged as prominent principles. The results suggest that AI-supported instructional materials should be designed in ways that optimize cognitive load and support effective learning processes. This study offers a practical framework for teachers, instructional designers, and researchers who aim to integrate AI tools into instructional material design in line with Cognitive Load Theory.

Keywords: Generative Artificial Intelligence; Cognitive Load Theory; Instructional Design; Educational Materials; Multimedia Learning

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Taming the Cognitive Load of AI: The Role of AI-TPACK in AI-Assisted Teaching

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Artificial intelligence is rapidly transforming language education, creating new instructional opportunities while also introducing additional cognitive demands for teachers. This study explored EFL teachers' perceptions of the role of AI-TPACK in facilitating cognitive load in AI-assisted teaching environments. Adopting a qualitative narrative inquiry design, data were collected through narrative frames from 17 in-service EFL teachers who had experience using AI tools in their instructional practices. The data were analyzed using Braun and Clarke's (2006) deductive thematic analysis with the support of MAXQDA 24.The analysis revealed three themes describing how teachers perceived the relationship between AI-TPACK and cognitive load in AI-assisted instruction. The first theme, pedagogical and content knowledge set the weight of instructional complexity, indicated that teachers' pedagogical knowledge (PK) and content knowledge (CK) largely shaped the intrinsic cognitive load of AI-supported teaching. Teachers reported that although AI tools could assist with generating materials and ideas, they still needed strong pedagogical and content foundations to align AI outputs with instructional goals and to make appropriate instructional decisions. When teachers felt confident in their pedagogical and content knowledge, the complexity of integrating AI tools became more manageable.The second theme, AI-informed pedagogical and content knowledge channels meaningful instructional reasoning, showed that AI-related pedagogical and content knowledge (AI-TPK and AI-TCK) contributed to germane cognitive load. Teachers described engaging in reflective thinking, evaluating AI outputs, and reconsidering their teaching strategies while integrating AI tools. These processes encouraged deeper instructional reasoning and supported the development of more coherent teaching practices.The third theme, AI technological fluency filters out unnecessary instructional cognitive load, revealed that teachers' AI technological knowledge (AI-TK) helped reduce extraneous cognitive load. Teachers with higher technological fluency reported fewer difficulties in navigating AI tools, correcting system outputs, and adapting materials to their instructional needs, allowing them to focus more on pedagogy rather than technical challenges.The study underscores the need for professional development that systematically strengthens teachers' integrated technological, pedagogical, and content knowledge, enabling AI to function as a cognitive support rather than an additional instructional burden, rather than introducing AI tools and techniques in a fragmented or haphazard manner without a coherent pedagogical foundation.

Keywords: AI-assisted Teaching; AI-TPACK; Cognitive Load in Teaching; EFL Teachers.

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Pre-Service Teachers' Metaphorical Perceptions of Generative AI Tools and Their Experiences with Educational Use of AI

Canan Çolak Yakar [1], Mithat Çiçek [1]

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This study aims to determine pre-service teachers' metaphorical perceptions of generative AI technologies and examine their experiences using GENAI for specific educational purposes. The study was designed using a phenomenological approach to qualitative research. Participants were selected from pre-service teachers through purposive sampling. During the study, the pre-service teachers were asked to conduct a literature review on a topic related to their field of study using ChatGPT, applying specific criteria. They were also asked to create a presentation and accompanying visuals as digital instructional materials on the same topic. They used the Gamma tool to create presentations and the NapkinAI tool to create visuals. They then evaluated the instructional materials they had developed. A metaphorical perception form and the pre-service teachers' activity reflection reports were used as data collection tools. This was to encourage them to reflect in detail on issues such as the accuracy, quality, appropriateness and ethical dimensions of the instructional materials they produced using various GENAI technologies (ChatGPT, Gamma and NapkinAI) for educational purposes in the instructional technologies course. The data obtained was analyzed using content analysis to establish themes and codes. Examining pre-service teachers' metaphorical perceptions of AI tools revealed positive views on AI's ability for in-depth analysis, its capacity as a comprehensive information source, its guidance and direction functions, and its success in enhancing efficiency and speed. However, it was also determined that they held negative perceptions regarding reliability and accuracy issues associated with the use of AI tools. Examining the experiences of pre-service teachers following the development of instructional materials using AI tools revealed positive themes, such as aesthetic success in visual content creation, accelerated content production processes, and the flexibility and control offered to users. At the same time, negative themes were identified, such as the inability to adhere to specified prompts, reliability issues with outputs, and the limitations and constraints of the applications. Based on these findings, pre-service teachers view AI tools as powerful assistants that provide in-depth information and guidance and, particularly in terms of time and efficiency, simplify their work. However, it was concluded that pre-service teachers do not blindly trust the output generated by AI tools and are aware of the need to verify the accuracy and reliability of information. Future research could therefore explore the impact of AI-generated instructional materials on students' academic achievement and classroom participation through experimental studies in real classroom settings.

Keywords: Generative Artificial Intelligence, Instructional Material Design, Metaphor Analysis, Pre-service Teachers

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University Students' Experiences in Creating Digital Stories by Using Artificial Intelligence (AI)

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Significant transformations in the field of education are being driven by rapid advancements in artificial intelligence (AI) technologies. Generative AI (GAI) technologies have the ability to generate various types of content, including text, visuals, audio and video. One of the significant instructional materials that integrates such multimedia design elements is digital stories. In this context, this study aims to explore the experiences of university students in the process of creating digital stories using artificial intelligence tools. Specifically, it examines the aspects of the digital storytelling process that participants found most challenging, the skills they believe they developed during this process, and their suggestions regarding the use of various artificial intelligence tools in digital story creation.The study was conducted within the scope of the elective course titled "Artificial Intelligence Applications in Education" offered at the Faculty of Education at Giresun University. Participants were selected through purposive sampling. In this research, a case study design—one of the qualitative research methods—was employed. Data were collected by a semi-structured interview form consisting of five questions. The interviews were conducted at the end of a three-week digital storytelling process, and the analysis of the collected data through content analysis is currently ongoing. Upon completion of the data collection process, relevant codes and themes will be generated to address the research questions, and the findings will be reported in relation to the existing literature. According to the preliminary findings, participants experienced particular difficulty in generating visuals for digital story scenes. Despite writing appropriate prompts, they reported not achieving the desired outcomes. In addition, participants indicated that the limited access provided by free versions of artificial intelligence tools compelled them to use multiple accounts. While some participants reported improvements in their visual design and creation skills, others emphasized the development of their prompt-writing skills. The remaining findings will be reported upon the completion of the data collection process.

Keywords: Digital Storytelling, Artificial Intelligence, Learners' Experiences

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The Serial Mediating Role of Cognitive Flexibility and Peer Victimization in the Relationship Between Perceived Parenting Styles and Resilience in Adolescents

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Adolescence is a developmental stage characterized by increased sensitivity to social stressors and an accelerated pursuit of autonomy. During this period, psychological resilience emerges as a critical determinant of long-term mental health. Although national and international literature has established that environmental and intrinsic factors contribute to resilience, the specific mechanisms through which family dynamics influence social outcomes and internal coping strategies remain to be fully elucidated. Specifically, how internal cognitive schemas shaped by parenting styles manifest in the social sphere (e.g., peer interactions) and subsequently affect overall resilience is an area requiring further investigation in the developmental literature.

The primary objective of this study is to examine the complex pathways between perceived parenting styles and resilience. This research proposes and tests a serial mediation model to determine whether the impact of parenting on resilience operates first through the adolescent's cognitive flexibility and subsequently through their experiences of peer victimization.

A quantitative research design utilizing the relational survey model was adopted. The sample will consist of 350–400 middle and high school students selected from Balıkesir, Turkey. Data will be collected using a battery of validated scales: the Parenting Style Scale (Sümer & Güngör, 1999), the Cognitive Flexibility Inventory (Çelikkaleli, 2014), the Peer Victimization Scale-Adolescent Form (Ayas & Pişkin, 2015) and the Brief Resilience Scale (Doğan, 2015). The hypothesized serial mediation model will be analyzed using SPSS/PROCESS Macro (Model 6) with a 5,000-bootstrap resampling procedure at a 95% confidence interval.

The theoretical framework suggests that perceived democratic parenting (acceptance/involvement) significantly and positively predicts cognitive flexibility. Increased cognitive flexibility is expected to serve as a protective factor, significantly reducing levels of peer victimization. The results are expected to confirm a significant serial mediation effect: Perceived Parenting-Cognitive Flexibility-Peer Victimization-Resilience. This suggests that the family environment builds a cognitive "armor" that assists adolescents in navigating social risks and ultimately reinforces their resilience.

The study concludes that enhancing resilience in adolescents requires a holistic approach that extends beyond individual-focused interventions. The findings underscore the critical importance of positive parenting in developing the cognitive tools necessary for social navigation. It is recommended that school counseling services implement integrated programs that combine parental guidance with cognitive flexibility training to mitigate the negative effects of peer bullying.

Keywords: Resilience, Cognitive Flexibility, Perceived Parenting Style, Peer Victimization, Serial Mediation Analysis.

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Challenge-Based Learning with Generative Artificial Intelligence in Higher Education: Teaching Innovation, AI Literacy, and STEAM-Oriented Learning

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In recent years, the integration of active methodologies and emerging digital tools has transformed teaching and learning processes in higher education. Within this context, challenge-based learning (CBL) places students in situations that require them to make decisions, search for and evaluate information, and construct reasoned responses to authentic problems. At the same time, the growing presence of generative artificial intelligence (AI) tools, such as ChatGPT, is opening new possibilities for designing more flexible, participatory, and interdisciplinary learning environments. However, the educational value of these tools depends largely on how they are pedagogically integrated into classroom practice. This study aims to analyze a teaching intervention based on challenge-based learning supported by generative AI in a higher education context. More specifically, it examines changes in students' perceptions of teaching innovation and their level of AI literacy, while also exploring the connection between this type of learning experience and the development of abilities associated with STEAM-oriented education, such as problem solving, critical thinking, and the integration of knowledge across disciplinary boundaries. A quasi-experimental design with pre-test and post-test measures was implemented. The intervention was organized around a set of interdisciplinary challenges in which students were allowed to use generative AI as a support tool to generate ideas, contrast information, and improve their responses. The proposal combined active student participation with the intentional use of digital resources, encouraging greater autonomy, engagement, and reflection throughout the learning process. Preliminary findings suggest a positive evolution in the way students interpret their own learning processes, showing greater awareness of what they do and how they do it. In addition, students' evaluations of the teaching approach became more favorable after the intervention, indicating increased acceptance of active, technology-supported methodologies. Early evidence also points to a more conscious and adjusted use of generative AI tools in relation to information handling and task development. Overall, the study suggests that the pedagogical integration of challenge-based learning and generative AI may strengthen digital competence and activate learning processes aligned with STEAM-oriented education when supported by intentional, well-structured, and critically guided instructional design.

Keywords: Challenge-based Learning, Generative Artificial Intelligence, Teaching Innovation, AI Literacy, STEAM Education

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Cooperative Learning with Generative Artificial Intelligence in Higher Education: Group Regulation and Computational Thinking-Related Processes

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Cooperative learning is based on peer interaction as a means of constructing knowledge collaboratively. The incorporation of generative artificial intelligence (AI) into classroom practice introduces an additional layer of support that may influence both the way groups organize their work and the cognitive and metacognitive processes activated during task resolution. In higher education, this raises important questions about how students plan, negotiate, monitor, and review their decisions when AI tools become part of the learning environment. It also invites further reflection on the extent to which these tools may support processes related to problem decomposition, solution evaluation, and computational thinking-oriented reasoning within collaborative settings. The aim of this study is to analyze the functioning of student groups when generative AI is used in cooperative learning situations. The work focuses on two main dimensions: the regulation of group work and the emergence of processes related to computational thinking during the development of academic tasks. Particular attention is paid to planning, task distribution, joint decision-making, review of responses, and critical evaluation of AI-generated outputs. A quasi-experimental design with pre-test and post-test measures was carried out with higher education students. The intervention was structured around cooperative tasks developed in small groups with defined roles. Generative AI was used as a support resource throughout the process, without replacing the collaborative work of the group. The proposed activities required students to break down problems, consider alternative solutions, justify their decisions, and construct shared responses. Preliminary findings suggest improvements in the initial organization of group work, greater clarity in task distribution, and more systematic review of responses. At the same time, early evidence indicates that some groups tended to reduce peer discussion when AI-generated answers were accepted too quickly and without sufficient critical examination. Overall, the findings suggest that generative AI can support group regulation and problem-solving processes in cooperative settings, although its educational value depends on the quality of pedagogical mediation and on students' ability to use these tools in a reflective, dialogic, and critically informed way.

Keywords: Cooperative Learning, Generative Artificial Intelligence, Group Regulation, Computational Thinking, Higher Education

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A Systematic Review of the ICAP Framework in Online Learning Environments

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According to the ICAP framework, assuming the learners' overt behaviours can determine their levels of cognitive engagement, these behaviours can be categorized into four modes: Interactive, Constructive, Active, and Passive. The framework further suggests a hierarchical relationship among the above-mentioned modes. As learners move from Passive to Interactive modes, they become more engaged with the materials, ultimately leading to higher levels of learning outcomes. In line with this framework, the present study conducts a systematic review using the PRISMA method to examine research on the ICAP framework in the context of online learning. A total of 160 studies, encompassing "ICAP framework" or "ICAP modes" in their titles or keywords, were retrieved from Scopus and Web of Science (WoS) databases. After screening, 13 studies were selected based on pre-defined inclusion criteria. This study aims to systematically review the existing literature on the implementation of the ICAP framework in online learning environments. Furthermore, the study seeks to identify how different engagement modes are observed and are linked to learning outcomes. The review is expected to reveal an increasing trend in the use of the ICAP framework and provide a comprehensive understanding of how it has been implemented across different learning contexts.

Keywords: ICAP Framework, Cognitive Engagement, Modes of Engagement, Online Learning, Systematic Review

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The Determinant Role of Digital and Physical Literacy on Stress Coping Strategies Among Pre-service Early Childhood Teachers

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Today, teacher candidates are expected to possess multifaceted literacy skills rather than mere academic knowledge. Early childhood is a critical phase where children establish their first conscious contacts with both physical and digital worlds. Pre-service early childhood teachers, as the architects of this phase, may encounter significant pressures in their professional lives, such as high noise levels, heavy responsibilities, and the constant demand for technological adaptation. While traditional perspectives often position digital and physical domains as rivals (e.g., screen time vs. physical activity), contemporary approaches argue that these two competencies are mutually reinforcing sources of self-efficacy. In this regard, whether individuals—and specifically pre-service teachers—utilize digital resources as a leverage to access health and movement information, and whether this holistic competence serves as a protective factor in coping with professional stress, emerges as a significant issue worthy of investigation.

The primary objective of this study is to examine the predictive role of digital and physical literacy levels of pre-service early childhood teachers on their stress coping strategies. Furthermore, the research aims to test a "mediation model" designed to reveal how digital literacy influences stress coping skills through the mediating role of physical literacy.

The research is designed using a relational survey model, a quantitative research methodology. The study sample will consist of 250–300 pre-service early childhood teachers selected through convenience sampling. Data collection will involve the Digital Literacy Self-Efficacy Scale for Teacher Candidates (Ocak & Karakuş, 2018), the Physical Literacy Scale for Adults (PLAS) (Orhan & Karaçam, 2025), and the Ways of Coping Inventory (Şahin & Durak, 1995). In addition to descriptive statistics, mediation analysis will be conducted to determine the direct and indirect effects between variables.

It is anticipated that digital literacy will significantly and positively predict physical literacy. Another expectation is that as both digital and physical literacy levels increase, candidates will more frequently utilize positive coping strategies such as "self-confident" and "optimistic" approaches, while "helpless" and "submissive" approaches will decrease. The most critical expectation is that physical literacy will serve as a bridge between digital literacy and stress management, creating a significant mediating effect. These findings are expected to contribute to the literature by suggesting that digital and physical competencies should be integrated as mutually supportive resources rather than separate entities within teacher education programs.

Keywords: Pre-service Early Childhood Teachers, Digital Literacy, Physical Literacy, Stress Coping, Mediation Analysis.

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Using Virtual Laboratory Affordances to Teach States of Matter in Grade 6: A Self-Study

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This self-study explores the integration of virtual laboratories in teaching the states of matter to Grade 6 Natural Sciences learners. My pedagogical foundation in practical science was shaped through early hands-on experiences; however, during teaching practice, I observed persistent conceptual gaps in learners' understanding of the particulate nature of matter. Despite access to well-resourced traditional laboratories, these misconceptions remained unresolved. A safety incident further prompted the need to explore alternative approaches that could address both conceptual and safety concerns.

Virtual laboratories emerged as a promising tool; however, there is limited literature on how they can be effectively implemented in primary school contexts. Guided by an interpretivist paradigm, this study seeks to understand meaning-making in classroom experiences through action research and narrative inquiry as qualitative research approaches. A bricolage approach was adopted to ensure methodological flexibility, allowing for the integration of diverse strategies in response to the dynamic nature of the classroom.

Data were generated through reflective journals, lesson plans, learner artefacts, questionnaires, and observation notes, with contributions from five critical friends and 23 learners to support dialogic validation and triangulation. Thematic analysis was used to identify patterns related to teacher development and learner engagement.

Preliminary findings suggest that virtual laboratories can transform the learning experience by enabling learners to visualise the particulate nature of matter and manipulate variables in a safe and controlled environment. These affordances can enhance observation, support inquiry-based learning, and promote sustained focus, contributing to the development of more accurate mental models of abstract scientific processes.

This study concludes that the integration of virtual laboratories creates a safer and more focused learning environment that promotes deep meaning-making and helps bridge the gap between macroscopic observations and microscopic explanations. It is recommended that primary school educators incorporate virtual laboratories alongside traditional methods and receive targeted professional development to support their effective implementation.

Keywords: Self-Study, States of Matter, Virtual Laboratories, Bricolage, Narrative Inquiry, Reflective Practice, Natural Sciences, Grade 6

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EFL Teachers' Interaction with AI in the Post-Truth Era: A Cognitive Bias Perspective

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This qualitative study explored the cognitive biases that shape English as a Foreign Language (EFL) teachers' interactions with artificial intelligence in AI-assisted classrooms, drawing on the heuristics-and-biases perspective and a human-centered view of AI use in educational contexts. The accounts and reflections of nineteen in-service EFL teachers were analyzed, focusing on how cognitive shortcuts influenced their judgments when interacting with AI-generated pedagogical suggestions. In particular, the study examined teachers' experiences in relation to the dimensions of reliability, safety, and trustworthiness that characterize human-centered AI use in teaching and learning environments.Data were collected through think-aloud protocols, narrative frames, and semi-structured interviews with teachers who had prior experience using AI-assisted tools in language teaching. A deductive thematic analysis was employed to identify patterns in how teachers interpreted, evaluated, and responded to AI-generated outputs during instructional decision-making. The analysis specifically focused on three cognitive heuristics that commonly shape human judgment under uncertainty: availability, representativeness, and anchoring. MAXQDA software was used to support the coding process and to develop a code map illustrating relationships between teachers' interaction patterns and the cognitive biases identified in their reasoning.

Findings revealed three key patterns in teachers' interactions with AI-assisted tools. First, teachers often relied on readily recalled experiences with technology when judging the usefulness of AI suggestions, reflecting availability-based reasoning. Second, teachers frequently interpreted AI outputs according to how closely they matched their existing beliefs and expectations about effective language teaching, indicating representativeness-based judgments. Third, many teachers adjusted their instructional decisions around the initial responses generated by AI systems, demonstrating anchoring effects during human–AI interaction.

The findings suggest that teachers' perceptions of AI reliability, safety, and trustworthiness are shaped not only by the technical quality of AI systems but also by cognitive biases that influence how AI outputs are interpreted and used in classroom practice. The study highlights the importance of promoting critical awareness of cognitive biases in teacher education and supporting the development of human-centered AI systems that encourage reflective and balanced human–AI collaboration in language education.

Keywords: Artificial Intelligence in Language Education; Cognitive Bias; EFL Teachers; Human–AI Interaction; Post-truth

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Bibliometric, Thematic, and Temporal Trend Analysis of Graduate Theses on the Diagnosis of Misconceptions in Science Education in Türkiye (2006–2024)

Kübra Kırca

Feride Şahin

Science education is essential for enabling individuals to understand their environment and develop scientific thinking skills. Students frequently enter science classes with prior knowledge derived from everyday experiences, which can result in the formation of scientifically inaccurate concepts. These misconceptions impede students' ability to assimilate new knowledge and contribute to persistent learning difficulties. Therefore, the accurate diagnosis of misconceptions is critical for effective science education. While numerous graduate studies have been conducted in Türkiye on this topic, comprehensive reviews that holistically examine general trends, methodologies, and research focuses remain limited. This gap necessitates a systematic evaluation of research trends in the field.

This study aims to examine the bibliometric, thematic, and temporal trends of graduate theses conducted in Türkiye between 2006 and 2024 that focus on the diagnosis of misconceptions in science education. The theses were analyzed according to their distribution by year, thesis type, subject area, research purpose, research methods, sample, and data collection tools. Document analysis, a qualitative research method, was employed. Data were obtained from 70 graduate theses selected from the National Thesis Center database of the Council of Higher Education based on specified criteria. The data were analyzed using content analysis and categorized according to emerging themes.

The findings indicate that most theses were conducted at the master's level and predominantly utilized quantitative research methods. The studies were primarily concentrated in the field of physics, with pre-service teachers as the most frequently selected sample group. Single-tier diagnostic tests for misconceptions were widely used as data-collection tools, whereas two-, three-, and four-tier diagnostic tests were used less frequently. Additionally, many studies found that students exhibited a high prevalence of misconceptions and that instructional interventions generally led to positive outcomes.

In conclusion, research on the diagnosis of misconceptions in science education in Türkiye is concentrated in specific areas and demonstrates limited methodological diversity. It is therefore recommended to increase the use of qualitative and mixed-method approaches, conduct more studies at the primary school level, and prioritize the development and implementation of multi-tier diagnostic tests. Early identification of misconceptions is expected to contribute to more effective and enduring learning processes in science education.

Keywords: Science Education, Misconception Diagnostic Tests, Graduate Theses, Bibliometric Analysis

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Feedback Literacy in the Context of Learning Analytics and Generative Artificial Intelligence

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This study argues that feedback literacy should be considered not merely as a supportive concept explaining the effective use of feedback, but as a fundamental set of competencies that determines students' ability to benefit meaningfully from feedback in learning analytics- and generative artificial intelligence-based feedback environments. Accordingly, the aim of the study is to reconsider the concept of feedback literacy in the context of contemporary digital feedback ecosystems and to support this discussion with concrete examples based on previous research. In this respect, the study proposes a conceptual positioning rather than a descriptive review. Feedback literacy is addressed here in terms of students' ability to recognize the value of and be open to feedback, seek feedback when needed, manage their affective responses to feedback, interpret the feedback they receive to make decisions and take action, and understand feedback as a reciprocal and social process. This multidimensional structure has recently been embodied in a developed scale, thereby demonstrating that feedback literacy is not merely a cognitive skill but also a holistic domain of competence with affective, behavioral, and interactional dimensions. The study also discusses the purposes for which feedback literacy can become functional and, at this point, focuses particularly on the context of learning analytics. Learning analytics-based feedback systems can provide students with rich data, visualizations, and guidance; however, the impact of such environments depends not only on the quality of the information provided but also on how students make sense of this information. Finally, the study extends this discussion to the context of generative artificial intelligence and argues that, in these environments, students are no longer merely individuals who receive feedback but have become active actors who question, iterate, select, filter, and sometimes superficially accept feedback. Therefore, it is concluded that feedback literacy should be reconsidered as the capacity to assess the reliability of recommendations, select appropriate ones, regulate affective responses, and transform the feedback received into a learning process.

Keywords: Feedback Literacy; Digital Feedback Ecosystems; Learning Analytics; Generative Artificial Intelligence; Making Sense of Feedback; Feedback Use

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A Systematic Review of Studies on Algorithmic Thinking

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Algorithmic thinking, computational skills, and programming education—which aim to raise new generations as analytical, inquisitive, and productive citizens—are becoming increasingly prominent and integrated into the core of national and international curricula. The inclusion of algorithmic thinking in curricula is considered crucial for cultivating the human resources needed in STEM fields. In the age of digitalization and the information society, it is critical for individuals to possess 21st-century skills to adapt to technological advancements and solve the complex problems they encounter in daily life. Individuals are expected to be able to identify problems, systematically plan solutions, interpret data, and structure the solution process step by step. At this point, algorithmic thinking can be described as one of the fundamental cognitive skills that enables a problem to be approached in a logical, sequential, and solution-oriented manner. The aim of this study is to systematically review the literature in the field of algorithmic thinking in terms of publication year, country, research approach and model, sample group, data collection tools, and data analysis techniques. Designed as a systematic review, this study followed the PRISMA protocol. Data were retrieved from the Scopus, ERIC, and TR Dizin databases using the English keyword “Algorithmic Thinking” and the Turkish keyword “Algoritmik Düşünme,” and 148 studies meeting the criteria were included in the analysis. Descriptive content analysis was used to analyze the data; the studies were coded according to the defined categories and tabulated using frequencies. The research findings indicate that academic interest in the field of algorithmic thinking has increased since 2019, with the highest number of studies recorded in 2022 and 2024. In terms of geographical distribution, studies were found to be most concentrated in Europe, followed by Turkey and Asia, while Africa and the Middle East were underrepresented. Methodologically, quantitative experimental designs and qualitative case studies were predominant, with mixed-methods studies also playing a significant role. In terms of the sample, it was determined that studies were primarily conducted at the higher education, high school, and middle school levels, while preschool and teacher samples were neglected. It was found that scales and digital tools were most frequently used in the data collection process, while content analysis and difference tests were employed in the analysis. In conclusion, while the literature on AD has grown in volume, it still requires further development in terms of conceptual clarity, methodological balance, and standardization of measurement and evaluation. It is recommended that future research establish clear conceptual frameworks, include different age groups in the process, and develop comparable standardized measurement tools.

Keywords: Algorithmic Thinking, Systematic Review, Mathematics Education, PRISMA

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A Digital System for Monitoring Classroom Brainstorming and Learning Processes

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Classroom brainstorming activities are widely used to promote student participation and idea generation. However, in practice, they often face several limitations. These include unequal participation, limited visibility of ideas, and the lack of persistent records for analysis. Although digital tools have been introduced to address these issues, most existing studies focus on general-purpose platforms. Few studies have examined purpose-built systems that integrate instructional design with research frameworks.

This study develops a digital brainstorming system, BIMS (Brainstorming Interaction Monitoring System), using GitHub Pages and a Supabase database. The system is designed specifically for research-oriented classroom use. It provides a customizable interface and full access to detailed log data. These features allow for fine-grained analysis of discussion processes, idea formation, and the evolution of individual student responses.

BIMS integrates several key functions. These include anonymous or pseudonymous participation, real-time input, threaded discussion, and database-based interaction logging. The system aims to reduce participation anxiety, enhance idea visibility, and generate analyzable learning process data.

The system has been developed and a functional prototype is currently available. A crossover-based quasi-experimental design is planned for the next phase of the study. Two classes will participate in two comparable brainstorming tasks under alternating conditions. One condition uses BIMS, while the other uses a structured physical method based on sticky notes and whiteboard organization. This design allows for controlling class-level differences and focuses on the effect of the digital medium.

Data collection will include system log data, transcribed physical artifacts, student questionnaires, and group outputs. The analysis will focus on participation patterns, idea quantity and diversity, and student perceptions. The study is expected to provide an evidence-based instructional model for brainstorming activities. It also aims to deepen the understanding of digital mediation in classroom interaction and to offer a methodological framework for future research.

Keywords: Learning Analytics, Digital Brainstorming, Classroom Interaction, Collaborative Learning

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A Multidimensional Analysis of Academic Performance: The Case of Antalya Belek University (2015-2025)

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This research aims to provide a comprehensive bibliometric and quantitative assessment of the scholarly productivity of 95 academics affiliated with Antalya Belek University. Raw data derived from the institutional academic database were subjected to multi-dimensional analysis across the variables of research article, conference proceeding, book/book chapter, and project, disaggregated by faculty, academic rank, publication index, coverage scope (national/international), and temporal trends. The study constructs an evidence-based academic capability map of the institution and systematically identifies areas requiring strategic intervention. Descriptive bibliometrics and academic productivity analysis were employed as the primary methodological framework. The dataset comprises 1,724 scholarly outputs: 669 peer-reviewed articles, 608 conference proceedings, 337 books and book chapters, and 110 research projects. Publications were classified by index type (SCI, SCI-Expanded, SSCI, AHCI, SCOPUS, TR DIZIN, and other indices), geographic coverage (national/international), and publication year. Authorship patterns were examined to calculate collaboration rates, and per-capita publication productivity was compared across academic rank and faculty affiliation. Temporal analysis covers the 2015-2025 period, with a comparative growth rate calculated between two consecutive five-year intervals (2016-2020 versus 2021-2025). The mean academic output per researcher was calculated as 18.15, decomposed into articles (7.04), proceedings (6.40), and books/book chapters (3.55). A pronounced hierarchical differentiation by academic rank was observed: full professors averaged 37.8 articles per capita, compared to 5.9 for assistant professors and 1.5 for research assistants. This asymmetry empirically substantiates the pivotal role of academic seniority in driving institutional research output. The international publication rate reached 55.5% at the article level and 68.6% at the conference proceedings level. Articles indexed in high-prestige databases (SCI/SCI-E/SSCI/AHCI/SCOPUS) numbered 166, representing 24.8% of total articles. The multi-authored article rate stood at 43.0%, suggesting that inter-institutional and interdisciplinary collaboration remains relatively constrained. Comparative five-year analysis demonstrated a 39.5% increase in article production during 2021-2025 (n=265) relative to 2016-2020 (n=190), reflecting a maturing institutional research capacity. The findings underscore the imperative for Antalya Belek University to develop targeted policies to enhance international academic visibility. Priority action areas include: incentivizing publications in SCOPUS and Web of Science-indexed journals; implementing early-career researcher support programs to mitigate productivity concentration; institutionalizing a research culture within the Vocational School; and systematically expanding inter-institutional co-authorship capacity.

Keywords: Bibliometrics, Academic Productivity, Publication Performance, Institutional Analysis, Productivity Concentration, Antalya Belek University, Higher Education Quality Assurance

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Teacher Resilience in the Age of AI: A Phenomenological Study of English and Mathematics Educators' Professional Identity Negotiations

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The rapid integration of generative AI tools into education has disrupted long-standing assumptions about teachers' roles. While existing research focuses on technical and pedagogical dimensions of AI, how teachers experience and negotiate AI's implications for their professional identity remains underexplored. This gap is critical because teachers' professional self-concept is closely tied to subject-specific expertise that AI now replicates. English teachers face AI systems producing fluent writing and corrective feedback, while mathematics teachers encounter solvers generating step-by-step explanations. These discipline-specific disruptions may shape teachers' vulnerability and resilience differently, yet cross-disciplinary comparative research is scarce.

This study explores the lived experiences of secondary school English and mathematics teachers as they navigate tensions between established professional self-concepts and the demands of AI-mediated instruction. It investigates how subject-specific epistemic cultures and AI adoption stances mediate professional identity negotiation and resilience.

The study employs interpretive phenomenological analysis (IPA) with a dual-case comparative design. Two disciplinary cases are constructed as separate interpretive units, each comprising 6–8 participants purposively selected from secondary schools. Within each case, participants represent a spectrum of AI engagement, from active adopters to conscious resisters, identified through a screening questionnaire. Semi-structured interviews serve as the primary data source. The theoretical framework integrates Kelchtermans' (2009) model of teacher vulnerability and professional self-understanding with Day and Gu's (2010) conceptualization of teacher resilience. Analysis follows three stages: idiographic analysis, within-case pattern identification, and cross-case comparison.

Three thematic horizons guide the analysis: (a) identity destabilization, where AI disrupts subject-specific teaching roles; (b) adaptive reframing, through which teachers redefine professional value via integration, selective appropriation, or principled resistance; and (c) institutional mediators, examining how school culture, leadership, and collegial networks support or hinder resilient identity negotiation.

By foregrounding both disciplinary culture and the engagement–resistance spectrum, this study offers a two-dimensional analytic matrix beyond single-discipline descriptions. Findings are expected to reveal how subject knowledge epistemology mediates identity resilience across disciplines and to contribute to discourse on teacher resilience as existential negotiation of professional purpose under technological uncertainty. Implications address differentiated teacher education curricula, professional development models accounting for varying AI readiness, and institutional policies for responsible AI integration.

Keywords: Teacher Resilience, Professional Identity, Generative AI, Interpretive Phenomenological Analysis, Cross-case Comparison, English Language Teaching, Mathematics Education

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The Future of Education in the Era of AI: Global Academic Perspectives Toward 2030

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This study explores the anticipated transformations in education by 2030 through the lens of artificial intelligence (AI), drawing on the perspectives of 40 academics from Türkiye, Azerbaijan, Kyrgyzstan, and Kazakhstan. Adopting a qualitative research design, the study examines how AI is perceived, concerns surrounding its integration, its expected impact on professional practices, and academics' preparedness for AI adoption. The findings reveal that AI is predominantly perceived as a supportive and complementary tool that enhances both professional efficiency and personal learning processes. Participants highlighted its utility in research, data analysis, and knowledge organization, emphasizing its role in increasing productivity.

Despite these positive perceptions, significant concerns were identified, particularly regarding data privacy, the reliability and transparency of AI systems, and the risk of overreliance on technology that could undermine human judgment. Academics also anticipate substantial changes in their fields, including improvements in diagnostic processes, the expansion of predictive analytics, and a shift toward data-driven decision-making.

In the context of teaching and learning, AI is expected to facilitate personalized and adaptive learning environments, transform knowledge production into a more data-intensive and interdisciplinary process, and enhance applied learning, particularly in fields such as medical education. Furthermore, the findings indicate that academics are actively preparing for AI integration through self-directed learning, continuous professional development, and the practical incorporation of AI tools into their research and teaching practices. The study underscores the transformative potential of AI in education while highlighting the need for ethical considerations, transparency, and capacity-building initiatives to ensure its effective and responsible implementation across diverse educational contexts.

Keywords: Artificial Intelligence, Academic, The Future of Education, Digital Transformation

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An Examination of Teacher Candidates' Informal Learning Experiences and Education 5.0 Self-Efficacy in the Digital Age

Mustafa Yeler

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The aim of this research is to examine the relationship between pre-service teachers' informal learning competencies using digital tools and their self-efficacy levels regarding Education 5.0 digital learning technologies, and to determine whether these variables differ according to certain demographic characteristics. The impact of digital transformation on education systems necessitates that pre-service teachers improve their professional competencies not only through formal learning processes but also through informal learning experiences in digital environments. In this context, it is considered important to determine whether the informal learning experiences that pre-service teachers have using digital tools are related to their self-efficacy perceptions regarding digital learning technologies as envisioned by the Education 5.0 approach.

The research was designed according to the relational survey model, one of the quantitative research methods. The sample of the research consists of a total of 489 prospective teachers studying in the Primary School Teaching, Preschool Teaching, English Teaching, and Turkish Teaching programs of the Faculty of Education of a state university. 358 of the participants were female and 131 were male students. The data collection instruments used in the research were the "Informal Learning Competency Scale with Digital Tools" developed by Ocak et al. (2024) and the "Education 5.0 Digital Learning Technologies Self-Efficacy Scale" developed by Karagül and Kinay (2024). In addition to descriptive statistics, independent samples t-test, one-way analysis of variance (ANOVA), and Pearson correlation analysis were applied in the analysis of the data.

According to the research findings, no statistically significant difference was observed in either scale based on the gender variable of prospective teachers. Significant differences were determined in some sub-dimensions based on the program of study, with prospective teachers in the Primary School Teaching and Preschool Teaching programs having higher scores in some digital competency dimensions. Regarding the class level variable, a significant difference was found only in the digital self-efficacy dimension. Furthermore, a moderate, positive, and significant correlation was found between prospective teachers' informal learning competencies with digital tools and their self-efficacy in Education 5.0 digital learning technologies.

The results show that informal learning experiences of prospective teachers in digital environments play a significant role in the development of their self-efficacy perceptions regarding digital learning technologies within the context of Education 5.0. In this context, it is recommended that teacher training programs include more applications supporting the pedagogical use of digital technologies and that prospective teachers' informal learning processes in digital environments be encouraged.

Keywords: Informal Learning with Digital Tools, Education 5.0, Digital Learning Technologies

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Strengthening Education Systems through Digital Transformation: A Deep Learning Analysis of Structural Barriers

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The digital transformation of the education system is highly important but difficult at the same time. Teachers not properly trained, poor policy support along with weak infrastructures act as barriers, stopping the overall progression of the system. The institutions struggle adapting to the fast-changing technology, which results in the ineffective implantation of the tools. This study aims to understand and predict how the structural barriers affect the transformation.

A structured dataset was collected from secondary data sources to analyse the impact of digital transformation. The three main variables were policy support, teacher training quality and infrastructure preparation. It was based on peer-reviewed journals, conference proceedings, published reports and education databases from years 2012-2025. For the analysis, quantitative, data driven research was taken. It examines the direct relation between infrastructure, training and policy. Furthermore, also measure the impact on the overall transformation. Python tools, NumPy and Pandas were used for the data processing and analysis. Descriptive statistics and data cleaning were done. The resulted correlation and regression helped analyze the link between the variables. Long Short-Term Memory (LSTM), Artificial Neural Networks (ANN), and Dense Neural Networks were the deep learning models used and their performance was evaluated by accuracy, loss, and prediction errors. The deep learning models were trained using Adam optimizer and the Mean Squared Error function.

The findings show weakness in infrastructure and training along with inconsistent policy implantation. Weak linear relations surfaced in the correlation results. The regression value was not strong enough to predict a probable outcome. Besides, the deep learning models are better at computing complex patterns. Hence, some instability and overfitting were noticed in the models. Overall, the digital transformation of the education system is still at moderate level.

In conclusion, the study demonstrates that the single factor improvements are not enough by themselves. The desired digital transformation is only possible through combined approach, a combination of deep learning methods and statistics that will give better insights. Multiple, properly coordinated strategies are necessary. The policymakers and institutions also need to align their efforts for success long-term. Ultimately, the goal is to achieve sustainable and resilient digital transformation to strengthen the education system.

Keywords: Digital Transformation, Deep Learning, Education Systems, Structural Barriers, Data Analytics

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Transforming Learning Landscapes: AI-Driven Personalization, Pedagogical Risks, and Ethical Frameworks for Responsible Integration in Education Systems

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Artificial intelligence (AI) in the field of education is revolutionizing the way knowledge is imparted, with the ability for a student to learn in a way that is best suited for them, assessments that can be adapted according to the student's ability, and the ability for a student to be tutored by a computer program. Despite these advantages, the use of AI in education also poses a number of disadvantages, which are a cause for concern for many educators and stakeholders in the field of education. This study seeks to evaluate the advantages and disadvantages of the use of artificial intelligence in the field of education, with a focus on primary and secondary education, higher education, and vocational training.
This study was conducted by researching over 100 peer-reviewed articles from 2015-2024, as well as case studies conducted in 5 different countries on the use of AI in the field of education, which includes AI-based feedback systems, monitoring in the classroom with computer vision, AI-based writing assistants, and dropout prediction systems for students. These are the four main criteria on which the use of artificial intelligence in the field of education was evaluated, and a model for the responsible use of artificial intelligence in the field of education was created, along with policy recommendations and guidelines.
The results of the study have shown that the use of artificial intelligence in the field of education can be a force for good, with a number of benefits for the student, as well as for the institution, in terms of operational efficiency, as long as a set of ethical guidelines are followed in its use. A roadmap for the use of artificial intelligence in the field of education, which is sensitive to the context in which it is used, was also proposed in this study, which can be used by educators, policymakers, and developers of technology in the field of education for the responsible use of artificial intelligence in the field of education, with a focus on ensuring fairness and integrity in the use of the technology.

Keywords: AI in Education, Personalized Learning, Algorithmic Bias, Responsible AI, Adaptive Learning, Ethical AI Practices.

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DisasterNavBot: An AI-Driven IoT-Enabled Robotic Platform for Disaster Response and Experiential Learning in Intelligent Systems Education

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This paper discusses DisasterNavBot, a semi-autonomous, IoT-integrated intelligent mobile robot platform on disaster response and as an educational learning platform in artificial intelligence (AI), robotics and embedded systems learning. The situations of disaster (like earthquakes, industrial incidents and structural collapses) cause the unstructured and hazardous environments in which human rescuers must operate which, in most cases, extend this duration and possibilities to cause even more casualties. In relation to these barriers, the proposed system incorporates technologies of machine learning, robotics, computer vision, and Internet of Things (IoT) in the form of low-cost and efficient solution.

A multi-source sensor-based complex perception system will be used in which the ultrasonic and infrared sensors will be integrated with an embedded vision module (ESP32-CAM) to read perceived environmental results. Real-time object detection, obstacle avoidance and intelligent path prediction functions, by the use of machine learning algorithms and lightweight convolutional neural networks, in uncertain environments will be enabled. Moreover, the robot will facilitate semi-autonomic operation by supporting IoT-linked remote control to ensure that the application of human operators who can monitor live video feeds and interfere to do so when there is a need to do so. It will also include a servo-driven robotic arm to handle the lightweight debris under a remote watch.

In addition to its technical input, the proposed system will foster teaching and learning by providing a problem-based learning platform to do so. It will allow placing students much closer to AI-based systems, helping close the gap between theoretical understanding and real practice and acquire computational thinking, critical problem-solving, and decision-making skills. Flexible and hybrid learning spaces will also be advanced with the incorporation of the IoT-based types of remote interaction. This research project will show how intelligent robotic systems promote engagement, flexibility, and future-relevant, through the integration of interdisciplinary concepts and a human-in-the-loop treatment, in learners.

Keywords: Artificial Intelligence in Education, Robotics-Based Learning, Internet of Things (IoT), Machine Learning, Human–AI Collaboration.

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Familiarity and Usability of Digital Assessment Platforms

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Purpose of the study - The integration of digital platforms into higher education has reshaped pedagogical practices, enabling more flexible, and student-centred approaches to teaching, learning, and assessments. The global shift toward blended and fully online learning environments has intensified the imperative for institutions to adopt robust digital infrastructures and pedagogically sound e-assessment strategies In this evolving landscape, digital platforms such as learning management systems (LMSs) and cloud-based assessment tools are no longer peripheral but central to the academic experience. This study investigates the relationship between students' familiarity with digital learning and assessment platforms and the perceived usability of these tools in academic contexts.

Methodology - Drawing on a quantitative research design, data were collected from 189 purposefully selected undergraduate students at the North-West University – South Africa , all of whom had prior experience with both digital assessment platforms used. The instrument measured students' digital platform familiarity and usability perceptions. Items were adapted from the System Usability Scale (SUS), a validated tool for assessing user experience across digital systems and familiarity with digital platforms - items assessed frequency of use, confidence in navigating the digital assessment platform, and awareness of digital assessment features. Additional items were included to capture dimensions such as interface clarity, system responsiveness, and ease of navigation.

Key findings - The correlation and regression analysis revealed a statistically significant modest positive relationship between familiarity and perceived usability. These findings suggest that increased exposure to digital platforms enhances students' confidence, engagement, ease of navigation, and overall satisfaction with online assessments.

Implications - The study underscores the importance of fostering digital readiness and integrating user-centred design principles into assessment technologies, particularly within under-resourced institutional contexts. It also highlights the need for further research into contextual and discipline-specific factors that shape digital assessment experiences in higher education, ensuring equitable, inclusive, sustainable, and effective literacy development outcomes.

Keywords: Digital Familiarity, Digital Assessment, Perceived Usability, Student-Centered, Technology-Enhanced Learning Formatting

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A Resilient Blended Learning Framework for Microprocessor and Embedded Systems Course through Outcome-Based Assessment and Evaluation

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This article explains a robust mixed teaching-learning basis customized to deliver and conduct a Microprocessor and Embedded Systems course. There are multiple teaching-learning (TL) disturbances due to pandemic situations, natural catastrophes, political unrests, fuel crisis, infrastructural development works, etc. Our developed model integrates both synchronous and asynchronous instructional approaches with a simulation software-based practices to ensure continuation of teaching-learning processes with some degree of flexibility but without hampering outcome-based learning, assessment, and evaluation. The key part of this hybrid model is the use of MS TEAMS platform to facilitate TL among students-teachers during an on-going semester. Proteus simulation platform enables students to design, draw, simulate, and validate microcontroller-based virtual systems to eliminate dependency on the on-site laboratory class. The course materials are organized under eight Course Outcomes (COs) that are mapped to several assessment modules to holistically evaluate these COs by mapping them to theory and laboratory assessment components equally, viz. a comprehensive Course Capstone Project (CCP), 2 theory examinations, 2 quizzes, 2 assignments, one performance test, 1 presentation, and an Open-Ended Laboratory (OEL) experiment. The CCP encourages students to relate theoretical knowledge to resolve real-life problems by designing embedded systems aimed at solving a complex engineering problem through complex engineering activities, fostering creativity, critical thinking, system-level integration, and presentation skills. The students write a CCP report and present it using PowerPoint slides. The theory examinations assess conceptual understanding, while the performance test evaluates psychomotor skills through unguided experimental work or simulation task. The OEL part encourages Inquiry-Based Learning, granting learners to search for alternative designs, troubleshoot and optimize system performance within a simulation environment. Blended Learning is accomplished via a mixture of lecture slides and solve sheets via note cloud, one drive and TEAMS, recorded lecture videos, live interactive online and on-site lecture class and demonstration session, digital resources via continuous feedback. The course coordinator merges with all of them to evaluate whether the overall student cohort has attained the COs or not. Hybrid TL method permits learners to take part either on-campus or remotely without negotiating CO. Such course outline emphasizes constructive alignment with course outcomes, particularly in the affective, psychomotor, and cognitive domains. The implementation results indicate improved learner engagement, enhanced complex engineering problem-solving skills, etc. The model reveals that with suitable pedagogical design and modern circuit simulation tool, high-quality scalable and compliant engineering education can be delivered to the learners.

Keywords: Blended And Hybrid Learning; Microprocessor And Embedded Systems; Outcome-Based Education; Outcome-Based Engineering Education; Complex Engineering Problem; Simulation-Based Laboratory Experiment Using Proteus; Course Capstone Project; Open-Ended Laboratory.

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Unveiling The Impact of GenAI on University Education: A Survey Identifying Key Factors

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The rapid adaptation of generative artificial intelligence (GenAI) into university education has caused a huge paradigm shift, which outpaced the evolution of institutional frameworks and pedagogical strategies. This study addresses a concerning issue where faculty members and students adopt GenAI tools without standardized guidance, raising issues related to academic integrity and raising ethical concerns. The objective of this research was to evaluate the impact of GenAI on university education through analyzing the usage patterns, perceived benefits, and challenges among the key users. Using a mixed method survey approach, data was collected from a diverse sample of 47 faculty members and 552 students from computer science. Quantitative data provided insights on why and how practitioners use GenAI based tools, meanwhile qualitative data presented complex viewpoints about educational benefits and ethics. The results underscore the importance of responsible implementation, faculty training, and continuous evaluation in maximizing the benefits of GenAI tools while upholding ethical educational standards. The study emphasizes the importance of maintaining critical thinking skills and promoting human interaction within the learning process. GenAI is no longer an optional thing. It is now a key part of the current academic world and has the potential to enhance personalized learning, but if its use became uncontrolled that might negatively impact the existing evaluation methodologies and academic rigor.

Keywords: GenAI, Higher Education, Learning Process, University Education.

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An Explainable AI Framework for Identifying Factors Influencing Student Academic Performance

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Traditional machine learning models frequently operate as black boxes, making accurate predictions but lacking the openness required for practical intervention as educational datasets become more complicated. Teachers are unable to fully understand the specific behavioral and demographic factors that influence students' success or failure due to this lack of understanding. The purpose of this research is to develop an explainable artificial intelligence (XAI) framework to analyze student academic performance using the Student Performance Prediction Dataset, where student attributes include demographic factors, behavioral factors, and academic factors such as study hours per day, attendance rate, previous exam marks, parental education level, internet access, and extracurricular activities. This paper proposes a classification model to distinguish high and low-performing students and focuses on explaining the factors that affect student academic performance. This paper applies interpretable machine learning techniques to identify the factors that affect student academic performance using feature importance analysis and SHAP value analysis. The proposed model showed promising results in terms of classification accuracy, precision, recall, and F1-score, validating its efficacy and reliability in explaining student academic performance. This paper successfully identifies students with low academic performance and provides an explanation for factors affecting student academic performance, contributing to data-informed strategies in education to enhance student academic performance.

Keywords: Explainable AI, Higher Education, Academic Performance, University Education.

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Developing a sustainable blended learning framework for UK transnational education in Bangladesh: Challenges and opportunities

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The gross enrolment rate in tertiary education in Bangladesh is 24%, with females much lower at 16.51%, below the global average of 44% (BANBEIS, 2024; Education International, 2024). Again, the high cost of living hinders many Bangladeshi students from enrolling in overseas universities, and this is particularly challenging for female and ethnic minority students. Transnational Education (TNE) could potentially address this problem by providing students with the choice of more flexible delivery methods such as blended learning (BL). Few studies to date have explored how UK TNE can be developed in Bangladesh through a sustainable blended learning approach. This research report explored the findings arising from a one-year British Council funded project that examined stakeholders' perceptions and the specific needs of female and ethnic minority students regarding UK TNE in Bangladesh in the context of the country's commitment to achieving UN Sustainable Development Goals 4 (Quality education) and 5 (Gender equality). The project utilised a convergent research design involving questionnaires and semi-structured interviews with policymakers, teachers, and students from public and private universities in Bangladesh, as well as document analysis. Two theoretical frameworks framed the analysis of data (a global framework for transnational education engagement (Ilieva et al., 2024) and the Complex Adaptive Blended Learning System (CABLS) framework (Wang et al., 2015)). A total of 450 randomly selected tertiary students and 50 university teachers participated in the questionnaires. Additionally, 5 policymakers, 10 university teachers, and 20 tertiary students participated in the semi-structured interviews. Document analysis included Bangladesh's National Education Policy (Ministry of Education, 2010), Branch Campuses or Study Centres of Foreign Universities or Institutions Rules (British Council, 2014), and the Policy on Blended Learning for Bangladesh (University Grants Commission of Bangladesh (UGC), 2022). Findings revealed significant support for blended learning as an appropriate mode for delivering international higher education for Bangladesh based on a low-tech operational framework. Policymakers identified the key aspects of a TNE policy framework that should be developed prior to the introduction of large-scale UK TNE in Bangladesh. Based on these findings, the project recommends the use of the proposed sustainable blended UK TNE framework for Bangladesh, which aims to contribute to transforming local education systems, as well as contributing to the achievement of the UN Sustainable Development Goals.

Keywords: Transnational Education; UK & Bangladesh; Blended Learning; Sustainable Development Goals 4 (Quality Education); Sustainable Development Goals 5 (Gender Equality)

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A Flexible Mixed Mode Educational Structure for Modern Control Systems Lab Employing MATLAB/Simulink and Hardware-Based Experiments in Erratic Teaching-Learning Contexts

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This paper acclaims a robust mixed mode learning framework for Modern Control Systems Laboratory course during indefinite didactic settings, ensuring steadiness of hands-on learning and execution of Outcome-Based Education (OBE) goals. The model assimilates physical and simulation environments for laboratory experiments by combining MATLAB/Simulink-based simulation with a few hardware-based works. This task enables students to develop practical control system skills regardless of access constraints. There are 4 well-defined Course Outcomes (COs) that are aligned with various Program Outcomes (POs) of the Board of Accreditation for Engineering and Technical Education (BAETE). The framework emphasizes higher-order cognitive skills, such as applying, analyzing, evaluating, and creating, alongside psychomotor and affective competencies viz. teamwork, leadership, and communication. Students engage in well-designed laboratory experiments covering various topics of control systems theory and Programmable Logic Controller (PLC) programming. These are reinforced through MATLAB/Simulink-based simulation-driven exploration and validation, bridging theoretical concepts with real-world system behavior. The assessment strategy evaluates the students' performance holistically through multiple components, like group-based Course Capstone Project (CPP) proposal, midterm laboratory quiz, Open-Ended Laboratory (OEL) experiment, and CPP demonstration and presentation. CPP encourages students to address complex and multidisciplinary control problems fostering innovation and collaboration. It offers the students opportunities to interact with various stakeholders to develop their presentation skills and smartness. Besides, OEL promotes Inquiry-Based Learning (IBL) requiring students to design, analyze, and optimize control systems under several constraints. The mixed-mode teaching delivery incorporates asynchronous learning resources, such as recorded demonstrations and simulation tutorials, alongside synchronous sessions for discussion, interactive question-answer session, troubleshooting, and performance evaluation. The mixed-mode teaching-learning model allows flexibility for both in-person and remote participation while maintaining rigorous evaluation standards. The mapping of COs and POs ensures key competencies, like problem finding, results analysis, teamwork, and communication skills. The integration of simulation and hardware-based learning enhances students' ability to validate theoretical predictions. Both direct and indirect assessments of COs and POs are made through conductions of examinations and surveys. The proposed framework demonstrates that a mixed-mode laboratory course model can effectively sustain empirical learning, improve student engagement, and ensure attainment of COs of the course in resource-constrained or disrupted academic situations.

Keywords: Mixed-Mode Learning; MATLAB/Simulink-Based Control Systems Laboratory; Outcome-Based Engineering Education; Course Capstone Project; Open-Ended Laboratory; Survey; CO-POI-PO Mappings; Knowledge Profiles; Complex Engineering Problem Attributes; Complex Engineering Activities.

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Integrating Ethical, Human-Centered, and Responsible AI in Outcome-Based Engineering Education: Ethics and Environmental Protection Course

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The fast adaptation of Artificial Intelligence (AI) in education system imposes a regulated weight on ethical, human-centered, and accountable procedures in engineering program courses. This article re-ports an Outcome-Based Education (OBE)-associated pedagogical context for embedding ethical AI principles into the Engineering Ethics and Environmental Protection course of undergraduate electrical and electronic engineering program. The suggested methodically combines cognitive and affective do-main Course Outcomes (COs) with Program Outcome (PO) 8 requirements; mainly this PO is suggested by the Board of Accreditation for Engineering and Technical Education (BAETE), focusing on engineering ethics, public safety, and social duty. The course is mainly designed to integrate case study-based student learning and structured presentations driven by worldwide documented professional and ethical code of conduct, viz. IEEE, NSPE, and IEB. Students engage themselves both in real-life and orchestrated ethical cases related to environmental compliance, public safety, public health, and sustainability issues, involving them investigating and resolving those cases. Such activities substitute a human-centered perspective by emphasizing the societal, environmental, and cultural implications of engineering verdicts, mainly in AI-driven systems where accountability and transparency are critical concerns. Assessment tactics are aligned with COs, evaluating both cognitive insight and affective characteristics, such as ethical rationalizing, professional liability, and worthy decision-making. Tools that are used for evaluation of the student learning outcomes are rubric-based evaluation of case studies, oral presentations targeting affective domain assessment, and systematic reports that quantify students' aptitude towards the application of ethical codes, assessment of risks, and proposing sustainable engineering solutions. The incorporation of open-ended problem-solving further enhances critical thinking and reflective judgment, essential for responsible AI development and deployment. The framework highlights the importance of environmental ethics, linking AI applications with sustainability goals and emphasizing engineers' responsibility toward ecological preservation and public welfare. By combining theory, practice, and ethical reflection, the model ensures that graduates are not only technically competent but also socially responsible with ethics. This study demonstrates that integrating ethical AI concepts through structured OBE approaches and case-based learning significantly enhances learners' pre-paredness to address complex and real-world challenges. The approach is scalable and adaptable across engineering disciplines, contributing to the development of ethical standards in the AI-driven transformation era. After the end of a semester, all OBE data are compiled, collecting them from all course teachers, and then evaluated to compute attainment of COs.

Keywords: Ethical And Responsible AI in Education; Human-Centered Engineering Ethics; Outcome-Based Educa-tion (OBE); Case Study–Driven Learning And Assessment; Engineering Ethics And Environmental Sustainability; Affective And Cognitive Domain.

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Manual versus AI-Assisted Test Design in Language Assessment: Insights from Pre-service English Teachers

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Reshaping the roles of educators through the power of language education, Artificial Intelligence (AI) is increasingly praised for its abilities in exam preparation, including designing test items, generating practice tests, and providing instant, personalised feedback. In addition to language assessment literacy, language educators need AI literacy to effectively incorporate AI-generated outputs into their critical evaluation, and teacher training programmes should prioritise developing this literacy to support AI-assisted language assessment. With a focus on the professional development of pre-service English teachers, this study compared their experiences and perceptions of manual versus AI-generated language assessment practices. Adopting a qualitative case study design, the study included 61 pre-service English teachers. All participants were first asked to design a language test based on the content provided in class, with freedom to choose item techniques and quantity. After completing their manual test design, they used a GenAI tool (ChatGPT) to produce a test on the same content, applying the effective prompt writing strategies they had been trained on. Following the submission of both their manually designed and AI-generated tests, they reflected on their experiences and perceptions of the test development process comparatively. Their tests and reflections were analysed thematically. The findings revealed that pre-service English teachers mostly preferred structured-response or extensive response items rather than multiple-choice items in their manually designed tests since they had difficulty writing distractors; however, their AI-generated tests included more variety and quantity in terms of items. Furthermore, pre-service English teachers mostly found the AI-generated language test design process more practical, time-efficient, and effective in ensuring content validity but also emphasised their roles in checking the appropriateness of the items, particularly for the levels of students and the objectives of the course. They also pointed out that they needed more practice in assessment design as well as theoretical aspects of language assessment to have assessment literacy and digital literacies, particularly AI literacy, for writing effective prompts to obtain expected outcomes. Suggesting a balanced approach in assessment design where AI does not replace but supports the teacher through its capabilities in assessment design, this study emphasises the development of AI literacy in teacher training to promote the ethical and effective use of these systems in language education.

Keywords: AI-generated Test, AI Literacy, Language Assessment Literacy, Test Design

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From Adoption to Integration: Governing AI in Higher Education for Ethical and Adaptive Learning Futures

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Though AI disrupted numerous fields, its impact on education is perhaps one of the most profound — opening doors while revealing new and complicated hazards, leading to a fractured system. Traditionally, learning has a purpose — to improve the human mind: making it more efficient, adaptive, and analytical. This process is also going through a major transformation with the introduction of artificial intelligence (AI). AI-based tools have become over-the-counter tutors helping students to study and understand multiple topics in a few minutes. This availability of information is beneficial, but it also poses serious concerns about authenticity, integrity, and ethics.

The immediate support offered by AI may foster reliance. Accordingly, this may vitiate learner's critical thinking skills. Human cognition, easily swayed by convenience and ease of use, becomes further reliant on generative AI systems that hand you answers without understanding why. Moreover, the integration of AI into assessment practices can widen existing inequality gaps, especially where disparities remain in access, digital literacy, and institutional support.

Outside the classroom, however, these changes have broader ramifications that go beyond education. Further, natural, comparable types of action will be outsourced by AI, further leading us towards biased opinions and unstable employment. With industries changing at a pace never seen before, the growing need for continuous upskilling and reskilling causes a constant churn in the workforce. Thus, the power which AI can harness for us is huge, but to acknowledge the catalyst which may act as a snare to human ambitions, intentions, and progress — this is the threat, subtle but deep.

In the context of technological upheaval and the transformation of employment, we have to shift from technology transfer to technology integration in higher education. This document intends to test the principle of prosperous, long-lasting knowledge using AI-based technology with acceptable ethical and legal morals. This study adopts an interdisciplinary qualitative approach that combines legal and educational analysis of AI in higher education. Secondary sources are used for examining AI- driven tools impacting literacy and employability while assessing ethical pitfalls and a governance- grounded frame for responsible AI integration.

It seeks to explore the role of AI-based technologies in catalyzing career intensity and contribution and supporting force development. As you can see, it focuses on micro-credentials, substantiated knowledge, and an AI-driven evaluation process. However, it also addresses the less tangible risks associated with AI-based design, such as algorithmic bias, information privacy, the risk of over-reliance on AI for learning logistics, and fairness concerns in business. This is to create a governance-based model that can guarantee the ethical compliance of AI-promoted technologies and the elasticity of workplace order.

Keywords: Artificial Intelligence, Micro-credential, Employability, AI Ethics.

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Beyond Access: AI Literacy Gaps and Platform Dependency as Structural Barriers to Digital Growth Among Women E-Commerce Entrepreneurs in Bangladesh

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Digital access has expanded rapidly for women entrepreneurs in Bangladesh. More than 300,000 Facebook-commerce (F-commerce) pages are active, but most of the businesses behind them stay small. Drawing on the multi-level digital divide model and Sen's capability approach, this study tests whether four capability barriers predict digital business growth: digital skills and confidence, AI literacy, platform dependency, and financial constraint. A cross-sectional survey of 115 women online sellers, available in English and Bangla, measured five constructs with 22 Likert-scale items, all with acceptable to excellent reliability. In a multiple regression, the four barriers together explained 26.4% of the variance in growth. Only digital skills and confidence significantly predicted growth; AI literacy, platform dependency, and financial constraint did not, and a bootstrap check confirmed this pattern. Because digital skills and AI literacy were very highly correlated ($r = .835$), the AI literacy result is less certain. The sample was young, concentrated on Facebook (84%), and based mainly in Dhaka (90%). Despite high self-rated digital confidence, most businesses processed 30 or fewer orders per month (73%). The findings are associational and may not generalize beyond this sample. Still, the pattern points to a gap between digital participation and digital competence, with general digital skill the capability most strongly associated with growth. Women in the informal digital economy are an underserved learner group in EdTech, and these findings bear on how AI and digital literacy education should be designed for them.

Keywords: digital divide; AI literacy; platform dependency; women entrepreneurship; F-commerce; Bangladesh

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From Pandemic Online Learning to AI-Oriented Educational Technology: A Longitudinal ICETOL Discourse Analysis

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The public release of ChatGPT in late 2022 confronted the educational technology community with a second major disruption before the implications of the COVID-19 pandemic had been fully consolidated. This study examines how the International Conference on Educational Technology and Online Learning (ICETOL) responded to these overlapping disruptions between 2021 and 2025. Conferences provide a useful lens for such analysis because they capture scholarly and practice-oriented discourse close to its point of emergence and can therefore make shifts in research attention visible at an early stage. The study draws on a longitudinal corpus of 1,302 ICETOL contributions published in the publicly available conference proceedings between 2021 and 2025. All contributions from the proceedings were included. Titles, abstracts, and keywords were standardised into English where necessary; 778 texts were available in English, and 524 were translated into English using DeepL, followed by manual revision and iterative source-translation checks supported by the paid version of ChatGPT. The analysis combined descriptive corpus statistics, first-author country coding, keyword bundle analysis, and VOSviewer-based term co-occurrence mapping. A conservative thesaurus was developed to remove non-thematic methodological, statistical, publication-related, and generic terms while preserving meaningful distinctions between terms such as artificial intelligence, generative artificial intelligence, ChatGPT, AI tools, and AI literacy. The final co-occurrence network was based on binary counting with a minimum occurrence threshold of 20 and comprised 70 terms, five clusters, 1,538 links, and a total link strength of 5,770. The findings show a marked temporal reconfiguration of the ICETOL discourse. The early corpus was strongly shaped by pandemic-related online and distance education. The COVID-19 / pandemic bundle appeared in 57.3% of contributions in 2021 but declined to 6.2% in 2025. Similarly, the Online/distance education bundle declined from 64.1% in 2021 to 18.3% in 2025. In contrast, the broad AI / artificial intelligence bundle increased from 1.9% in 2021 and 4.2% in 2022 to 51.5% in 2025. More specific generative AI terminology emerged later: the Generative AI / LLM bundle appeared from 2023 onwards and reached 15.6% in 2025, while the ChatGPT bundle reached 8.6% in 2025. The VOSviewer analysis identified five discourse regions: school-based EdTech practice and digital skills; access, openness, engagement, and educational equity; artificial intelligence, generative AI, and critical AI literacy; language learning and instructional practice within regional contexts; and pandemic-driven online and distance education. The overlay visualisation further showed that pandemic-related terms were concentrated in earlier average publication years, whereas artificial intelligence, ChatGPT, AI tools, and AI literacy appeared later. Overall, the study shows that ICETOL's discourse did not simply move from COVID-19 to AI as isolated topics. Rather, the conference discourse was reconfigured from emergency-oriented online and distance education towards a broader post-pandemic educational technology agenda shaped by artificial intelligence, digital competence, educational equity, language learning, and pedagogical integration. Methodologically, the study demonstrates the value of longitudinal conference discourse analysis for identifying emerging transformations in educational technology before they become fully stabilised in journal literature.

Keywords: Bibliometric Analysis; Generative Artificial Intelligence; Educational Technology; Conference Discourse; COVID-19; Online Learning; VOSviewer

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Towards an Improved Online Proctoring Solution: A Comparative Study and Survey-Based System Design

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Online learning platforms play a vital role in maintaining educational continuity during natural disasters, with the COVID-19 pandemic serving as a significant example of their importance and effectiveness. Therefore, online proctoring is becoming a crucial part of digital education due to the quick growth of online learning settings, which has raised the demand for safe, equitable, and easily accessible assessment systems. However, existing proctoring applications often face challenges related to usability, privacy, reliability, and inclusivity, which can hinder equitable access to quality education. In alignment with the goals of United Nations Sustainable Development Goal 4 (Quality Education), this study aims to enhance the effectiveness and inclusiveness of online assessment practices. A comprehensive comparative analysis of widely used online proctoring systems was conducted to identify their key features, strengths, and limitations. Additionally, a survey involving the educators was carried out to capture user experiences, concerns, and expectations. The results of the survey and literature analysis were merged to identify the fundamental needs for a reliable and user-focused proctoring system. This study suggests designing an enhanced online proctoring system that considers the key components of an online proctoring solution based on these insights. The suggested system architecture supports the general goals of SDG 4: Quality Education by filling in existing gaps in proctoring technologies and advancing inclusive, high-quality digital education.

Keywords: Online Proctoring, SDG, Educational Continuity, Online Learning Platforms

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An Educational Module Supported by Augmented Reality to Enhance a Culture of Educational Health and Safety Among Primary School Students*

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Although the concept of occupational health and safety may seem like a phenomenon belonging to the adult world, even before becoming adults and entering the workforce, individuals are occasionally exposed to various hazards and risks during infancy, childhood, and adolescence. However, it is crucial for children to be aware of these hazards and risks so they can recognize and manage the various types of risks they may encounter throughout their future working lives. According to data from the ILO and Eurostat, Turkey ranks first among European countries in work-related fatalities. This underscores the need for OHS to be addressed at the national level and for policies to be developed. The concept of educational health and safety refers to protecting children from all types of risky situations on their way to school, at school, and in the school environment. Based on this information, this study will develop an Augmented Reality-supported education, health, and safety module for primary school students. The purpose of this study is to develop and evaluate the effectiveness of an Augmented Reality-supported Health and Safety education module based on the context-based REACT strategy. The research question for determining the design characteristics of the educational module to be used in developing EHS culture among elementary school students has been defined as “What are the design characteristics of the module?” The Design-Based Research (DBR) process will be followed in the development of an Augmented Reality (AR)-supported health and safety education module for third- and fourth-grade elementary school students, based on the context-based REACT strategy. DBR is a flexible research method in which the processes of analysis, design, development, implementation, and improvement are carried out in a cyclical manner; researchers and participants collaborate in practical settings; and design principles and theories are developed. Within this framework, the study will develop AR applications that utilize the context-based REACT strategy to foster a culture of health, safety, and environmental awareness among elementary school students. EHS activities will include elements such as AG applications, 2D/3D models, videos, graphics, simulations, and animations. Based on the data from the analysis phase, drafts will be prepared for the EHS activities that will constitute the EHS-AR module, the AR applications to be included in these activities, an AR mobile application for the EHS-AR module, and AR markers. With the EHS-AR module, students will use augmented reality applications to experience problems they are likely to encounter in daily life both inside and outside the classroom and discover solutions.

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Keywords: Occupational Health And Safety Culture, REACT Strategy, Design-Based Learning, Augmented Reality

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A Needs Analysis for Occupational Health and Safety Culture Practices Supported by Innovative Teaching Technologies for Primary School Students*

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Schools must be safe environments not only for students but also for other school stakeholders such as teachers and parents. School safety begins the moment all school stakeholders including school staff, teachers, and students leave their homes and continue until they return home after school. A safe school refers to an environment free from security concerns and anxieties, based on mutual trust. In situations where school safety is not adequately ensured, various accidents occur, and children are the ones who suffer the most from these accidents. These accidents cause various psychological, physical, and social problems in children. Despite all the legal regulations, precautions taken, and efforts made, unfortunately, many different types of accidents and unwanted incidents resulting in fatalities continue to occur in schools and educational institutions. . This is achieved by fostering an OHS culture from an early age to address risks. To develop measures and policies aimed at fostering an OHS culture in schools, it is necessary to identify the needs of the target audience. Based on this need, this study focuses on the perspectives of teachers and OHS experts to create designs aimed at instilling an OHS culture in primary school students. Based on the importance of early intervention in instilling an OHS culture in children, this study plans to conduct a needs analysis to develop an educational module supported by innovative teaching technologies. In this context, the following research question have been identified to determine the needs within schools. -What are the perspectives of teachers and OHS experts on applications supported by innovative teaching technologies? In this study, the phenomenological research design a qualitative research method has been adopted to identify the current state of OHS culture development in schools. Approximately 10 classroom teachers and 5 OHS experts are expected to participate in the study. Thematic analysis will be conducted to analyze the data. In the study, based on the views of teachers and OHS experts, it is anticipated that codes will first be identified, followed by categories derived from the codes, and finally themes derived from the categories, in a manner suitable for thematic analysis. As a result of the study, it is anticipated that findings will be obtained that reveal the views of teachers and OHS experts regarding the problems encountered in schools regarding OHS and their proposed solutions. Additionally, the study aims to determine perspectives on and expectations regarding applications supported by innovative instructional technologies as an intervention to address these issues. .

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Keywords: Innovative Instructional Technologies, Occupational Health And Safety Culture, Needs Analysis

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Exploring the effectiveness of game-based environments in developing conflict management skills amongst Singapore students

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The advent of game-based learning (GBL) has presented the potential in creating a more engaging learning environment for a new generation of students in Singapore. While Singapore is still in the process of harnessing such potential from online GBL environments, its capacity for developing conflict management skills – a key component of the Character and Citizenship Education (CCE) Framework – remains yet to be explored. This study seeks to investigate the effects of online GBL environments in developing conflict management skills among students in comparison to the traditional forms of social interaction that helps develop such skills. Additionally, this study looks to explore how students communicate and cooperate while engaging in game-based learning environments, seeking to understand how these online GBL environments shape students' communication and cooperation strategies during conflicts. Ultimately, this study seeks to explore the potential of online GBL environments in developing conflict management skills amongst Singaporean students and how they can be utilised in the Singapore curriculum for conflict resolution training.

Keywords: Game-based Learning; Conflict Management Skills; Character And Citizenship Education

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An Adapted Information Behaviour Model for Distance Education: Integrating Self-Regulation in Digital Learning Contexts

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The nature of distance education requires learners to take control of their studies by using digital technologies to access information. This means that self-regulated learning is an important aspect of distance education, but how it affects the academic success of learners is not entirely clear. This study seeks to investigate self-regulated learning behaviour of distance learners and how it affects their adaption to technology, information access behaviour and academic performance based on a modified General model of information behaviour. Using a survey research design, data was collected from a random sample of 200 distance education students from the University of Education, Winneba. The data was analyzed using multiple linear regression and structural equation modelling (SEM). It was found that the learners had high levels of engagement in seeking academic information and using digital technologies for their studies. Learners' information access behavior and their technology adaptation were found to be significant predictors of their academic performance. Moreover, the learners' self-regulated behaviour was found to have a significant influence on information access behaviour, technology adaption and academic performance. Interestingly, learners self-regulated behaviour accounted for 65.2% of the variance in their academic performance. The findings of the study emphasize the critical role of self-regulation in influencing how distance learners seek out information, adjust to digital technologies, and achieve better academic results.

Keywords: Information Access Behaviour, Technology Adaption, Self-Regulation, Academic Performance, Distance Education, Distance Education Students.

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Institutional Resilience and Inclusive Educational Technology in the Age of Artificial Intelligence: Bangladesh's Higher Education Digital Transformation in South Asian and Global Perspectives

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This paper offers a state of the art analysis of digital transformation in Bangladesh's higher education sector, examined within broader South Asian and global contexts. It explores how higher education institutions navigate uncertainty in the age of artificial intelligence (AI) by drawing on interdisciplinary scholarship from education policy, educational technology, human–computer interaction, and resilience studies. Institutional resilience is conceptualized as a multidimensional capacity that combines absorptive responsiveness, adaptive governance, and longer term transformative potential, grounded in ethical accountability and inclusive, human centered design principles. The analysis shows that Bangladesh demonstrated strong absorptive resilience through rapid, state led digital responses during the COVID 19 pandemic. However, adaptive and transformative capacities remain uneven across the sector. Persistent digital inequalities, limited faculty preparedness for AI mediated pedagogy, fragmented AI governance, and the weak integration of inclusive design continue to constrain systemic change. Comparative insights highlight shared regional challenges alongside global disparities in AI governance and critical AI literacy. The study contributes to advancing debates on resilient higher education systems in the Global South.

Keywords: Higher Education; Artificial Intelligence; Institutional Resilience; Inclusive Educational Technology; Digital Transformation; Global South; Bangladesh

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Visualizing Research Trends on Algorithm in Computer Science and Engineering: A Bibliometric Analysis

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This study provides a detailed overview of research trends in algorithms in the fields of computer science and engineering through bibliometric analysis. By analyzing a large number of research papers, we aim to identify the most influential works, emerging topics, and key areas of focus in algorithmic research. The analysis highlights how the study of algorithms has evolved over time, showing patterns in publication frequency, popular research topics, and the impact of different papers on the field. The findings offer valuable insights for researchers, educators, and practitioners, helping them understand the current state of algorithm research and its future direction. In essence, this study presents a clear and simple visualization of the progress and developments in algorithm research, making it easier for anyone to grasp how the field has grown and where it may be headed.

Keywords: Bibliometric Analysis, Algorithmic Research, VOSviewer, Research Trends, Computer Science Engineering, Citation Analysis

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Bridging Digital Divides in Crisis Contexts: Migrant English Literacy and Micro-Learning with Generative AI-Supported Mobile Learning – A Case Study of a Rural Shelter in Zimbabwe

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Adopting a critical-interpretivist epistemology, this study recognises that knowledge of displacement, literacy, and technology is unevenly distributed and subject to power relations. Moreover, language practices carry colonial legacies, while digitalisation reproduces exclusion. In sub-Saharan Africa, forced displacement is rising rapidly. Notably, migration is not voluntary but an imposed necessity due to political instability and economic collapse. To mitigate the challenge, rural Zimbabwean migrants need to advance in formal language as some are yet to experience formal English literacy programmes. Besides these, to survive as migrants, English literacy becomes essential for accessing shelter and employment. Using an explorative case study, twenty-four (n=24) purposively selected migrants (participants) completed ten-minute micro-learning sessions via a GPT-4o mini-powered WhatsApp chatbot over eight weeks. Transcripts from the migrants' WhatsApp Texts were thematically analysed, revealing that low-friction repetition enabled migrants with no prior English exposure to produce novel three-word requests within two weeks. Furthermore, the findings revealed reduced anxiety and absence of social shame. Nevertheless, barriers included inconsistent electricity, limited smartphone access, and culturally inappropriate outputs. We conclude that generative AI micro-learning via WhatsApp can help bridge English literacy gaps in crisis contexts, but only within a human-AI hybrid model where bilingual facilitators address trust, access, and algorithmic limitations.

Keywords: Forced Displacement, GPT-4o Mini-powered WhatsApp Chatbot, Micro-Learning, Migrant English Literacy, Rural Migrants

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Exploring the Interplay of L2 Grit, AI Literacy and L2 Writing Performance of Bangladeshi Tertiary EFL Learners

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In the current educational landscape, the use of Artificial Intelligence (AI), such as ChatGPT, has rapidly grown due to its user-friendly interface, personalised interactive learning and real-time feedback. The use of this widely accessible and highly valuable learning partner is often linked to increased learner motivation, participation, and the development of language skills, including writing. However, its usefulness as an effective language learning tool is not universal and is subject to Individual Learner Differences (ILD) and learners' AI literacy. While many researchers have hailed ChatGPT for its ability to facilitate continuous independent learning, the majority have cautioned against the risks of overdependence and emphasized the need for monitoring, training and ethical awareness. Hence, this mixed-methods study aims to explore the interaction of L2 Grit, a non-cognitive ILD, AI literacy and writing performance of tertiary learners in an EFL setting. For Quantitative data, 120 students' writing test scores and survey responses were collected using 2 separate questionnaires: a modified L2 Grit Scale (Teimouri, Plonsky & Tabandeh, 2020) to measure learners' persistence, consistency and engagement in AI-mediated writing environment and an AI literacy questionnaire to find out how well students understand, access, prompt, corroborate and incorporate AI in English language learning while in-depth qualitative information was gathered through interviews with 7 students. The findings reveal a strong positive correlation among learners' L2 Grit, AI literacy and writing performance. The majority of participants with higher L2 Grit also scored higher in the AI literacy scale and the writing test, with only a minority of the students with significantly lower proficiency levels compared to others in the groups doing otherwise. The study brings forth useful insights for teachers and policymakers by highlighting the psychological and technological demands on EFL learners in the age of AI. It addresses the crucial need to develop AI literacy among students to ensure effective and ethical use of AI in language learning and emphasizes the importance of ILD, such as L2 Grit to overcome the challenges in the process.

Keywords: Artificial Intelligence, ChatGPT, L2 Grit, AI Literacy, Writing, EFL

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Real-Time Multimodal Student Engagement and Confidence Analysis for Online Learning Environments

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The growth of online education has created new challenges for instructors in monitoring student engagement, attention, and confidence during virtual learning sessions. Traditional evaluation methods in online classrooms rely primarily on manual observation, which may be subjective and difficult to perform consistently in large classes. This research proposes a real-time multimodal confidence analysis system designed to monitor student focus and behavioral engagement during online lectures and viva examinations. The system integrates facial expression analysis, hand gesture tracking, and vocal feature extraction to estimate user confidence and engagement levels in real time. Facial landmarks are analyzed to detect gaze direction, head pose, facial expressions, and eye activity, while hand gesture recognition evaluates movement stability and communication gestures. In addition, vocal features such as pitch stability, loudness, and spectral characteristics are extracted to assess speech clarity and confidence. These multimodal behavioral signals are combined through a weighted scoring mechanism to generate a continuous confidence score ranging from 0 to 100. The system was evaluated using data collected from 100 participants, achieving an accuracy of approximately 94.97% when compared with self-reported confidence assessments. The proposed system can assist instructors in identifying disengaged students during online lectures and support objective evaluation during online viva or presentation sessions.

Keywords: Multimodal Learning Analytics, Student Engagement Detection, Confidence Analysis, Virtual; Classroom Monitoring, Facial Expression Analysis, Gesture Recognition, Behavioral Signal Analysis

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The Role of Generative AI in Transforming Online Education: Evidence from Bangladesh

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The rapid growth of online education in Bangladesh is showing the persistent challenges in engagement, personalization and instructional quality. Generative artificial intelligence (AI) is offering a transformative solution by enabling adaptive learning, automated support and enhanced content accessibility. Therefore, this study investigated the impact of generative AI on learning effectiveness, student engagement and instructional assistance within Bangladeshi online education, while identifying key factors influencing successful adoption. A mixed-methods approach was employed in the study, beginning with qualitative insights from focus group discussions involving students, educators and practitioners. These insights were then operationalized into measurable variables for quantitative analysis. Regression analysis using SPSS examined the relationship between AI usage and online learning outcomes, with learning effectiveness as the dependent variable and AI-driven personalization, accessibility, and instructional support as independent variables. Findings suggest that generative AI significantly enhances learning outcomes by facilitating tailored learning paths, improving content accessibility and reducing instructional workload. However, challenges such as digital inequality, limited technical skills and academic integrity concerns may moderate these benefits. The study emphasizes that effective integration requires strategic investments in teacher training, digital infrastructure, ethical guidelines and user-centered platform design. These results provide actionable insights for policymakers, educational institutions and technology developers seeking to harness generative AI to improve the quality, inclusivity, and effectiveness of online education in Bangladesh.

Keywords: Generative AI, Digital Learning, Educational Technology, Online Education

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The Effect of Applications Implemented by Prospective Elementary Mathematics Teachers Using a Flowchart-Based Visual Programming Tool on Various Variables

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The aim of this study is to examine the effects of applications carried out by prospective mathematics teachers using a visual programming tool on their mathematical reasoning and computational thinking skills, as well as to explore their views regarding the implementation process. For this purpose, a mixed-methods approach was adopted in the study. The participants consisted of 31 prospective mathematics teachers studying in the fourth year at a state university. Within the scope of the study, six-week algorithm activities in a mathematical context were conducted using Flowchart Visual Programming Language 3.01 as the visual programming tool. As data collection instruments, the "Mathematical Reasoning Assessment Scale," the "Computational Thinking Scale," and a semi-structured interview form developed by the researchers were used. In the analysis of quantitative data, paired samples t-test and Wilcoxon Signed-Rank Test were employed, while qualitative data were analyzed through content analysis. The findings obtained from the quantitative data revealed that the algorithm activity process conducted in a mathematical context using the visual programming tool had a positive effect on the prospective teachers' mathematical reasoning and computational thinking skills. The findings based on qualitative data indicated that the prospective teachers' overall views regarding the process were mostly related to the category of cognitive contributions. The difficulties experienced during the process included issues related to creating flowcharts, the interface of the tool, and the delete/undo functions. Regarding the integration of the visual programming tool into mathematics education, prospective teachers expressed that it would contribute to thinking skills, promote meaningful learning, and increase motivation and active participation. Prospective teachers also stated that using the visual programming tool as an instructional material in mathematics education has advantages for both teachers and students; however, they noted certain disadvantages such as time management, classroom management, preparation process, and technological bias from the teacher's perspective, and decreased motivation, the requirement of digital literacy, and lack of access to technology from the student's perspective. Finally, the majority of prospective teachers reported that they would be able to use the visual programming tool in their future professional teaching practices. At the end of the study, suggestions for future research are presented. Accordingly, it is recommended that similar studies be conducted with prospective teachers from different fields, employing various visual programming tools and examining the effects of the process on different variables. * This study was supported by the Scientific Research Projects Coordination Unit of Necmettin Erbakan University within the scope of the Research Start-Up Support Project (ABDEP) numbered 25AB28001.

Keywords: Algorithm, Visual Programming Tool, Mathematics Education, Prospective Teacher

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Enhancing Student Engagement Using Generative AI Tools in Online Learning Environments

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The improvement of student engagement is one of the most important challenges in online learning environments that directly affects motivation, participation, knowledge retention and overall academic outcomes. As the world has been rapidly advancing with generative AI services like ChatGPT and Google Gemini, new opportunities have emerged to transform conventional online learning into more interactive, adaptive and personalized experiences. Despite this potential, there is still limited empirical evidence quantifying how generative AI contributes to enhancing different dimensions of student engagement in real-world educational contexts. This study presents a controlled experimental framework to quantify the enhancement of student engagement through generative AI-assisted learning. It uses a two-condition design where participants learn to use the same materials in traditional and AI-assisted settings, allowing direct comparison and identification of AI effects. Engagement is assessed across behavioral, emotional and cognitive dimensions using structured Likert scale measures collected from participants. To ensure methodological rigor, statistical analyses including reliability testing (Cronbach's alpha), paired sample comparisons and correlation analysis are conducted to identify improvements in engagement and examine relationships between AI usage, interaction levels and perceived learning effectiveness. The novelty of this research lies in its focus on measuring engagement improvement in a controlled setup, rather than only observing general perceptions. It also introduces a transparency-related perspective by examining how awareness of AI involvement can influence trust, participation and critical thinking among students. The results are expected to show that there are possibilities for generating more engagement from the students through the use of more interactive and personalized learning tools. However, there are also concerns such as becoming too dependent on AI and losing critical thinking skills. This study aims to provide a simple and realistic guideline for replication as well as practical recommendations for educators and institutions who want to utilize generative AI effectively in online learning.

Keywords: Generative AI, Student Engagement, Online Learning, Personalized Learning, HumanAI Interaction

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EdFin: An AI-driven Solution for Financial Challenges Faced by University Students in Bangladesh

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University students in Bangladesh are facing significant financial pressure as tuition fees, accommodation, and living expenses continue to rise, while employment opportunities remain limited. As a result, many students borrow money or are forced to depend only on their family income to continue their studies. Past research confirms that financial stress negatively affects academic performance and mental health, especially for students from low and middle-income families. This study aims to explore the financial challenges encountered by university students in Bangladesh and investigate their preferred support systems. A quantitative research approach was employed. Data were collected through a structured online survey using Google Forms from over 100 students at American International University-Bangladesh. The survey included closed-ended questions about demographics, income, expenses, employment status, and preferences for financial support. The findings revealed that most students were from middle-income families with a monthly income of 30,000 to 60,000 BDT, but still faced high or very high financial pressure, mainly due to high tuition fees and rising accommodation costs. In addition, over 80% of students were unemployed, and even the employed ones could cover only up to 25% of their own expenses. The main reasons included limited part-time opportunities, low pay rates, and heavy academic workload. Despite these challenges, more than 70% of students expressed support for scholarships, structured on-campus employment programs, and financial literacy workshops. This research contributes to the field by not only highlighting the severity of financial challenges faced by Bangladeshi university students but also proposing EdFin, an AI-driven platform that offers personalized need-based financial aid, a structured on-campus employment portal, and financial literacy education to reduce financial pressure and improve academic performance. Such a platform can help universities provide crucial support to students through reducing financial stress, improving academic performance, and better preparing graduates for the job market. This study provides valuable assistance to university administrators and policymakers who are working to address student well-being and enhance equity, access and resilience in higher education.

Keywords: AI-driven Solution, Financial Challenges, Part- Time, Employment, University Students

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Conceptual Perceptions and Associations of Gifted Students in Immersive Virtual Reality Environments: The Case of Chemical Change

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The concept of chemical change is encountered by students in various aspects of daily life. However, studies in the literature indicate that students experience difficulties in understanding this concept, hold misconceptions, and struggle to distinguish between physical and chemical changes. Research conducted with gifted students similarly shows that they encounter challenges in constructing this concept at a conceptual level. The aim of this study is to examine the perceptions and conceptual associations of gifted students who experience immersive virtual reality (IVR) regarding the concept of chemical change.

The study was conducted with 20 seventh-grade gifted students. Before and after the implementation, students generated metaphors related to the concept of chemical change and completed a word association test (WAT). Within the scope of the implementation, students experienced chemical change and chemical reactions through the VR Chemistry Lab platform in an IVR environment. Following this experience, classroom discussions were held, and conceptual deficiencies and misconceptions were addressed with teacher guidance. The metaphors obtained from the data were analyzed using content analysis, while the word association data were examined through descriptive analysis.

Gifted students most frequently used the metaphor of cooking both before and after the implementation. Based on the content of the metaphors, three themes emerged in both the pre- and post-application phases. Prior to the implementation, students' metaphors indicated confusion with physical change and included some ambiguous expressions. In contrast, the metaphors generated after the implementation reflected more observation-based inferences, scientific definitions, and/or biological transfer. However, it was determined that some misconceptions regarding the distinction between physical and chemical change were not entirely eliminated. Analysis of the WAT revealed that before the implementation, associations were mostly related to experiment and chemistry, whereas after the implementation, associations such as experiment, chemistry, explosion, reaction, acid, fire, and gas release became more prominent. Additionally, more specific concepts related to indicators of chemical change emerged following the implementation.

The findings suggest that IVR-supported learning environments facilitate gifted students' construction of the concept of chemical change in a more scientific manner. Accordingly, it is recommended that IVR environments be utilized as virtual laboratories in science education for gifted students and that learning processes be enriched through IVR-based activities, particularly in the teaching of abstract topics such as chemical change. This study was supported by the Scientific Research Projects Unit of Çanakkale Onsekiz Mart University (Project Code: SBA-2025-5434).

Keywords: Immersive Virtual Reality (IVR), Chemical Change, Gifted Students, Metaphor, Word Association Test (WAT)

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Immersive Virtual Reality (IVR) Experiences of Gifted Middle School Students in Science Education

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Immersive Virtual Reality (IVR)-supported learning environments are considered capable of addressing the cognitive and affective needs of gifted students, who are distinguished from their peers by their high learning speed, curiosity about science, scientific creativity, information processing speed, abstract thinking, and problem-solving skills. This study examined the IVR experiences of gifted middle school students in science education within the scope of project No. 2025/226 supported by the Scientific Research Projects Unit of Balıkesir University, and the preliminary findings obtained from the project are presented in this study. A total of 60 gifted students from 5th, 6th, 7th, and 8th grades (15 students per grade) participated in the study. Students experienced three IVR applications via the Oculus Quest 3 headset over 6 class hours: Newton's Room in physics, 10K Science–CRISPR & Sickle Cell in biology, and Futuclass–Atomic Structure in chemistry. Prior to each activity, students received introductory content knowledge; post-activity explanation and discussion sessions were conducted. Before beginning the IVR applications, students were introduced to the device and completed an orientation process to detect potential physical discomforts such as nausea and dizziness. Following the implementation, data were collected using a 14-criteria experience evaluation form developed through literature review and expert opinion. The criteria covered action sense, interest, motivation, mental comfort, physical comfort, immersion, presence, reality/representability, attention, flow/time perception, contribution to learning, self-directed learning, enjoyment of participation, and willingness to use IVR in the future. All criteria were scored on a 1–10 scale. The overall mean score of students' IVR experiences across 14 criteria was calculated as $\bar{x}$ = 7.92 (SD = 1.26). The highest average was obtained in enjoyment of participation ($\bar{x}$ = 9.23, SD = 1.33), followed by immersion ($\bar{x}$ = 8.87), willingness to use IVR in the future ($\bar{x}$ = 8.73), attention ($\bar{x}$ = 8.62), contribution to learning ($\bar{x}$ = 8.48), reality/representability ($\bar{x}$ = 8.32), presence ($\bar{x}$ = 8.08), and self-directed learning ($\bar{x}$ = 8.05). Action sense, motivation, mental comfort, and interest ranged between 7.00–8.00. Flow/time perception yielded the lowest average within this group ($\bar{x}$ = 7.18, SD = 3.37), while physical comfort stood out markedly as the lowest-scoring criterion overall ($\bar{x}$ = 3.93, SD = 2.65). The results reveal that gifted middle school students rated IVR applications in science education highly across all dimensions except physical comfort. Accordingly, it is recommended that a systematic adaptation process be planned before IVR implementation, session durations be adjusted according to individual tolerance levels, and measures be taken to improve physical comfort.

Keywords: Immersive Virtual Reality (IVR), Gifted Students, Science Education, IVR Experience

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Evaluating AI readiness in Bangladeshi Higher Education: Routes to Digital Transformation

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Technological advancement has enabled the extensive integration of artificial intelligence (AI) across diverse businesses and sectors, including finance, manufacturing, agriculture, and education The AI revolution is rapidly revolutionizing education, providing transformative opportunities to customize learning experiences, assisting educators in their daily responsibilities, and enhance educational management Unfortunately, the utilization of AI in education is more evident in countries with higher AI readiness, such as China and the United States (Zawacki-Richter et al., 2019). In underdeveloped countries like Bangladesh, resource shortages and inadequate training opportunities for educators raise worries about the quality of university faculties. Moreover, a recent report published by the Asian Development Bank indicated that Artificial Intelligence holds strategic importance for Bangladesh for two primary reasons: (i) Economic expansion and workforce readiness, (ii) Guaranteeing fair access to high-quality education. Thus, to contribute to the current AI readiness studies, this research seeks to: 1. Evaluate the present level of AI preparedness in higher education institutions (HEIs) 2. Determine the principal facilitators and obstacles to AI-assisted learning in higher educational institutions. 3. Propose strategies for enhancing AI preparedness that are pertinent to South Asian institutions.

The research will employ a purposive sampling technique to collect data from educators now engaged in higher education institutions in Bangladesh via a standardized questionnaire. Only higher education institutions whose educators possessed AI awareness and utilized some form of AI in their teaching practices will be considered. Following data collection, the results will be presented through descriptive statistics regarding the AI readiness of educators at the tertiary level across six dimensions. These six dimensions included for the study are Technology readiness, People, Infrastructure, Organizational strategy, Culture, and Ethics. The study aims provide recommendations on policies which will enable policymakers at the institution level and government level to accelerate the use of AI-assisted learning in higher education in Bangladesh. Furthermore, the suggested six-dimensional framework may be employed to evaluate AI preparedness in various institutions across South Asia, hence establishing a systematic approach to prepare these institutions for AI integration.

Keywords: Artificial Intelligence, Emerging Economies. Tertiary Education

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Assessing the Institutional Status of Sharing Knowledge and Experience Among the Educators of Higher Secondary Level and Undergraduate Level in the field of Physics and Chemistry in Bangladesh-----A pilot Study

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Challenges for the academicians have been increasing day by day especially in the era of artificial intelligence (AI), data science and current digitally connected world. The skills that require to meet the inquisitiveness of the young minds and learners are enormous. Therefore, it is important to share the knowledge between different level of academicians of a country such as primary, high school and undergraduate level, in order to uphold the overall scientific temperament of any country. Understanding its importance, United Nation also placed the issue in its sustainable development goals (SDG 4: Quality Education and SDG 17: Partnership to Achieve the Goals). Aiming to achieve such goals study of the current structure of collaborations of different levels of educators is required for starting early mentorship and developing teaching as well as professional competency. Our current study focuses on such communication gap, particularly, among the higher secondary level teachers and undergraduate level educators. The primary purpose of the study is to realize on how the tertiary level academicians in the field of Basic Science (e.g: Physics, Chemistry etc) are exchanging their experiences, viewpoints and ideas with high school teachers in the current given structure in Bangladesh. Based on the extracted data several recommendations are made for the national interest in order to meet its SDG goals laid by United Nations (UN), which Bangladesh aims to achieve by 2030. In the current study, two groups of educators of under graduate level were interviewed on how they are interacting and exchanging their views with previous level educators of the learners. How the shortcomings of the students are addressed are put in the questionary too. The activities of three professional platforms of Bangladesh namely: Bangladesh Physical Society and Bangladesh Chemical Society are also reviewed and assessed to understand their contribution in this regard. Current study showed only limited number of educators of Physics and Chemistry, took initiatives to interact with high-school educators and teachers. A large portion of the study depicts their personal initiatives leaving the scope to develop communication mechanism between higher secondary and tertiary level academicians. Knowledge and experience sharing for the betterment of the learners are not found explicitly from the activities of professional platforms too. Activities of those professional platforms are limited mainly in showcasing research works at higher education level, which leaves more room to work in this direction. Future Scope and Conclusion: The current study represents a brief picture of institutional knowledge sharing status in Bangladesh which highlighted the knowledge sharing gap between different level of educators. This gap should be addressed with various steps to achieve SDG by 2030.

Keywords: Teacher Education, STEM Education Professional Competencies, Lifelong Learning, Digital Future

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Advantages and Limitations of Video Games in Language Learning

Firuza Ismayilova

This study investigates the role of video games as tools for English language learning by examining their benefits and limitations. With the increasing popularity of digital gaming, video games have emerged as a potential medium for informal language acquisition, offering immersive environments, contextual learning opportunities and increased learner motivation.

The study adopts a quantitative research design using a survey methodology. Data were collected from primary school language learners through an online questionnaire that examined participants' gaming habits, language learning experiences and perceptions of video games as educational tools. The sample consisted of young learners from diverse language backgrounds.

The findings indicate that video games contribute positively to vocabulary development, reading comprehension, speaking and listening skills, primarily due to repeated exposure to authentic language and interactive contexts. Participants also reported increased motivation and engagement while learning through games. However, the results reveal certain limitations, including a lack of structured learning objectives, limited opportunities for productive skills such as writing and speaking and the potential for distraction and excessive gameplay.

Overall, the study concludes that while video games can be effective supplementary tools for language learning, they should be integrated with formal instructional methods to maximise their advantages and minimize their drawbacks.

Keywords: Video Games, Language Learning, Language Acquisition, Game Based Learning

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Exploring the Influence of Radiation on the Learning of Heat Concepts: Rural Tertiary Students' Perspectives

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In rural higher institutions, teaching physics topics like heat and temperature through real-world methods has evolved over time as a hands-on approach to demonstrate how heat behaves, especially for students in both urban and rural areas. Although many rural physics students are eager to learn, they often miss out on proper laboratory work due to their geographical location. Another concern that has emerged in rural physics contexts is that when lecturers adapt tools that emit heat radiation during laboratory demonstrations, students face radiation exposure instead of genuinely grasping heat concepts. This study examined the problem by exploring students' perspective using an exploratory case study design. Specifically, the study gathered viewpoints from purposively selected rural physics students whose coursework included heat lessons, through an interview session.The viewpoints collected from the participants were then analysed thematically. The analysis revealed that when lecturers use heat-radiating instruments while teaching, it affects students' mental focus and laboratory engagement. However, the findings also showed that a lack of follow-up practice at home, including rural beliefs around heat absorption, limits understanding of the subject matter. Furthermore, limited access to laboratory resources and poor safety infrastructure in rural institutions constrain knowledge acquisition. As a result, the findings underscore that whether radiation from heat lessons is framed as a threat or simply as a scientific phenomenon, its influence directly shapes students' cognitive understanding and mental representation of heat concepts. The study recommends using instructional strategies that fit local contexts to improve safety awareness among physics students.

Keywords: Rural Higher Institution, Heat, Mental Focus, Students, Laboratory Engagement

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An Investigation of Artificial Intelligence Chatbot Dependency Among Mathematics Teacher Candidates in Terms of Various Variables

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The widespread integration of artificial intelligence (AI) based chatbots into educational processes in recent years has necessitated the examination of students' usage habits and potential dependency levels regarding these technologies. Various AI-supported tools are intensively utilized by higher education students for accessing information, preparing assignments, and supporting learning processes. This situation warrants an investigation into the relationship between students' frequency of use and their dependency levels on AI-based chatbots. Accordingly, the purpose of this study is to examine the AI chatbot dependency levels of mathematics teacher candidates in the context of academic achievement, usage frequency, usage purposes, and preferred tools. The study, which employed a correlational survey model, one of the quantitative research methods, included 252 mathematics teacher candidates studying at a state university. Data were collected using a demographic information form and the "Artificial Intelligence Chatbot Dependency Scale" adapted into Turkish by Yıldız-Durak and Balıkçı (2025). Spearman Correlation, Kruskal-Wallis H, and Chi-Square tests were employed for data analysis. The results indicated no significant relationship between academic achievement and AI chatbot dependency. Similarly, no significant relationship was found between academic achievement and usage frequency. According to the Kruskal-Wallis H test results, it was observed that as the frequency of AI tool usage increased, the mean rank of dependency scores consistently rose. It was determined that teacher candidates with high chatbot dependency levels primarily used ChatGPT only (33.8%), followed by the combined use of ChatGPT and Gemini (21.5%). Regarding usage purposes, it was found that they generally used these tools for daily life-related tasks (36.2%), assignment preparation (13.8%), exam preparation (7.7%), and research (7.7%). No significant relationship was found between the frequency of AI use and the specific AI tools utilized ($\chi^2(42) = 37.67$, $p > .05$). Furthermore, no significant relationship was observed between the frequency of AI use and the purposes of use ($\chi^2(196) = 177.29$, $p > .05$). Finally, no significant relationship was identified between the purpose of AI use and AI chatbot dependency. In conclusion, although the level of dependency increases as the frequency of use rises, this situation is not reflected in academic achievement. This result indicates that mathematics teacher candidates adopt artificial intelligence as a functional tool that facilitates their academic processes rather than as a learning partner.

Keywords: Artificial Intelligence Dependency, Mathematics Teacher Candidates, Academic Achievement, Frequency of Use

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MAST: A Gamified Philosophical Inquiry Model for Children Based on the Octalysis Framework

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Philosophy for Children (P4C), originally developed by Lipman, engages young learners in structured philosophical dialogue through a Community of Inquiry. Despite its well-documented benefits for critical thinking and ethical reasoning, P4C programs may face challenges related to students' intrinsic motivation and sustained engagement, especially in middle school settings. Existing motivational supports in P4C are primarily based on social processes such as dialogue, peer interaction, and a sense of community belonging. In contrast, meaning-based motivation—grounded in students' perception of the activity as personally meaningful and valuable—and curiosity-oriented motivational dimensions are addressed to a comparatively more limited extent. Gamification research, on the other hand, has been related to dialogic and community-of-inquiry-based pedagogies such as P4C only in a limited and fragmented manner. This study proposes the MAST Model (Meaning, Agency, Surprise-Curiosity, Togetherness), a motivational framework integrating P4C pedagogy with the Octalysis gamification framework for middle school children. MAST identifies four motivational constructs drawn from selected Octalysis Core Drives: Epic Meaning ignites Philosophical Curiosity; Curiosity drives Argument Ownership; Ownership deepens Community Belonging; Community Belonging recursively strengthens Epic Meaning, completing and amplifying the cycle. It is anticipated that this process will enhance students' active participation in philosophical inquiry. The study adopts a theoretical-developmental methodology through systematic conceptual alignment between P4C's Community of Inquiry principles and the selected Core Drives from the Octalysis Framework. Three classroom activity prototypes addressing the themes of friendship, freedom, and peace were designed in accordance with the MAST cycle and subjected to expert review, yielding favourable assessments of structural coherence and classroom applicability. It is suggested that, when applied in line with motivation-based core drives rather than superficial reward mechanisms, gamification has the potential to enhance the depth and sustainability of philosophical inquiry in children. Future research should prioritise empirical testing of the cyclical model through longitudinal measurement and randomised comparison with conventional P4C sessions.

Keywords: Philosophy for Children, Gamification, Octalysis Framework, Philosophical Inquiry Engagement

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A Local AI-Assisted Academic Integrity and Writing Support System for Higher Education

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Academic integrity and scholarly writing support are key issues in higher education, especially in resource-constrained settings where access to commercial plagiarism detection tools, citation support, and writing assistance tools are often limited due to cost. In many South Asian universities, instructors have to review large volumes of assignments with limited institutional support, making similarity checks slow, inconsistent, and hard to audit, while students often lack affordable, ethical tools for paraphrasing, citation, and grammar checks. Existing solutions are often expensive, cloud-based, and unsuitable for institutions with limited budgets. Moreover, many plagiarism tools function as black boxes that provide similarity scores without sufficient context, while writing support tools remain disconnected from integrity workflows. To overcome this deficiency, this research aims at a local AI-assisted academic integrity and writing support system for higher education, offering evidence-based similarity risk detection, ethical paraphrasing support, citation support, grammar improvement, and teacher/admin monitoring within a single university-controlled system. The proposed system utilizes institutionally available academic records such as archived submissions, assignment repositories, student-related academic data, etc. for internal similarity analysis using deterministic and interpretable methods like text overlap detection and semantic similarity measurement. Instead of providing accusatory statements blindly, the platform produces an integrity risk report that marks the level of similarity, highlights matched text segments, and points to probable references of the sources, making the teacher's review process more transparent. In parallel, the system provides formative support for writing in terms of ethical paraphrasing suggestions, citation recommendations in APA, IEEE and MLA styles, and grammar and clarity improvement while retaining the intended meaning. The teacher and administrator workflows are also facilitated by batch checking dashboards, review queues, audit logs and semester-level analytics. To enhance the research contribution, the study will incorporate a pilot assessment framework based on archived and simulated assignment submissions, assessment criteria comprising similarity detection efficiency, processing fastness, consistency of the evidence reporting, usefulness of the writing help outputs, diminution of teacher examination, usability of the dashboards, and privacy/deployment appropriateness relative to cloud-based options. The proposed system will ensure both academic integrity management and student learning as a transparent, affordable, and privacy-preserving alternative to commercial systems.

Keywords: Academic Integrity, Higher Education, Local AI, Similarity Detection, Writing Support, Citation Guidance, Privacy-Preserving Systems.

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ShieldOps Edu: An Institutional Privacy-preserving Prototype for Shadow AI Governance and Cyber-Safety in Higher Education

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The rapid integration of generative AI in higher education offers major benefits for teaching, research, and administration but also introduces challenges such as unapproved AI use, weak policy visibility, cyber-safety risks, privacy concerns, and declining digital trust. Many institutions face the rise of Shadow AI, where users adopt external tools without approval or awareness of associated risks. Current responses remain fragmented, relying on disconnected tools, policies, or informal practices that fail to provide coherent, privacy-preserving governance. Many existing monitoring solutions are designed for enterprise settings and rely on intrusive data inspection, making them unsuitable for educational environments that prioritize confidentiality and academic freedom. This highlights a clear research gap for institution-centered systems that enable responsible AI governance and cyber-safety without invasive surveillance. To address this gap, this study proposes ShieldOps Edu, an institutional privacy-preserving prototype designed to support Shadow AI governance and cyber-safety across universities and online learning ecosystems. The prototype consists of two integrated components. The first, OrgGuard, provides domain-level detection of AI-tool usage and supports administrative allow, warn, and block policies, policy synchronization, analytics, and audit logging. The second, BreachGuard, focuses on cyber-safety support by monitoring institution-linked email exposure, generating alerts, and guiding users through structured recovery workflows with progress tracking and security support features. The system is designed around a privacy-first architecture that uses authenticated APIs, encrypted email storage, hashed identifiers, role-based access control, retention-aware event handling, and modular service separation. Importantly, the prototype stores only minimal metadata necessary for governance and support operations, such as domain, timestamp, policy action, and protected user identifiers, while explicitly excluding prompts, uploaded files, clipboard content, and user-generated text. In this way, the platform aims to provide institutional visibility without compromising the confidentiality of academic interactions. As an implementation-based research prototype, ShieldOps Edu contributes more than a technical solution; it reframes Shadow AI governance and cyber-safety as an educational technology and institutional trust problem. The proposed evaluation of the prototype focuses on policy enforcement effectiveness, administrative usability, recovery workflow usefulness, visibility into risky AI tool usage, and suitability for privacy-sensitive university deployment. By integrating governance, cyber-safety, and privacy-preserving design into one higher education-oriented prototype, this work contributes to current discussions on responsible AI, digital trust, institutional resilience, and trustworthy transformation in technology-enhanced education

Keywords: Shadow AI, Higher Education, Privacy-Preserving Governance, Cyber-Safety, Digital Trust.

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A Multi-Agent Economic Simulation with LLM-Based Reflection for Experiential Learning in Economics Education

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Economic education often relies on equations, static graphs, and simplified examples that fail to capture how economic behavior evolves under constraints and uncertainty, creating a gap between conceptual understanding and experiential learning, particularly in observing how repeated labor decisions influence income, savings, and adaptation. This study develops a multi-agent economic simulation with LLM-based reflection for use in economics education, with a particular focus on modeling how heterogeneous individuals adjust work effort and income-related behavior over time. The goal is to design an interactive and interpretable simulation environment in which learners can analyze the relationship between labor decisions, income trajectories, savings outcomes, and economic shocks, while preserving mathematical feasibility and transparency. The proposed framework uses a hybrid architecture in which a rule-based economic engine enforces real-world constraints, including wage-based earnings, education-linked labor limits, baseline consumption, savings updates, investment dynamics, and bounded mood states, while an LLM-based reflective layer proposes adaptive daily labor choices using short-term memory of recent outcomes. Each agent maintains a reflection memory that summarizes prior work hours, income, spending, savings outcomes, and emotional state, and this memory is used to generate context-aware labor decisions under stringent numerical constraints. The system has been evaluated through a 60-day simulation using aggregate behavioral analysis, educational comparison, feasibility checks, and interpretable, prompt-level inspection of labor decisions. Results indicate that the reflective architecture produces adaptive but bounded labor behavior across groups, with mean labor levels under the reflective setting of approximately 7.99 hours for below-primary agents, 7.42 hours for primary-only agents, and 7.41 hours for tertiary agents, while labor variability remained interpretable rather than arbitrary. The average savings across the simulation were about 33091.13 for below-primary agents, 34167.57 for primary-only agents, and 35882.00 for tertiary agents. This shows that different groups had different economic outcomes. Mood dynamics also varied across categories, with mean mood values of 0.00, 1.00, and 0.82 respectively, suggesting that labor-income interaction and financial stability influenced behavioral state over time. All simulated agents remained within enforced economic bounds, including non-negative savings and constrained labor choices, showing that the LLM reflection layer did not violate the mathematical consistency of the model. The study contributes to educational technology and economics education by demonstrating that LLM-based reflective agents can be integrated into a constraint-aware multi-agent simulation to support experiential learning about income generation, labor adaptation, and economic resilience.

Keywords: Multi-Agent Simulation, Economics Education, Experiential Learning, LLM-Based Reflection, And Economic Resilience.

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Explainable AI for Transparent Student Performance Prediction in Digital Learning Systems

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Digital learning systems are becoming more dependent on the Artificial Intelligence (AI) technique to process large-scale educational data and predict student performance. These predictive models play a crucial role in identifying at-risk learners and enabling timely academic intervention. Nevertheless, numerous popular machine learning and deep learning systems operate as black-box systems that offer limited interpretability of their predictions. Such a lack of transparency decreases the level of trust among educators and students and restricts the practical adoption of intelligent decision-support systems in educational environments. To overcome this gap, this paper introduces an Explainable Artificial Intelligence (XAI)-driven framework for student performance prediction in online learning contexts. The presented framework combines interpretable machine learning models with the most advanced explainability methods, ensuring greater transparency and usability. Specifically, methods such as SHAP (Shapley Additive Explanations), LIME (Local Interpretable Model-Agnostic Explanations), and attention-based visualization are included to determine the most important factors affecting the outcomes of students. The system uses various educational data, such as demographic features, historical academic performance, and learning management system (LMS) interaction data, such as quiz attempts, content access rate, and interaction patterns. Tree-based models and hybrid interpretable deep learning architectures are explored to generate meaningful decision rules and highlight influential behavioral features. The proposed framework is evaluated based on performance in prediction and interpretability. Standard performance metrics, including Accuracy, Area Under the Curve (AUC), Mean Squared Error (MSE), and the coefficient of determination (R^2) are used to assess predictive capability. The standard performance measures for models are accuracy, AUC, MSE, and the coefficient of determination (R^2). Besides, the concept of explainability is tested through measures of fidelity and human-initiated validation methods to assess the understandability and applicability of the generated explanations. Ethical issues like data privacy considerations, including data privacy, fairness, and bias detection, are incorporated to promote responsible and equitable use of educational data. The proposed XAI-based framework enhances the trust, transparency, and accountability of the systems that predict student performance. The system may provide interpretable results and actionable recommendations to help educators understand student learning behaviors and design personalized interventions. However, this research could help developers create reliable educational analytics systems. These systems support personalized learning, improve academic outcomes, and enable data-driven decision making in a modern digital learning environment.

Keywords: SHAP And LIME, Learning Management Systems (LMS) , Model Transparency, Ethical AI, Explainable Artificial Intelligence (XAI)

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Preparing students of preschool and early school education to conduct STEAM classes

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[1] Uksw W Warszawie

The aim of this article is to analyze the self-assessment of students of preschool and early childhood education regarding their preparation for teaching STEAM (Science, Technology, Engineering, Arts, Mathematics) courses. Given the growing importance of interdisciplinary education and the development of future competencies, it is particularly important to examine the extent to which future teachers feel competent in implementing the STEAM approach in their teaching practice.

The study utilized an adapted research tool, the Instrument to Measure Natural Science Teachers' Self-Perception about Implementing STEAM Approach in Pedagogical Practices, tailored to the specific needs of preschool and early childhood teacher education. Selected components were analyzed: planning, implementation, and assessment of classes.

The study results allow for the identification of areas requiring support in the teacher education process and suggest directions for curriculum modification. The article contributes to the discussion on preparing future teachers for implementing modern educational models and emphasizes the importance of developing reflective self-assessment as a component of professionalizing the teaching profession.

Keywords: Preschool Pedagogy, Early School Pedagogy, STEAM, Teacher.

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Development and Validation of the Generative Artificial Intelligence Instructor Competencies Scale: A Two-Factor Structure for Higher Education

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The integration of generative artificial intelligence (GenAI) tools into higher education teaching practices has created an urgent need for valid and reliable instruments to assess faculty competencies in this domain. However, existing scales often focus on general AI literacy and fail to capture the pedagogical dimensions of GenAI use in instructional contexts. This study aimed to develop a valid and reliable measurement tool to assess faculty members' competencies in integrating generative artificial intelligence tools into their teaching and learning practices. The scale development process followed systematic psychometric procedures, including conceptual framework construction based on the UNESCO AI Competency Framework for Teachers and the European DigCompEdu framework, item pool generation, expert review for content validity using Lawshe's technique with nine experts, pilot testing with ten faculty members for item clarity, and large-scale psychometric evaluation. Content validity analysis resulted in the removal of six items with content validity ratios below .75, yielding a 28-item pool with a content validity index of .904. The resulting items were administered to two independent samples of faculty members from Sakarya University and other Turkish universities, recruited through voluntary self-selection sampling. Exploratory factor analysis was conducted on the first sample (N = 305) using principal components analysis with varimax rotation, revealing a two-factor structure that was conceptually labeled as Basic AI Competencies (10 items) and Teaching-Oriented AI Competencies (14 items). Confirmatory factor analysis conducted on the second independent sample (N = 306) supported the two-factor structure, with acceptable to excellent fit indices ($\chi^2/df = 1.788$, RMSEA = .051, CFI = .951, TLI = .949, SRMR = .036). Reliability analyses using multiple coefficients (Cronbach's α, McDonald's ω, Guttman's λ_2 and λ_6) demonstrated strong internal consistency across both subscales and both samples, with all coefficients ranging from .86 to .96. The findings provide strong psychometric evidence for the validity and reliability of the 24-item Generative Artificial Intelligence Instructor Competencies Scale, offering researchers and practitioners a robust instrument for assessing and supporting faculty development in the age of generative AI.

Keywords: Generative Artificial Intelligence, Instructor Competencies, Scale Development, Higher Education, Faculty Development, Teaching with AI

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Modeling Academic Resilience in Online Learning: A Robust Methodological Approach Using Moodle Logs and Stochastic Perturbations

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In the face of uncertain educational futures, identifying students' capacity to navigate academic challenges especially defined as academic resilience becomes more critical than predicting success alone. This study proposes a novel Academic Resilience Index (ARE) derived from Moodle LMS logs and assessment data (quizzes and midterms) to quantify students' behavioral persistence and recovery patterns. Unlike traditional predictive models, our methodology integrates stochastic perturbations specifically controlled Gaussian noise and data dropout simulations into the engagement metrics to evaluate the stability and robustness of the proposed index under environmental uncertainty. The ARE index is formulated based on three primary dimensions; performance trend (P_{trend}), interaction consistency (E_{consistency}), and volatility risk (V_{risk}). We validate the predictive power of this index by modeling final exam performance through both statistical regression and machine learning architectures. Preliminary findings suggest that students with high ARE scores demonstrate a significant capacity to recover from low midterm results, even when simulated noise is introduced into their activity logs. This study contributes to the field by providing a methodology for Responsible AI in Education ensuring that learning analytics tools remain reliable and transparent when supporting student retention in fluctuating digital learning environments.

Keywords: Learning Analytics, Academic Resilience, Machine Learning, Moodle Log Data, Stochastic Perturbations, Uncertain Educational Futures

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Research on Personalized Teaching Feedback Generation Based on Multi-Agent Retrieval-Augmented Large Language Models

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Generating personalized pedagogical feedback at scale represents a central challenge in the intelligent transformation of adult higher education. Existing approaches either rely on single large language models (LLMs) without learner state awareness, or incorporate retrieval-augmented generation (RAG) while neglecting the personalization driven by knowledge tracing, making it difficult to simultaneously satisfy the dual requirements of technical reliability and cognitive adaptability.

This paper proposes MA-RAG-KT-PF, a system that deeply integrates multi-agent collaborative architecture, retrieval-augmented generation, knowledge tracing, and personalized feedback generation within a unified framework, specifically designed for adult higher education in software engineering. The system comprises four specialized agents—Planning, Retrieval, Personalization, and Feedback—coordinated through a shared state bus and an orchestrator-worker communication protocol. The Personalization Agent constructs dynamic multi-dimensional learner profiles by fusing SAKT attention-based sequence modeling, LLM semantic enhancement, and forgetting curve modeling. The Retrieval Agent employs a hybrid strategy combining FAISS dense retrieval and BM25 sparse retrieval, augmented with a CRAG-style quality control mechanism. The Feedback Agent achieves iterative refinement through a generation-evaluation-regeneration cycle. In a six-month longitudinal experiment involving 200 adult learners, MA-RAG-KT-PF reduces the technical hallucination rate to 3.8% (a 79% reduction compared to direct LLM generation), achieves a feedback specificity of 0.841, and attains a learning outcome effect size of Cohen's d=0.79, significantly outperforming four baseline systems across all automated and pedagogical metrics. Ablation experiments reveal differentiated contributions: RAG contributes most to hallucination suppression, knowledge tracing most prominently improves feedback relevance, and multi-agent iterative refinement independently enhances linguistic coherence. This research provides a reproducible technical paradigm and empirical evidence for multi-technology synergistic architecture design in intelligent educational systems.

Keywords: Multi-Agent Systems; Retrieval-Augmented Generation; Personalized Feedback; Intelligent Tutoring Systems

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Inducing Social Exclusion in Adolescents with Intellectual Disabilities: Cyberball vs. Comic Book Scenes

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Social inclusion is a concept defined as the ability to exist within society and develop meaningful relationships. From this perspective, it plays a significant role in reducing the feelings of loneliness experienced by individuals with intellectual disabilities. However, these individuals often lead isolated lives within society and face various social and physical barriers. As the social environment of these individuals is more limited than that of others, the experience of exclusion has particularly adverse effects on the social and emotional development of children. Consequently, studying the phenomenon of social exclusion in these individuals is seen as a critical need. In this pilot study, the topic of inducing feelings of social exclusion—which has been studied in the literature with typically developing individuals—will be investigated, and it will be examined which method of emotional induction is more successful in eliciting this emotion in individuals with intellectual disabilities. Accordingly, the first induction method to be used is the 'Cyberball' task, which is the most frequently studied method for eliciting feelings of social exclusion. Cyberball is an experimental method documented in the literature that enables participants to imagine interacting online with two or three people and is capable of successfully inducing feelings of social exclusion. However, the effectiveness and validity of this task have been limited to samples of typically developing individuals. Another method to be used in the study will be 'social exclusion-themed comic books', owing to the advantage of using visual stimuli in conceptualisation and skill acquisition within the field of special education. Studies support the view that the use of visual materials, such as comic books, is effective in these individuals across many skill areas, particularly academic ones. However, there is insufficient research in the literature regarding the role of visual materials, such as comic books, in evoking feelings of social exclusion. Consequently, it is anticipated that this study will contribute to the literature by comparing the two methods. This pilot study will employ a pre-test–post-test between-groups experimental design, with a sample comprising 40 young individuals aged 16–18 who have been diagnosed with mild to moderate intellectual disability. Two distinct groups will be formed, one assigned the Cyberball task and the other the comic book reading task, and emotional measurements will be obtained using Likert-type scales. Due to the developmental nature of the sample, the measurement tools to be used will be designed with visual elements and incorporated into the study following expert consultation. The scales used will enable the assessment of both basic emotional skills and feelings of social exclusion. The results will be discussed in line with the existing literature, and recommendations will be presented.

Keywords: Social Exclusion, Intellectual Disability, Cyberball Paradigm, Comics

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Individual Course Experience in the Context of Volunteering in Distance Mathematics Teaching: An Examination of Students' Opinions

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Distance education is a form of teaching that uses technology to bring together the tools and materials of the teaching process when the teacher and the student are in different environments. When the historical process is examined, it is seen that it initially emerged as teaching by letter. The COVID-19 pandemic, which began to have a global impact in 2019, has greatly affected educational institutions, including non-formal and higher education institutions, especially in the field of health, due to the uncertainties it creates (Can, 2020). For this reason, education and training activities in schools have been temporarily suspended in many countries as part of COVID-19 response efforts (Hopegood, 2020). With the onset of the global pandemic, students were unable to receive face-to-face education in schools, and educational activities began to be delivered through the Education and Information Network (EIN) platform created by the Ministry of National Education (MoNE). The process was not limited to EIN TV broadcasts; As of April 23, 2020, online live lessons have been implemented at all grade levels. Thanks to this system, teachers and students came together in the digital environment and carried out their lessons through distance education. Teachers were able to share course materials with students, use the virtual board application, and conduct the teaching process using various visual content (MoNE, 2020).

Distance education practices, which became widespread during the pandemic, did not end with the pandemic and continued as a sustainable model in education and training afterward. When the literature is examined, it is seen that studies on distance individual course experience are limited. In this study, distance individual mathematics teaching is discussed from the perspective of students, with its pedagogical, cognitive, and affective dimensions, and it is thought that determining the strengths and limitations of the process will contribute to the field. The aim of this study is to examine students' opinions on individual course practices carried out within the scope of distance mathematics teaching on a voluntary basis and to determine the strengths and limitations of distance individual mathematics teaching. This research employed a qualitative approach, and data were collected through interviews. The research study group consists of 20 students who took individual mathematics lessons remotely during the 2025-2026 academic year, with the voluntary participation of their families and themselves. An interview form was used as a data collection tool, and the questions were aligned with the expert's field of expertise. Interviews were conducted online with each student and recorded in writing. The research's data analysis continues.

Keywords: Mathematics Education, Distance Education, Individual Course.

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Behavioral Justification Behind Persistent Fireworks Use: Exploring the Psychology of Wildlife Harm using Fireworks

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Fireworks are largely used in the time of festivals, celebrations, occasions and now a days even when it is not needed. But their environmental effect on birds and animals is significant as they cause disorientation, injury, nest abandonment and even mortality caused by loud noise and air pollution. Even after doing campaigns to promote awareness and social media highlighting the harm caused by these fireworks, many individuals continue to use fireworks. To understand and find out why people ignore harmful environmental facts as they celebrate functions and occasions can help establish a better and sustainable place for the animals and birds to live. The aim of this study is to investigate the psychological and social factors that inspire people to continue using fireworks despite having the knowledge of potential harm. It intends to explore the awareness and action gaps combining the examination of psychological justifications for involvement in harmful actions and assessing the willingness of alternative and environment friendly celebration ways. The research will rely on primary data collection using anonymous structured survey, scenario-based questions to reduce society oriented expected responses and also short interviews for deeper understanding and insights. Visual and media references combining films, documentaries, news footage and verified social media content that will help to provide contextual support with emotional and psychological responses from participants. Survey and interview participants responses will be collected from students and general people then it will be analyzed to identify patterns in awareness, justifications and behavior obstacles. The study is expected to provide deep leanings of behavior and psychological patterns that tell why individuals still use fireworks at festivals even when they know it is harmful to the environment. Preliminary analysis is used to anticipate revealing the patterns of how each individuals justify continued firework use, how they perceive personal environmental responsibility, and the degree to which they keep an open mind to adopt alternative celebration methods. These patterns will be examined without presuming any kind of specific outcomes. Findings from this study will investigate strategies to improve awareness and guide climate sensitive behavioral adaptation, and support policies aimed at eradicating the ecological effects of the celebrations on birds and animals.

Keywords: Fireworks, Psychological Justification, Awareness And Action Gap, Harmful Effect on Birds And Animals.

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An Investigation of Third-Grade Primary School Students' Number Sense Strategies in Solving Fraction Problems

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Number sense is defined as the ability to understand the relationships between numbers and operations and to use these relationships flexibly, meaningfully, and effectively in problem solving processes. In this respect, number sense plays a fundamental role in the development of students' mathematical thinking, reasoning, and estimation skills. Number sense, which is particularly developed at an early age, contributes to students' ability to make sense of more advanced mathematical concepts in later learning processes. In this context, number sense strategies enable individuals to develop alternative solution paths that reduce cognitive load in problem-solving processes by using mental operations more effectively. At their core, these strategies involve cognitive skills such as counting, decomposing a whole, and recomposing parts into a whole, which play a critical role in the development of early number sense (Jordan et al., 2007).

The concept of fractions is a structure that students can relate to everyday life experiences, however, due to its abstract nature, it is relatively difficult to learn. The literature emphasizes that students' early achievement in fractions is closely related to their later mathematics performance and, in particular, to their algebraic thinking skills (Siegler et al., 2012). Therefore, identifying the number sense strategies used by students while solving fraction problems is important in terms of both gaining a deeper understanding of students' thinking processes and contributing to the improvement of instructional quality.

The aim of this study is to examine the number sense strategies used by third-grade primary school students while solving fraction problems. The study group consists of five third-grade students. The study group was selected using convenience sampling, one of the purposive sampling methods, and includes volunteer students. Open-ended fraction problems developed by the researchers were used as the data collection instrument. These problems were designed to reveal the number sense strategies used by students during their solution processes. Data analysis of the study is ongoing.

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Keywords: Fractions, Number Sense, Number Sense Strategies

(257)

Design of an AI-Powered Mobile Application for Pronunciation in Turkish as a Foreign Language Instruction

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Advances in artificial intelligence offer benefits such as personalized learning, instant feedback, and constant access in foreign language instruction. These benefits enable the "adaptive learning" approach—whose foundations were laid in the 1970s with the Aptitude-Treatment Interaction paradigm—to be implemented far more effectively and efficiently today. Adaptive learning systems are dynamic structures that tailor content to a student's abilities and interventions designed to improve their performance. In foreign language instruction, where individual differences such as native language, demographics, learning styles, and language aptitude influence learning, an adaptive environment tailored to these differences can provide an efficient learning experience. Within this framework, this study aims to design an adaptive learning environment that leverages AI to enhance learners' Turkish as a foreign language pronunciation skills. An approach based on needs analysis was followed during the application design process. In the first phase, a systematic literature review was conducted on AI and adaptive learning in pronunciation instruction for foreign language teaching. In the second phase, interviews were conducted with learners learning Turkish as a foreign language, audio recordings were collected, and pronunciation errors were analyzed descriptively. After the needs analysis, the application development began, and 4787 pronunciation activities were prepared. The mobile application's infrastructure was established, and the activities were integrated. Two user types were defined: administrators and users. Administrators, i.e., lecturers, coordinated the process and were responsible for the feedback mechanism. Users—that is, learners—are held accountable for completing the activities sent to them by the AI in a timely manner, as determined by administrators. The system is designed so that the content and intensity of activities sent to learners are determined by the AI, which adapts based on learners' pronunciation errors. Additionally, learners can customize preferences such as text size, theme color, and font through the app's adaptability features. After the app was designed, an analysis was conducted on the number of times activities were repeated, their difficulty levels, and intensity to observe user experience. Within this framework, a three-week pilot application process was conducted with four learners. The improvements addressed the identified issues, leading to the final version of the application. As a result, the mobile application—developed based on needs analysis and designed to enhance pronunciation in Turkish instruction for non-native speakers—could serve as an effective learning tool. It is also believed that a hybrid system combining lecturers and AI will help develop AI applications and support the creation of materials for foreign-language instruction.

Keywords: Teaching Turkish As a Foreign Language, Artificial Intelligence, Application Development, Adaptive Learning Environment, Instructional Design

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Beyond Bite-Sized Content: Proposing an Integrated Socio-Cultural Framework for Microlearning in Resource-Constrained Higher Education Contexts

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Microlearning has emerged as a prominent approach in higher education, promising enhanced engagement, retention, and flexibility through short, focused learning modules. However, prevailing understandings of microlearning are often heavily influenced by cognitive load theory and corporate training paradigms, frequently neglecting the socio-cultural realities that inform learning in diverse and resource-constrained environments. In the context of South African higher education, persistent challenges, such as digital inequality, linguistic diversity, historical disadvantage, and elevated student dropout rates, create a risk that microlearning might reinforce existing structural inequities rather than alleviate them.

This conceptual paper introduces an integrated Socio-Cultural Microlearning Framework (SCMF) tailored for South African higher education. Drawing on Vygotsky's sociocultural theory, communities of practice (Wenger), Ubuntu philosophy, and critical perspectives surrounding digital access and decolonisation, the framework underscores five interdependent dimensions: (1) contextual relevance and cultural responsiveness, (2) social interaction and collective knowledge construction, (3) equitable access and infrastructure considerations, (4) learner agency and identity affirmation, and (5) alignment with institutional cultures and academic integrity.

The proposed framework builds upon existing models by highlighting how microlearning can either challenge or reproduce power structures in post-apartheid South Africa. It posits that thoughtfully designed microlearning, delivered through mobile-first, multilingual, and community-oriented methods, has the potential to enhance access, foster deep engagement, and mitigate academic misconduct by alleviating the cognitive and temporal pressures that often lead to plagiarism. The paper discusses implications for policy, curriculum design, and lecturer development, offering recommendations for future empirical investigation within South African universities.

Keywords: Microlearning, Socio-cultural Framework, South African Higher Education, Academic Integrity, Decolonisation, Digital Equity, Ubuntu.

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Transitioning, Reactive and Proactive Integrity Cultures: Institutionally Differentiated Approaches to AI Use

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The rise of generative Artificial Intelligence (AI) has disrupted conventional notions of academic integrity, challenging South African higher education institutions to safeguard ethical practices while embracing digital innovation.

While global debates on AI and integrity are expanding, limited research has examined how different South African university typologies, Universities of Technology, Traditional Universities, and Comprehensive Universities, frame and respond to AI misuse.

This study investigates institutional policy responses to generative AI, comparing how universities conceptualize AI misuse as plagiarism or dishonesty, and contrasting reactive (detection-focused) with proactive (education-first) approaches.

A comparative document analysis was conducted across six institutions: two Universities of Technology, two Traditional Universities, and two Comprehensive Universities. Policy documents, integrity frameworks, and AI guidelines (2023–2025) were analyzed to identify institutional framings, strategies, and challenges.

Universities of Technology emphasize compliance and detection, adopting reactive approaches; Traditional Universities balance punitive measures with developmental ethics, reflecting transitional strategies; Comprehensive Universities increasingly adopt proactive, literacy-based approaches that embed AI education into curricula. Persistent challenges include uneven student preparedness, digital divides, and limited staff capacity.

The study argues for a paradigm shift from punitive to educative cultures of integrity. It recommends integrated microlearning modules on ethical AI use, grounded in Ubuntu and decolonial perspectives, to empower staff and students. This socio-cultural framework aligns integrity with South Africa's broader goals of equity, transformation, and digital inclusion, positioning institutions to lead ethically in the age of AI.

Keywords: Academic Integrity, Generative Artificial Intelligence, South African Higher Education, Institutional Differentiation, Microlearning And Ubuntu Ethics, Decolonial Frameworks for AI Literacy

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Cultivating Adaptability Through EdTech: Equipping Students with Lifelong Learning Skills

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This qualitative study explores a central question: how can educators use educational technology (EdTech) to help students become adaptable and develop lifelong learning skills? Set within higher education institutions (HEIs), the research responds to a rapidly shifting global landscape, one marked by technological disruption, evolving workforce needs, and complex societal challenges, requiring HEIs to produce graduates who are not merely knowledgeable but also flexible, self-directed, and resilient. Grounded in a constructivist framework, the study examines how lecturers guide students in using technology to develop adaptive learning behaviours and continuous skill-building. To capture these dynamics, data were collected across purposively selected HEIs through semi-structured interviews, classroom observations, and an analysis of educational technologies aiding or not, lifelong learning skills among students. Subsequently, thematic analysis was applied to identify patterns in how technology either supports or hinders adaptability. The findings reveal that when technology is integrated intentionally, through collaborative platforms, virtual simulations, Artificial Intelligence (AI), or self-paced learning systems, it strengthens learner autonomy, critical thinking, knowledge representation and problem-solving skills development. As a result, students become more capable of taking ownership of their learning and navigating unfamiliar situations. Nevertheless, the findings reported significant barriers. These include unequal access to digital resources, insufficient pedagogical training for lecturers, and a persistent focus on technologies rather than on students-centred practices. Therefore, the study argues that HEIs need strategic, pedagogy-driven approaches to technology adaptation, approaches that prioritise flexibility, creativity, and student responsibility. By offering concrete, context-specific insights, this research contributes to the broader conversation on educational technology for uncertain lifelong learning futures. However, the findings underscores that HEIs can leverage technology not as an end in itself but as a means to cultivate adaptable, lifelong higher education students ready for continuous and impactful learning.

Keywords: Educational Technology, Students' Adaptability, Lifelong Learning Skills, Higher Education Institutions (HEIs), Pedagogy

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Digital Literacy Through the Lens of Social Science Educators in Bangladesh: A Qualitative Exploration of Knowledge, Perception, and Awareness

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Higher education is rapidly transforming due to technological advancements, globalization, and evolving social and cultural expectations. In this context, digital literacy has emerged as a critical competency for educators, enabling innovative and transformative learning. Despite its growing importance, understanding of digital literacy among social science educators in Bangladesh remains limited, with prior studies often shaped by narrow definitions or assumptions.

This study explored the knowledge, perception, and awareness of digital literacy among social sciences educators who are located in Dhaka, Bangladesh. A qualitative design was employed using a triangulation approach, combining key informant interviews, focus group discussions (FGDs), and a review of relevant literature. Participants were purposively selected to reflect diverse teaching experiences, academic backgrounds, and exposure to digital tools. Data were analyzed thematically to uncover patterns, challenges, and perceptions.

Findings indicate that educators feel both the necessity and the challenges of digital literacy. While they recognize its importance for enhancing teaching and learning, many reported limited confidence, uneven practical skills, and difficulty adapting traditional methods to digital platforms. Engagement with digital literacy was influenced by prior education, professional development, and institutional support. Educators emphasized the need for continuous training and collaborative opportunities to strengthen competence and confidence in using digital tools.

This study contributes by providing context-specific insights, identifying gaps between awareness and practice, and offering implications for policy, professional development, and institutional support to advance digital literacy in higher education in Bangladesh.

Keywords: Digital Literacy, Social Sciences, Bangladesh

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Digital Transformation in Health Tourism Education: Theoretical Approaches and Sectoral Requirements

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Today, health tourism stands as one of the primary drivers of global economic growth and a critical component of the international service sector. This rapid growth brings about a comprehensive process of technological change. In the modern health tourism ecosystem, processes now involve complex structures such as digitalization, data management, and the integration of AI-supported decision-making mechanisms. Particularly, the use of artificial intelligence, big data analytics, and automation systems fundamentally transforms the competency sets expected from industry professionals.

In this process, where traditional methods are replaced by digital-oriented approaches, it has become a necessity for personnel to possess digital literacy and data-based management skills beyond operational knowledge. This study aims to analyze the current state of health tourism education in the face of digital transformation and investigate the extent to which academic curricula can respond to the future requirements of the sector. The primary motivation of the research is to examine the relationship between theoretical education in universities and dynamic expectations in the field through a Management Information Systems (MIS) perspective.

The methodology is structured in two main stages to holistically synthesize theoretical knowledge with practical applications. In the first stage, a comprehensive systematic literature review is conducted to identify current trends and fundamental approaches. In the second stage, semi-structured interviews are held with industry experts and competent institutional structures in Turkey to determine the sectoral reflections of theoretical findings. Through these interviews, the applicability of literature recommendations is analyzed, and the required "next-generation skills" are clarified.

The expected results aim to reveal potential mismatches between academic models and the expectations of sector stakeholders. The study emphasizes the importance of equipping professionals with abilities such as using AI tools, data management, and taking ethical responsibility in digital processes. Consequently, this research provides a strategic roadmap for adapting health tourism curricula to the technological world of the future.

Keywords: Health Tourism Education, Digital Transformation, Artificial Intelligence, Management Information Systems (MIS), Data Management.

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The Moderating Role of Science Self-Efficacy in the Relationship Between Sustainable Living Awareness and Scientific Literacy

Feride Sahin

This study investigates the impact of awareness of sustainable living on scientific literacy among middle school students, with particular attention to the moderating role of science self-efficacy. The development of scientifically literate individuals is a central objective in science education, particularly given the growing global sustainability challenges. Although previous research has established the significance of both sustainability awareness and self-efficacy in predicting scientific literacy, the conditional influence of self-efficacy on this relationship has not been sufficiently examined.

A quantitative correlational research design was utilized. The sample comprised 407 seventh-grade students from public schools in a province in western Türkiye, selected through convenience sampling. Data were collected using validated instruments assessing scientific literacy, sustainable living awareness, and science self-efficacy. Analyses were conducted using SPSS 23, and a moderation model was tested with the PROCESS Macro (Model 1) employing bias-corrected bootstrapping procedures.

Moderation analysis results indicated that sustainable living awareness was a significant positive predictor of scientific literacy. Science self-efficacy also significantly predicted scientific literacy. The interaction between sustainable living awareness and self-efficacy was statistically significant, confirming a moderating effect. Including the interaction term substantially improved the model's explanatory power. The findings showed that the positive effect of awareness of sustainable living on scientific literacy diminished as self-efficacy increased. Conditional effects analysis further demonstrated that this effect was more pronounced among students with lower self-efficacy and less pronounced among those with higher self-efficacy.

These findings contribute to the literature by demonstrating that self-efficacy serves both as a direct predictor and as a conditional factor influencing the relationship between sustainability awareness and scientific literacy outcomes. Accordingly, this study provides additional insight into a moderation mechanism that has received limited attention in previous research. Moreover, the results underscore the importance of addressing both cognitive and motivational dimensions within science education. Educational interventions designed to enhance scientific literacy may benefit from considering students' self-efficacy levels, given that the impact of sustainability awareness appears to vary across individualsFuture research should investigate additional moderating mechanisms to achieve a more comprehensive understanding of the complex processes underlying the development of scientific literacy.

Keywords: Scientific Literacy, Science Self-Efficacy, Sustainable Living Awareness, Moderation Analysis

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The Hidden Curriculum of AI in Higher Education: Informal Practices, Workarounds, and Institutional Silence in Online Teaching

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The fast adoption of generative AI tools by universities has prompted institutions to establish official guidelines governing their application. There is, however, not much information as to how teachers use AI in their daily teaching activities beyond the formal guidelines. This paper examines the hidden curriculum of AI in higher education, including informal AI use practices, workarounds, and institutional silence on AI use in online teaching.

This qualitative research, informed by institutional theory and practice theory, explores how university educators negotiate the conflicts between official rules and the teaching demands. University faculty who are involved in online teaching participated in semi-structured interviews. Thematic analysis was used to analyze data and reveal patterns of unofficial AI use and the contextual factors influencing these practices.

Results indicate that shadow practices have emerged, in which teachers use AI tools in unofficially acknowledged and unreported ways. Participants often talked about workarounds to institutional restrictions, and ethical uncertainties about acceptable AI use. Another issue that is also pointed out in the study is that there is a wide gap between the institutional policies and the daily teaching practices, which in many cases, is marked by either limited guidance or institutional silence.

This study adds to the existing body of research on AI in education by refocusing the emphasis on formal adoption to informal practice and highlighting the importance of context-specific policy, which recognizes the reality of AI usage in education. The implications of the findings are on institutional governance, teacher professional development, and ethical integration of AI in higher education.

Keywords: Generative AI, Hidden Curriculum, Informal Practices, Institutional Theory, Higher Education

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Pre-Service Science Teachers' Views on Virtual Laboratory Applications: Learning Processes, Motivation, and Real-Life Connections

Elvan Ince Aka

Virtual laboratory applications are considered an important tool in science education for concretizing abstract concepts, providing a safe experimental environment, and offering interactive learning opportunities. The aim of this research is to examine the views of science teacher candidates on virtual laboratory applications. Designed using a case study design, a qualitative research method, the study group consisted of 17 second-year science teacher candidates studying at a state university in Ankara during the 2024-2025 fall semester. The study group was determined using convenient sampling. Data were collected using an opinion form developed by the researcher, consisting of 5 open-ended questions covering the advantages, disadvantages, connection to daily life, motivation, and skills acquired through virtual laboratories. During the process, the teacher candidates designed virtual experiments within the scope of the "Physics in Daily Life" course and transferred them to structured experiment templates. At the end of the application, opinions were obtained in writing, and the data were analyzed using thematic content analysis. The findings showed that virtual laboratories were positively evaluated in terms of their contribution to the learning process, accessibility and flexibility, economic and temporal advantages, safety, repeatability, affective effects, and technological contributions. In particular, the concretization of abstract concepts and their connection to daily life stood out as key elements supporting learning. However, lack of physical experience and psychomotor skills, technological dependence, limitations in modeling, attention and motivation problems, and decreased social interaction were noted as significant limitations. Furthermore, it was determined that virtual laboratories increased conceptual understanding and awareness, but limitations in knowledge transfer were experienced in some cases; however, in terms of motivation, they positively contributed to learning thanks to their visual and interactive structure. It was also concluded that virtual laboratories contributed to 21st-century skills such as higher-order thinking, problem-solving, scientific process skills, digital literacy, and self-regulation, but this contribution should be supported by real laboratory experiences. In conclusion, it appears that virtual laboratory applications offer a multidimensional learning environment that supports the learning processes and increases the motivation of prospective science teachers. In this context, it is recommended that virtual laboratories be integrated into science teaching programs in a way that is seamlessly linked to real laboratory experiences, and that practices be developed to utilize both types of experiences together in teacher training.

Keywords: Virtual Laboratory, Science Education, Pre-service Science Teachers

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Digital Literacy in Science Curriculum: A Comparative Analysis of Finnish and Turkish Science Programs Using the ICILS Framework

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Digital literacy has become a central competency in international educational agendas, encompassing individuals' ability to access, evaluate, produce, and share information in digital environments. According to the International Computer and Information Literacy Study (ICILS 2023), approximately half of students in participating countries perform below the baseline level of digital competence. Given that digital literacy extends beyond basic technology use to include higher-order skills such as critically evaluating information, producing digital content, and communicating responsibly in digital environments, this finding is particularly significant for science education. In this context, national science curricula need to be reconsidered in terms of how and to what extent they position digital literacy. This study aims to compare Turkey's 2024 Science Curriculum, revised under the Century of Türkiye Education Model, with the science section of Finland's National Core Curriculum (2016). The study adopts a systematic qualitative document analysis, utilizing an alignment matrix based on the ICILS 2023 Computer and Information Literacy (CIL) framework. This matrix enables a structured comparison of how digital literacy is represented across learning outcomes, cross-curricular components, and content frameworks. Finland was selected as a contrasting case due to its high performance in ICILS 2023 and its explicit integration of digital competence as a cross-cutting element within the curriculum. This selection enables a meaningful comparison of two distinct curricular approaches to integrating digital literacy. The findings are expected to reveal key structural similarities and differences between the two curricula and to identify potential gaps in the Turkish science curriculum. The study aims to contribute to the literature on the curricular positioning of digital literacy in science education and to inform curriculum development by emphasizing the importance of explicit, measurable digital literacy outcomes aligned with international frameworks.

Keywords: Digital Literacy, Science Education, Curriculum Analysis

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The Relationship Between Informal Learning Competencies Through Digital Tools and Perceived Academic Achievement in Sports Sciences

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The aim of this study is to examine the relationship between informal learning competencies through digital tools and perceived academic achievement among university students studying in the field of sports sciences. The research was conducted using a relational survey model within the framework of quantitative research methods. The study group consists of students enrolled in faculties of sports sciences located in different provinces of Türkiye. As data collection instruments, the “Scale for the Development of Informal Learning Competencies through Digital Tools” and the “Perceived Academic Failure Scale” were utilized. The obtained data were analyzed using the SPSS 27 statistical software package. Initially, normality tests were conducted, and parametric tests were applied to the data that demonstrated a normal distribution. The findings revealed that informal learning competencies through digital tools are a significant and positive predictor of perceived academic achievement. It was determined that students’ abilities to plan their own learning processes, access information rapidly, and individualize learning strengthen their perceptions of academic success. However, it is also noteworthy that the unconscious and uncontrolled use of digital tools may reduce learning efficiency. In conclusion, creating learning environments that promote the effective use of digital tools in the field of sports sciences will both enhance students’ informal learning competencies and positively influence their academic achievement. Accordingly, it is recommended that educational programs integrate content that supports digital literacy and self-regulated learning skills.

Keywords: Informal Learning Competency, Perceived Academic Achievement, Sports Sciences, Digital Tools

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The Role of Participation in Sports in the Relationship Between Social Media Use Disorder and Perceived Academic Achievement Among University Students

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The aim of this study is to examine the relationship between social media use disorder and perceived academic achievement among university students and to reveal the moderating role of sports participation in this relationship. The research was conducted using the correlational survey model, one of the quantitative research methods. The study group consists of university students from various provinces in Turkey. Data collection tools included the Social Media Use Disorder Scale, the Perceived Academic Achievement Scale, and survey questions designed to determine the level of participation in sports. The data obtained were analyzed using the SPSS 27 statistical software package. First, normality tests were performed on the data, and then parametric tests were applied to examine the relationships between variables. The analysis findings revealed that students with a high level of sports participation were less affected by the negative impacts of social media use disorder. It was observed that individuals engaged in regular physical activity had more developed time management skills, lower stress levels, and were more actively involved in academic processes. The results of the moderation analysis revealed that participation in sports plays a significant moderating role in the relationship between social media use disorder and perceived academic achievement. Consequently, consciously limiting social media use and encouraging students to engage in regular physical activities can be considered an important strategy for enhancing perceived academic achievement. In this regard, it is recommended that universities develop programs aimed at both increasing students' digital awareness and encouraging their participation in physical activities.

Keywords: Social Media, Perceived Academic Achievement, Participation in Sports, College Students

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Artificial Intelligence or Teachers? A Comparative Analysis of Teacher Candidates Using Large Language Models in the Assessment of Written Expression

Sibel Ekşi

The aim of this study is to comparatively examine the quality of rubric scores and feedback provided by Turkish language teacher candidates versus large language models (Claude and Gemini) in the assessment of written expression within mother-tongue education.

The research was conducted using a mixed-methods approach combining quantitative and qualitative methods. The study sample consisted of 18 Turkish language teacher candidates enrolled in the Turkish Language Teaching programme at Recep Tayyip Erdoğan University during the 2025–2026 academic year. The participants and models (Claude and Gemini); assessed nine written narrative texts of varying achievement levels, written by Year 5 pupils, using Bilican Demir and Yıldırım's (2019) six-criterion rubric (content, discourse management, clarity, context-appropriate language, spelling rules, grammar; total 24 points), whilst also providing feedback. In the analysis of the study's quantitative data, descriptive statistics were utilised and Kendall's coefficient of concordance (W) was calculated. In the qualitative section, the feedback provided was analysed—taking into account the theoretical frameworks of Sadler (1989), Ferris (1997), Hattie and Timperley (2007), Shute (2008) and Brookhart (2008)—were evaluated through content analysis in terms of specificity, guidance and appropriateness of language level. Once the evaluation process was complete, the trainee teachers' views on the assessments produced by the models were collected via a reflective form, and these data were analysed using thematic analysis.

Upon examination of the research findings, Kendall's W value among candidate teachers was found to be above 0.50 in all texts and was deemed statistically significant; moderate agreement was observed for the 'content' and 'context-appropriate language' criteria, whilst high levels of agreement were found for the other criteria. Upon examining the overall total score ratios for the rubric assessment, it was found that the average scores of the candidate teachers (15.99) and the generative AI models (14.78) were at a similar level. In the content analysis of the feedback, it was found that the Claude model achieved the highest score in the "specificity" and "directiveness" dimensions across all texts, whilst the vast majority of candidate teachers remained at a moderate level in these dimensions. It was found that candidate teachers evaluated the feedback generated by the models as a supportive tool under pedagogical supervision.

The results of the study revealed that the rubric scores generated by the models performed at a similar level to those produced by candidate teachers; however, it was found that the feedback generated by the models was more 'specific' and 'guiding'. Consequently, it is recommended that these models be used under the teacher's supervision as a supportive tool to assist the teacher and alleviate their workload during the feedback process.

Keywords: Artificial Intelligence, Written Expression Assessment, Feedback Quality, Turkish Language Education, Teacher Candidates

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The Effect of Total Physical Response Method Supported by Drama on Students' English Vocabulary Acquisition and Attitudes Toward Language Learning

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Although Total Physical Response (TPR) method and drama have each been shown to support young learners' language development, their integration has rarely been investigated. Addressing this gap, the present study explores the combined use of TPR and drama in teaching English vocabulary. This study investigates the effects of total physical response (TPR) method supported by drama on students' English vocabulary acquisition and attitudes toward language learning in a primary school. In the research, a quasi-experimental design with a pre-test post-test control group design, which is one of the quantitative research methods, was used. The participants consisted of 4th-grade students from a primary school affiliated with the Ministry of National Education in the central district of a province of the Eastern Anatolia Region. There are two classes in the 4th grade at the school. One of these classes was determined as the experimental group and the other as the control group. The pre-test vocabulary test and attitude scale were applied to both groups. The implementation continued for 6 weeks, and in the experimental group, English courses were carried out with activities related to TPR-drama methods, while in the control group, the courses were carried out with activities related to the traditional vocabulary instruction. At the end of the research, the post-test vocabulary test and the attitude scale were applied to both groups. The findings indicated that TPR-drama method significantly improved vocabulary acquisition and attitudes toward language learning compared to the control group. However, retention tests showed that the positive effects on vocabulary did not persist over time, while the improvement in attitudes was partially sustained. Integrating kinesthetic and affective approaches through TPR-drama creates an active and engaging learning environment, contributing both theoretically and practically to language education. Yet, reinforcement strategies such as spaced repetition are needed to ensure long-term retention of vocabulary. Teachers should incorporate drama-based activities alongside TPR instructions to enhance the engagement and accessibility of English courses, particularly for young learners and plan follow-up and reinforcement activities, such as spaced review sessions or repeated dramatization of learned vocabulary, to support long-term retention.

Keywords: Total Physical Response, Drama, English Vocabulary Acquisition, Attitudes To The Course

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Designing an Artificial Intelligence-Supported Gamified Classroom-Based Learning Platform for Foreign Language Teaching

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This study aims to design an artificial intelligence-supported and gamified classroom-based learning platform to enhance the effectiveness, motivation, and monitorability of foreign language teaching at the middle school level. The study is grounded in the problem that many existing digital language learning applications primarily focus on individual practice, provide limited support for teachers in managing classroom-based learning processes, and often fail to sustain students' long-term engagement. In response to this need, the study adopts the design and development research model and focuses on the creation of an integrated system consisting of a teacher panel and a student mobile application. Within the proposed platform, teachers are expected to have a high level of instructional control through features such as creating classes, assigning homework, defining badges, setting task durations, determining reward structures, monitoring student progress, and reviewing task completion data. On the student side, the mobile application is structured around gamified learning experiences including task completion, point collection, badge earning, avatar development, progress tracking, and leaderboard visibility. These features are intended to increase participation, encourage continuity in learning, and make classroom-based language practice more engaging. The development process is planned to benefit from artificial intelligence-supported tools for interface design and coding support, while the free version of the Gemini API is expected to be used for functions such as speech-based response processing, short-answer checking, and automated feedback generation. At the current stage, the primary outcome of the study is the development of a feasible prototype framework that combines teacher guidance, learning analytics, gamification, and student participation in a single classroom-oriented structure. The usability and educational appropriateness of the platform are planned to be evaluated through a pilot implementation involving one teacher and ten students. Based on the pilot process, teacher feedback and student experiences will be used to revise the system in terms of interface usability, task design, motivational elements, and instructional functionality. As a result, the study proposes a practical and developable educational technology model in which artificial intelligence is positioned not as a replacement for the teacher, but as a supportive tool that strengthens classroom-based foreign language teaching, increases learner engagement, and enables more systematic monitoring of student learning.

Keywords: Artificial Intelligence, Gamification, Foreign Language Teaching, Design And Development Research, Classroom-based Learning

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Comparing the Effects of Task-Based Gamification and Collaborative Question-Solving Gamification on High School Students' Academic Achievement, Flow Experience, and Attitudes Toward Collaborative Learning in Geography Education

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The purpose of this study was to comparatively examine the effects of task-based gamification and gamification based on collaborative question-solving on high school students' academic achievement, flow experiences, and attitudes toward collaborative learning in Geography courses. The study was designed using an explanatory sequential mixed-methods approach, integrating quantitative and qualitative data collection processes within a holistic framework. Accordingly, different types of data were employed in a complementary manner to obtain more in-depth and comprehensive findings. The study group consisted of 54 students enrolled in an Anatolian high school. Students were randomly assigned to either an experimental group or a comparison group. The experimental group participated in task-based gamification activities, whereas the comparison group engaged in gamification based on collaborative question-solving. The findings revealed that the collaborative question-solving gamification approach was more effective in enhancing students' academic achievement. This result may be attributed to the supportive effects of group interaction, knowledge sharing, and collaborative problem-solving processes on learning. In contrast, low but positive relationships were identified between students' flow experiences and academic achievement in the task-based gamification group. These relationships were particularly evident in the dimensions of enjoyment, concentration, and altered perception of time, indicating that students became more engaged in the learning process and developed greater interest in the course. This finding supports the motivational potential of gamification in educational settings. Although no significant differences were found between the groups regarding attitudes toward collaborative learning, qualitative findings highlighted the importance of task distribution, group communication, and synergy in the learning process. While physical activity and individual responsibility were more prominent in task-based gamification, group motivation, competition, and tournament structures were found to guide students toward academic goals in collaborative gamification. Furthermore, analyses based on player typologies indicated that "player" and "achiever" students demonstrated higher academic performance in both gamification approaches. In addition, some students appeared to benefit more from socially interaction-oriented learning environments. The results suggest that gamification contributes positively to the learning process; however, its effectiveness depends on the alignment of the selected gamification approach with students' individual characteristics, motivational sources, and learning preferences. Therefore, it is recommended that instructional processes incorporate flexible and diversified gamification strategies tailored to different player types, learning styles, and course objectives. Moreover, teachers should assume a facilitative role and adapt classroom practices according to students' needs to maximize the effectiveness of gamified learning environments.

Keywords: Geography Education, Gamification, Player Typologies, Collaborative Learning, Flow Experience

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Digital Assessment Tools in Science Education: An Analysis of Textbook-Based Assessment Tasks

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The integration of digital technologies into educational materials has transformed assessment practices by enabling interactive engagement and immediate feedback. Within the scope of the curriculum reform implemented in Türkiye in 2024, science textbooks revised under the Türkiye Century Education Model incorporate a substantial number of digital assessment components alongside traditional printed content. The present study aims to examine the digital assessment content embedded in the 5th-grade science textbook updated in accordance with the 2024 Maarif Model, to identify the assessment techniques employed in these tools, and to reveal their pedagogical potential.

This study adopts a qualitative research approach based on document analysis. The primary data source consisted of the digital assessment components contained within the 5th-grade science textbook revised under the Türkiye Maarif Model. All assessment components directing students to digital environments were systematically identified and examined. The data obtained were subsequently categorized using content analysis based on established classification frameworks in educational assessment.

The findings indicate that digital assessment tools featured in the textbook predominantly employ traditional assessment techniques, including matching exercises, fill-in-the-blank questions, multiple-choice tests, and true–false items. While these techniques are effective for rapid assessment and feedback, they primarily focus on cognitive processes related to remembering and understanding. The limited inclusion of open-ended, inquiry-based, or performance-oriented tasks suggests that digital tools are used primarily to transfer traditional assessment formats into digital environments rather than to support higher-order thinking skills such as analysis, evaluation, and creation.

Digital assessment tools offer significant opportunities for interactive and formative assessment. However, the findings reveal that the tools in the 5th-grade science textbook largely reflect a traditional, convergent assessment approach. The prevalence of formats such as matching, fill-in-the-blank, multiple-choice, and true–false questions indicates that digitalization has not advanced beyond replicating conventional paper-and-pencil assessments in a new medium. Furthermore, this suggests that the unique advantages of digital environments—such as immediate feedback, adaptive item delivery, and process-oriented assessment—are not being fully utilized.

Keywords: Digital Assessment, Science Education, Textbook Analysis, Maarif Model

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An Analysis of Theses on Digital Transformation in Education in Türkiye

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This study aims to analyze graduate theses examining the concept of digital transformation. Theses were published by the Higher Education Council National Thesis Center, focusing on Education and Teaching and incorporating the concept of digital transformation, and were examined using document analysis. A search conducted in April 2026, targeting theses in which the term “digital transformation” appeared in any field (Thesis Title, Abstract, or Subject), yielded 298 records. These theses, where the “Subject” field did not include “Education and Teaching,” were excluded from the scope, and the analysis was conducted on the remaining 17 theses. The data obtained from the master’s theses examined within the scope of the research were analyzed based on the parameters of publication year, thesis type, sample group, geographic distribution, field of study, and thesis objective.

When examining the publication years of theses on digital transformation in education, it is observed that the studies gained momentum particularly as of 2021. The fact that digitalization became a mandatory paradigm in the post-pandemic period is the primary driver of this momentum. The year 2025 was identified as the year when graduate studies on digital transformation reached their peak in terms of quantity and publication volume. When the 17 graduate theses were analyzed by type, it was determined that the vast majority were at the master’s level. When examining the sample groups at the center of the research, it is notable that teachers—who implement the process—and school administrators—who manage institutional transformation—are the most frequently selected study groups. This indicates that the research focuses on measuring the field-level implications and managerial dimensions of digital transformation. The geographical distribution of the universities where the studies were conducted indicates that the subject has found a broad academic ecosystem across Turkey. In addition to the pioneering role of established universities in metropolitan cities such as Istanbul and Ankara, universities in provinces like Erzurum, Konya, and Düzce have also made significant contributions to the literature through the theses they have produced in this field. When examining the departments where the thesis studies were conducted, it was determined that the Department of Educational Administration and Supervision produced the highest number of theses, followed by the Departments of Management Information Systems, Mathematics and Science Education, and Business Administration. This diversity indicates that digital transformation is approached not merely as a pedagogical process but also as a managerial and technical organizational process. When the research objectives of the theses are analyzed, concepts such as digital transformation awareness, digital transformation competence, and digital leadership emerge as key focuses.

Keywords: Digital Transformation, Theses, Document Analysis, Education And Teaching

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Water Resources, Climate Change, and Education: Preparing Future Generations for Sustainable and Resilient Water and Energy Management in Pakistan

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Pakistan is increasingly facing the dual challenge of water scarcity and energy insecurity, both exacerbated by climate change. Rising temperatures, erratic rainfall, glacial melting, and frequent floods and droughts are placing significant stress on water resources and hydropower potential. While hydropower offers a renewable and environmentally friendly energy solution, its sustainability depends on informed management, public awareness, and skilled human resources.

In this context, the Ministry of Water Resources, Government of Pakistan, plays a critical role through initiatives such as flood protection and early warning systems, development and protection of water reservoirs, and management of transboundary water challenges with neighboring countries including India and Afghanistan.

This study explores the role of education in promoting sustainable hydropower and water resource management in Pakistan by integrating climate-responsive knowledge and skills into learning systems. The objectives were to: (i) examine awareness of hydropower and climate change among students and educators; (ii) assess the extent to which curricula address water and energy sustainability; and (iii) identify strategies to strengthen education for climate-resilient water and energy management.

A mixed-methods design was adopted. Quantitative data were collected through surveys of university students (n=500) and teachers (n=70). Qualitative data included semi-structured interviews with policymakers, hydropower experts, and faculty (n=15), along with focus group discussions (n=3). Policy documents, including the National Water Policy and curricula, were also analyzed. Quantitative data were analyzed using descriptive statistics, while qualitative data were thematically analyzed.

Findings reveal limited awareness and fragmented understanding of hydropower sustainability and climate change linkages. Although hydropower is widely recognized as a key renewable energy source, curricula insufficiently address its environmental and social dimensions. Gaps were also identified in interdisciplinary learning, practical exposure, and policy–education integration. The study highlights the need to align education with national priorities such as flood risk management, water storage, and transboundary water governance, while emphasizing opportunities for integrating climate and water literacy.

The study concludes that building a resilient future requires integrating climate-responsive education, strengthening collaboration between academic institutions and relevant ministries, and investing in capacity building. Key recommendations include revising curricula to incorporate water–energy–climate nexus concepts, promoting project-based learning, strengthening partnerships, and developing targeted training programs aligned with national priorities.

Keywords: Climate Change, Water Resources Management, Hydropower, Education for Sustainable Development, Climate Resilience, Water Governance, Pakistan, Water–Energy–Climate Nexus

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Navigating the Policy-Practice Divide: A Comparative Analysis of Indigenous Language Policies in Australia and Bangladesh

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Indigenous language extinction constitutes one of the most urgent contemporary challenges to global linguistic and cultural diversity, with UNESCO estimating that 40% of the world's approximately 7,000 languages face endangerment and one language disappearing every two weeks. This article undertakes a critical comparative analysis of indigenous language policies in Australia and Bangladesh—two nations with distinct colonial histories, political systems, and institutional capacities that have produced significantly different policy trajectories and implementation outcomes for indigenous language communities. Drawing on critical language policy analysis (Tollefson, 2012), Spolsky's (2004) tripartite model, Ricento and Hornberger's (1996) multilevel framework, and the Consolidated Framework for Advancing Implementation Science (Damschroder et al., 2009), this study examines how historical contexts, constitutional provisions, ideological commitments, and institutional capacity shape policy effectiveness. The comparative approach reveals that while both nations have recently adopted progressive indigenous language policies, persistent implementation barriers—including inadequate teacher training, insufficient resource allocation, and limited political commitment—continue generating significant gaps between policy rhetoric and educational practice. Australia's relatively more advanced institutional infrastructure, including the Closing the Gap Target 16 framework and dedicated funding mechanisms, contrasts sharply with Bangladesh's rudimentary Mother Tongue-Based Multilingual Education implementation constrained by foundational capacity limitations. The analysis concludes that achieving genuine indigenous language revitalization requires not merely policy adoption but systemic transformation in educational governance, resource distribution, and societal attitudes toward linguistic diversity.

Keywords: Indigenous Language Policy, Comparative Education, Language Revitalization, Critical Language Policy Analysis, Implementation Science, Australia, Bangladesh

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From Predictive Learning Analytics to Generative AI: Mapping the Intellectual Structure of Educational Data Mining Research (2015–2025)

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This study aims to examine the field of Educational Data Mining (EDM) through a bibliometric analysis approach, with a particular focus on the transformation from predictive learning analytics models to generative artificial intelligence–driven educational technologies, as well as the global methodological differences within the field. In this context, the study specifically analyzes how the impact of GenAI, which has accelerated especially after 2023, has reshaped the thematic and methodological orientations of the field. The dataset was retrieved on 08.01.2026 from the Web of Science (WoS) database using a Topic search with the keywords Educational Data Mining, Learning Analytics, Artificial Intelligence in Education, AIED, and Intelligent Tutoring Systems. In the first stage, 13,428 records were obtained; after applying filters for Article and Review document types only, specific WoS categories, and English language criteria, a total of 4,631 documents covering the period 2015–2025 were included in the analysis.

In the analysis process, the R-based Bibliometrix package was used to generate annual growth rate indicators, author productivity metrics, and strategic diagrams illustrating thematic development. The findings show that the EDM literature has grown at an annual rate of 21.69%, expanding approximately sevenfold over the last decade. The results indicate that the field initially exhibited a predominantly technical structure focused on prediction accuracy and model performance; however, particularly after 2023, a new thematic orientation has emerged, driven by generative AI technologies and centered on pedagogical alignment, learner–AI interaction, and ethical dimensions. Country-based analyses further indicate that research foci differ across regions, with certain thematic orientations becoming more prominent in specific contexts. In this study, pedagogical alignment is defined as the meaningful and effective integration of artificial intelligence systems into learning processes beyond technical performance alone.

The findings reveal that process-oriented learning analytics approaches and deep learning-based technical studies continue to coexist within the EDM field, demonstrating its methodological diversification. Unlike existing bibliometric studies, this work explicitly identifies the thematic shift emerging in the post-GenAI period and conceptually articulates the new direction of the field. In conclusion, the study highlights that artificial intelligence applications in educational technology should be considered beyond technical performance metrics, incorporating pedagogical and ethical dimensions, and contributes to the development of a new research agenda for future studies in educational technology research.

Keywords: Educational Data Mining, Bibliometric Analysis, Artificial Intelligence, R-Bibliometrix, Learning Analytics.

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Designing an Adaptive VR-Based Disaster Preparedness Environment for Teacher Education: Expert Validation, Pilot Revision Cycles, and Scenario-Based Assessment within the REACT Project

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Preparing teachers for uncertain futures requires more than theoretical awareness; it demands experiential competence, adaptive decision-making, and resilience under pressure. This study presents the design, pilot implementation, and iterative refinement of the REACT Project (Resilient and Sustainable Adaptive-Responsive Learning Culture Based on Mixed Reality Technology), which developed a Virtual Reality (VR)-based earthquake preparedness environment for teacher education. The project aimed to strengthen pre-service teachers' disaster preparedness competencies through immersive scenario-based learning.

Initially conceptualized as a VR/AR model, the intervention was refined into a VR-centered environment following pedagogical, financial, and technical feasibility analyses. The final environment simulates a traditional classroom exposed to earthquake-related risks and requires users to make adaptive decisions before, during, and after a disaster. The instructional design followed a Design-Based Research (DBR) approach with iterative expert review, pilot testing, and evidence-informed revisions.

Three scenario clusters were developed: (1) communication-based emergency response scenarios, (2) transportation and access disruption scenarios, and (3) infrastructure and engineering risk scenarios. These scenarios were designed to foster not only cognitive understanding, but also rapid intervention capacity, collaboration, emotional regulation, and decision-making under stress.

The environment was evaluated through two pilot groups: 11 experts (relevant disciplinary backgrounds) and 11 pre-service teachers. Quantitative findings indicated high perceived relevance, usability, realism, and pedagogical value. Qualitative feedback highlighted the need for stronger guidance cues, expanded post-earthquake tasks, clearer navigation, additional branching consequences, and richer stakeholder interaction. Based on these findings, the environment was revised by improving interface clarity, feedback mechanisms, environmental realism, adaptive prompts, and learning analytics structures.

The study also proposes a scenario-based assessment model in which users receive performance scores for decision quality (e.g., +10 safe high-priority action; +5 delayed acceptable action; 0 unsafe action), replay opportunities after repeated unsafe behavior, and competency badges such as Disaster-Ready Teacher. This approach combines immersive learning with authentic assessment and micro-credential logic.

The findings suggest that VR-based adaptive environments can provide a scalable pathway for preparing teachers for uncertain futures by integrating resilience education, experiential learning, and data-informed instructional improvement.

Keywords: Virtual Reality, Teacher Education, Disaster Preparedness, Adaptive Learning, Resilience, Design-based Research, Authentic Assessment

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Rethinking Mathematics Education in the Age of Artificial Intelligence: A Systematic Review

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The rapid advancement of artificial intelligence (AI), particularly generative AI tools, is transforming mathematics education by introducing new forms of interaction, feedback, and adaptive learning. AI-powered systems such as intelligent tutoring systems, automated assessment tools, and large language models are increasingly positioned as “cognitive partners” that support students’ learning processes. However, this transformation also raises critical concerns, including over-reliance on AI, limitations in mathematical reasoning, and challenges related to academic integrity and ethical use. In addition, the fast-paced evolution of AI technologies has led to a fragmented and rapidly expanding body of literature, making it difficult to develop a coherent understanding of their pedagogical impact.

This study aims to systematically examine the applications, benefits, challenges, and pedagogical implications of AI in mathematics education. Specifically, it addresses three research questions: (1) What are the primary application areas and purposes of AI in mathematics education? (2) What opportunities and challenges do teachers, pre-service teachers, and students encounter when integrating AI into teaching and problem-solving processes? (3) What are the effects of AI-supported educational practices on students’ mathematical reasoning, engagement, and learning outcomes?

A Systematic Literature Review (SLR) methodology was employed following the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines to ensure transparency and replicability. The literature search was conducted using the Web of Science and Scopus databases, selected for their academic rigor and comprehensive coverage of peer-reviewed research. The review process involved identification, screening, eligibility assessment, and inclusion stages, resulting in a curated set of high-quality studies.

The findings highlight that AI offers significant opportunities for personalized learning, immediate feedback, and enhanced engagement in mathematics education. However, they also reveal critical risks, including diminished critical thinking, excessive dependence on AI tools, and ethical concerns such as plagiarism and misuse. Furthermore, the review underscores that many educators lack sufficient technological pedagogical knowledge and AI literacy to effectively integrate these tools into their teaching practices.

This study provides a comprehensive synthesis of current research and offers evidence-based insights for educators, researchers, and policymakers. It contributes to the field by mapping the opportunities and risks of AI integration and by proposing the need for structured, responsible, and pedagogically grounded implementation strategies in mathematics education.

Keywords: Mathematics Education, Generative AI, Systematic Literature Review, PRISMA, Cognitive Partner, AI Literacy, Educational Technology

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From Red AI to Green Awareness: Developing a Scale to Measure Environmental and Economic Impacts of AI

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With the rapid acceleration of digitalization, the use of artificial intelligence (AI) technologies has increased significantly, bringing along substantial environmental costs such as high energy consumption and carbon emissions. In the literature, this trend is often referred to as "Red AI," which prioritizes performance at the expense of resource efficiency, whereas the "Green AI" approach emphasizes more efficient and sustainable solutions. In this context, examining individuals' awareness of the environmental and economic impacts of AI has become increasingly important.

The aim of this study is to determine undergraduate students' levels of awareness regarding the energy consumption, natural resource use, and economic costs of AI technologies, and to examine how this awareness relates to their behavioral intentions. The study is grounded in the Norm Activation Theory (NAT), the Theory of Planned Behavior (TPB), and the Value-Belief-Norm (VBN) Theory.

Within the scope of the study, an initial pool of 36 items was developed and first administered to a pilot group of undergraduate students representing the target population to assess clarity and comprehensibility. Based on the feedback obtained, necessary revisions were made, and the items were subsequently evaluated by experts to ensure content validity, resulting in a 24-item scale. To examine the construct validity of the scale, Exploratory Factor Analysis (EFA) will be conducted on data collected from the first sample to identify the underlying factor structure. The resulting structure will then be tested using Confirmatory Factor Analysis (CFA) on an independent second sample to evaluate model fit indices. The study sample consists of undergraduate students from different universities in Türkiye, selected through convenience sampling.

The study will analyze students' perceptions of AI-related environmental risks, awareness of economic costs, and their ethical responsibility tendencies toward conscious AI use. In addition, the roles of personal norms and awareness of consequences in shaping pro-environmental behavioral intentions, as well as the role of trust in this process, will be examined. To the best of our knowledge, no existing scale in the literature comprehensively measures individuals' awareness of both the environmental and economic impacts of AI. Therefore, the proposed scale is expected to represent one of the first attempts in this area and to make a novel contribution to the field.

This study is expected to contribute to the growing body of AI research by emphasizing that efficiency and sustainability, alongside performance, should be considered as fundamental criteria. It also highlights the importance of individual awareness and responsible usage behaviors in fostering a sustainable technological ecosystem.

Keywords: Green AI, Sustainability, Environmental Awareness, Economic Cost, EFA, CFA, Norm Activation Theory, Theory of Planned Behavior, Value-Belief-Norm Theory

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Designing a Task-Based E-Learning Environment for Gifted Students: A Pedagogical, Functional, and Analytical System Framework

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This study presents the pedagogical, functional, and analytical architecture of a task-based e-learning environment designed for gifted students aged 11 to 14. In this study, the digital learning environment is conceptualized not merely as a structure for delivering content, but as an integrated learning ecosystem in which students engage in different types of learning activities, develop products, interact with peers, receive and provide feedback, and where the teacher can monitor the process and intervene when necessary. In line with this perspective, the proposed system is designed as a multilayered structure based on a simple and guiding user experience on the student side, and on task management, assessment, monitoring, and intervention functions on the teacher side. In addition, structured peer feedback, hybrid assessment, product-based tasks, and learning analytics dashboards that make progress visible are among the core components of the system. The platform is particularly intended to make learning experiences more trackable, interpretable, and open to intervention, especially within the context of controlled classroom use. In this respect, the study offers a holistic system proposal for the design of digital learning environments to be developed for gifted students.

Keywords: Task-based Learning; E-learning Environment; Learning Analytics; Peer Feedback; Hybrid Assessment; Gifted Students.

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Psychometric characteristics of the AI-Supported Learning Experience in Health Sciences Scale

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Background: Today, it is seen that students studying in the field of health sciences commonly use artificial intelligence (AI) technologies as a learning tool, and therefore, there is a need for more information about students' AI learning experiences. However, no comprehensive measurement tool with validated and reliable studies evaluating the AI-supported learning experience of students studying in the field of health sciences was found.
Aim: To develop and test the validity of the AI-Supported Learning Experience in Health Sciences Scale (AISLEHSS).
Design: A methodological and cross-sectional study.
Settings: The study was conducted at the faculties of health sciences, nursing, and dentistry of two different state universities in Turkey.
Participants: The study included students (n=660) studying in the health sciences departments of two state universities in Turkey.
Methods: A literature review was conducted by the researchers to create the initial items of the scale. The construct validity of the scale was evaluated using exploratory and confirmatory factor analysis, and its internal consistency was assessed using Cronbach's Alpha reliability coefficient.
Results: The scale was given its final 31-item form by removing one item which showed overlap as a result of factor loading analyses. Factor analysis results of the final 31-item version indicated a three-factor structure. These three factors explained 64.68% of the total variance. The first factor explained 55.52% of the total variance, the second factor 5.25%, and the third factor 3.91%. Examining the factor loadings of the items, it was observed that each item loaded highly and clearly on to a single factor. The Cronbach's Alpha reliability coefficient of the scale was calculated as 0.972.
Conclusions: The AISLEHSS has a high level of reliability and validity. It can help to determine the experiences of students studying in the health sciences field who use AI-powered technologies.

Keywords: Artificial Intelligence, Artificial Intelligence Supported Learning, Scale, Health Sciences

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Artificial Intelligence in Education: Opportunities, Risks, and Responsibilities from Teachers' Perspectives

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Artificial Intelligence (AI) technologies have rapidly evolved in recent years, leading to notable changes in teaching and learning practices, particularly with the widespread use of tools such as ChatGPT. While these developments create valuable opportunities to improve instructional processes, they also raise important concerns related to ethics, data privacy, and professional responsibilities. This study explores teachers' perspectives on the use of AI in education, focusing on its potential benefits, associated risks, and emerging responsibilities.

Using a qualitative research design, the study is based on semi-structured interviews conducted with 18 teachers from different subject areas. The collected data were analyzed through thematic analysis. The results indicate that AI tools support teaching practices by enhancing content development, improving time efficiency, and increasing student engagement. Furthermore, AI is perceived as a transformative element that encourages a shift in teachers' roles from traditional knowledge providers to facilitators of learning.

However, the findings also highlight significant concerns. Teachers expressed reservations regarding data privacy, the reliability of AI-generated content, and the risk of over-dependence among both students and educators. In addition, varying levels of AI literacy and trust among teachers point to the need for structured professional development and clearer institutional guidelines.

The study concludes that while AI presents substantial opportunities for improving educational processes, its effective integration requires a human-centered and ethically grounded approach. Ensuring transparency, data security, and active teacher involvement is essential for building trust and achieving the sustainable use of AI in education.

Keywords: Artificial Intelligence, Education, Teacher Perspectives, Ethics, Data Privacy

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Video-Based Anomaly Detection for Crime Behavior Classification: A Deep Learning Approach

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Detecting anomalous and criminal behaviors in surveillance videos is a critical yet challenging task due to complex temporal dynamics and class imbalance in real-world data. This study aims to develop a deep learning-based approach for video-based anomaly detection and to evaluate the effectiveness of different feature extraction and modeling strategies.

In this context, various deep learning models and feature representations were explored, including transformer-based architectures and recent video representation methods. The study focuses on improving the model's ability to capture temporal patterns and distinguish between normal and anomalous behaviors.

Preliminary findings indicate that while deep learning models can successfully identify dominant patterns in surveillance data, challenges remain in detecting subtle and short-duration anomalies. The results suggest that both feature representation and temporal modeling play a critical role in improving classification performance.

This study highlights the ongoing challenges in video-based anomaly detection and aims to contribute to the development of more robust and generalizable models for intelligent surveillance systems. Future work will focus on enhancing model performance through improved architectures and advanced learning strategies.

Keywords: Video Anomaly Detection, Crime Detection, Deep Learning, Transformer Models, Surveillance Systems

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Designing Autonomous Avatars for Metaverse-Based Learning

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The ongoing digital transformation is fundamentally changing teaching and learning processes. In particular, immersive technologies and metaverse-based learning environments open new possibilities for interactive educational formats. In contrast to traditional, mostly two-dimensional e-learning systems, such environments provide three-dimensional, persistent spaces in which learners can act through avatars, communicate with others, and interact with digital objects. This combination of interactivity, social presence, and embodiment creates learning settings in which knowledge is not merely consumed but actively constructed through action and experience.

A central element of such learning environments is the use of autonomous avatars. These are computer-controlled characters that are not directly operated by real users but act based on system-driven logic. In educational applications, they assume the role of pedagogical agents that support learners through tasks, dialogues, or feedback. In this way, they can structure learning processes, enable individual interactions, and accompany learners even without the continuous presence of a human teacher.

For the practical implementation of such systems, the question of their technical architecture and implementation is particularly important. Current research generally distinguishes between two fundamental approaches.

Script-based autonomous avatars rely on predefined rules, decision trees, and fixed dialogue structures. User interactions are processed by an internal logic that responds to known inputs with predefined answers. This approach enables a high degree of didactic control, as learning paths and interaction options can be designed in a targeted manner. In addition, such systems are comparatively easy to implement technically and are particularly suitable for structured learning tasks, such as vocabulary exercises or dialogue-based scenarios in foreign language education.

In contrast, AI-based autonomous avatars follow a more adaptive approach. Here, methods from artificial intelligence, particularly natural language processing, are used to interpret free text input and respond flexibly. As a result, interactions can be designed to be more natural and dynamic. However, this approach significantly increases the requirements for computational resources, system architecture, and data management.

This paper analyzes these implementation approaches in the context of metaverse-based learning environments and discusses their didactic as well as technical implications. Using a concrete example scenario, the goal is to illustrate fundamental design possibilities for avatar-based learning interactions and to provide a foundation for the development of practical implementation concepts. In particular, the study investigates in which scenarios script-based systems represent a robust and controllable solution and in which contexts AI-based agents can offer added value for adaptive learning processes.

Keywords: AI, Avatars, Metaverse, Learning

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Assessment Practices in Primary Schools: The Gap Between Educational Regulations and Classroom Reality

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Assessment Practices in Primary Schools: The Gap Between Educational Regulations and Classroom Reality

This study aims to examine the relationship between the assessment and evaluation approaches prescribed for primary schools in the Ministry of National Education's Regulation on Measurement and Evaluation and the Guidelines for Written and Applied Examinations, and the actual practices implemented in classrooms. The research seeks to determine whether there is alignment or divergence between regulation-based expectations in the field of assessment and evaluation and teachers' day-to-day instructional practices.

The study is designed using a mixed-methods research approach. In the quantitative phase, a structured questionnaire will be administered to approximately 100 primary school teachers. The questionnaire will collect data regarding teachers' levels of knowledge about the relevant regulations, their assessment and evaluation practices, and their views on these practices. The quantitative data will be analyzed using descriptive statistics. While forming the study sample, particular attention will be paid to ensuring balanced representation of teachers working in both public and private schools.

In the qualitative phase, semi-structured interviews will be conducted with five teachers in order to deepen the quantitative findings and obtain rich, in-depth descriptions of classroom practices. The qualitative data obtained from the interviews will be analyzed using content analysis. The findings of the study are expected to reveal the extent to which assessment and evaluation practices in primary schools are aligned with the principles outlined in official regulations, to identify challenges and deviations encountered in practice, and to offer recommendations for policymakers and practitioners.

Keywords: Ölçme Ve Değerlendirme, Mevzuat Ve Uygulama, İlkokul, Süreç Odaklı Değerlendirme

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A Constructivist Default? Shared and Divergent Teaching Perspectives in Three Large Language Models

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Large language models (LLMs) are now widely used in education as on-demand tutors, with surveys indicating that 60–90% of students employ them for concept explanation, homework support, and examination preparation. Yet systematic, theory-grounded comparisons of the pedagogical orientations expressed by different LLMs remain scarce: most existing evaluations focus on factual accuracy or on a single instructional dimension rather than on a multidimensional, validated model of teaching. This leaves two related questions unanswered: whether contemporary LLMs share a common pedagogical default, and whether they diverge in ways that matter for educational practice. The present study addresses both questions by applying the Teaching Perspectives Inventory (TPI)—a 45-item instrument organised into five subscales (Transmission, Apprenticeship, Developmental, Nurturing, and Social Reform)—as an observer-rating framework to profile the perceived pedagogical orientations of GPT-4o, DeepSeek-R1, and Gemini 1.5. In a within-subjects design, 67 pre-service teachers each evaluated the outputs of all three models, generated using an identical prompt on the zone of proximal development. Because TPI data are ordinal and diagnostics indicated non-normality, non-parametric repeated-measures tests were used: Friedman's test for omnibus comparisons, followed by Holm-corrected Wilcoxon signed-rank post-hoc tests, with Kendall's W as the effect size and matched-pairs rank-biserial correlations for pairwise contrasts. Cronbach's alpha was computed per subscale per model. All three sampled outputs converged on the Developmental perspective, with no significant difference observed ($\chi^2(2) = 0.91$, $p = .635$) and uniformly high ratings, suggesting that a constructivist-adjacent orientation may operate as a shared default. Against this shared baseline, significant divergences emerged on the remaining four subscales: Transmission ($\chi^2(2) = 60.01$, $W = .408$), Apprenticeship ($\chi^2(2) = 38.53$, $W = .237$), Nurturing ($\chi^2(2) = 28.42$, $W = .199$), and Social Reform ($\chi^2(2) = 42.51$, $W = .293$). Gemini's output was rated highest on Transmission; GPT-4o's output was rated highest on Apprenticeship, Nurturing, and Social Reform; DeepSeek-R1's output was consistently rated lower across most subscales. The study concludes that the instructional outputs of contemporary LLMs are not perceived as pedagogically interchangeable, but nor are they idiosyncratic: a shared constructivist-adjacent baseline coexists with model-specific signatures on other dimensions. These findings should be read as a methodological pilot rather than model-level claims, given the use of a single sampled output per model and lower reliability on the Developmental and Transmission subscales. Recommendations include replication with multiple prompts and outputs, blinded designs, inter-rater reliability computation, and deliberate prompt engineering where pedagogical diversity is a design goal.

Keywords: Large Language Models, Teaching Perspectives, Teaching Perspectives Inventory, Constructivism, AI Tutoring, Pedagogical Orientation, Educational AI

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AI Literacy Skills in The Deepfake Era: A Chatbot-Integrated Game

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The widespread adoption of generative artificial intelligence has intensified the risks of disinformation and manipulative content, particularly through educational chatbots and deepfake technologies. The reliability of such AI-generated information presents a significant challenge for accessing accurate knowledge. In response, this study focuses on designing a scenario-based interactive video game aimed at improving university students' awareness of deepfakes and their ability to verify information.

The study follows an Educational Design Research approach guided by the ADDIE model. During the analysis phase, a needs assessment conducted with 159 university students showed that while 54.1% were familiar with deepfakes, only 16.4% felt confident identifying fake content. Notably, 71.1% expressed that an interactive game would support their learning. Based on these findings, the design phase was structured around Scenario-Based Learning (SBL) and the dimensions of the AI Literacy Heptagon (AILH), which includes technical skills, application proficiency, critical thinking, ethical awareness, social impact, integration skills, and legal knowledge.

The developed game environment integrates a chatbot and requires students to actively engage in decision-making and inquiry processes. The game begins with a realistic deepfake video to highlight social impact and encourage awareness of manipulation risks. Students are then introduced to the technical foundations of deepfake technology through instructional videos and assessments. Critical thinking and application skills are developed as students analyze visual content to distinguish real from fake and justify their reasoning.

Integration skills are reinforced through activities requiring students to explain why content is manipulated, while ethical awareness is addressed through scenarios emphasizing privacy, responsibility, and misuse. Legal and regulatory knowledge is incorporated through tasks that highlight the potential consequences of producing or sharing deepfake content. Throughout the process, the chatbot acts as a supportive tool, offering hints rather than direct answers, encouraging students to develop independent verification strategies.

Overall, this study proposes a comprehensive educational intervention that combines AI literacy, ethical awareness, and interactive learning. The model aims to enhance students' resilience to disinformation while promoting informed and responsible use of AI technologies in educational contexts.

Keywords: Deepfake, Scenario-Based Learning, Interactive Video Game, AI Literacy, Chatbot.

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Beyond Generic Questions: A RAG-Based Agentic AI System for Pedagogically Aligned Question and Answer Feedback Generation

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Recent advances in generative AI have demonstrated considerable promise for AI-assisted educational content generation. However, their adoption in real classroom settings remains limited because the generated content is often overly generic and insufficiently aligned with course-specific learning objectives. To bridge this gap, this paper presents the design and development of an agentic AI system integrated with retrieval-augmented generation (RAG) to produce contextually grounded multiple-choice questions and answer feedback. The system employs a dual-agent architecture in which a Generator agent produces questions while an Auditor agent independently assesses question quality across seven pedagogical dimensions. To evaluate the system's effectiveness, six subject-matter experts (SMEs) assessed 288 questions generated using the system across the same seven dimensions. This process yielded 2,016 human-AI rated pairs and 239 instances of qualitative feedback regarding disagreements with the Auditor's assessments. Analysis of SME judgments reveals strong overall system performance, with F1 scores exceeding 0.90 across all dimensions. The system achieved exceptional performance on concept alignment (F1 = 0.993) and question stem clarity (F1 = 0.989). Dimensions associated with technical correctness also demonstrated strong performance, including code validity (F1 = 0.977), correct answer feedback quality (F1 = 0.976), and correct answer validity (F1 = 0.972). In contrast, distractor-related dimensions yielded comparatively lower performance: distractor quality (F1 = 0.902) and distractor feedback (F1 = 0.943). Qualitative analysis of SME feedback reveals generative AI's limitations in recognizing pedagogically suboptimal distractors and evaluating instructional depth in feedback, underscoring the continued necessity of human expert oversight. Collectively, these findings support a human-in-the-loop framework in which AI serves as an initial content generator while domain experts focus their attention on pedagogically nuanced dimensions, offering a scalable and reliable pathway for AI-assisted educational content generation.

Keywords: Pedagogical Alignment, Generative AI, Retrieval-augmented Generation, Agentic AI, LLMs, Human-in-the-loop, Multiple-choice Questions, Coding Comprehension

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Digital Transformation Competence as a Predictor of Institutional Resilience in Schools: A Survey of Teachers and Administrators

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Schools operate in an increasingly volatile environment shaped by pandemics, rapid technological change, and shifting policy demands. Although digital transformation has accelerated across K–12 education, empirical evidence on how educators' digital competence relates to their schools' capacity to absorb shocks and sustain core educational functions—institutional resilience—remains limited. Prior studies tend to examine technology adoption or organizational resilience in isolation, rarely modeling the two together across professional roles.

This study investigates the relationship between digital transformation competence (DTC) and perceived institutional resilience (IR) among teachers and school administrators, and examines whether role and seniority moderate this relationship.

A cross-sectional correlational survey design was used. Participants were 200 educators in Turkish K–12 schools: 120 teachers and 80 administrators selected via stratified purposive sampling. Two instruments were developed and piloted: the Digital Transformation Competence Scale (20 items; four subdimensions: digital pedagogy/leadership, technical proficiency, digital citizenship/ethics, openness to digital change) and the Institutional Resilience Scale (15 items; adaptive capacity, learning-organization culture, resource/infrastructure resilience). Cronbach's alpha values were .92 and .89. Construct validity was confirmed via CFA. Analyses included descriptive statistics, independent-samples t-tests, one-way ANOVA, Pearson correlations, and multiple linear regression.

Administrators reported significantly higher DTC (M=4.02, SD=0.49) and IR (M=3.77, SD=0.55) than teachers (M=3.68, SD=0.54; M=3.41, SD=0.60), with moderate effect sizes (d=0.66 and 0.62). Seniority showed a non-linear effect: educators with 16+ years of service scored significantly lower on DTC than early-career colleagues, $F(3,196)=5.87$, $p<.01$, $\eta^2=.08$. DTC correlated strongly with IR, $r=.64$, $p<.001$. DTC subdimensions jointly explained 47% of the variance in IR, $F(4,195)=43.26$, $p<.001$; openness to digital change ($\beta=.34$) and digital pedagogy/leadership ($\beta=.29$) were the strongest predictors.

Digital transformation competence robustly predicts institutional resilience, and the gap between administrators and teachers and between senior and early-career staff points to uneven capacity within schools. Resilience-oriented professional development should emphasize adaptive mindsets and distributed digital leadership alongside technical skills. Districts are advised to embed digital transformation indicators into school-improvement and crisis-preparedness plans and to design mentoring structures pairing digitally confident teachers with senior colleagues.

Keywords: Digital Transformation, Institutional Resilience, Digital Leadership, Teacher Competence, K–12 Education

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An Examination of University Students' Experiences with Career Indecision: A Phenomenological Analysis

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Career indecision is not only about individuals having difficulty deciding between career options it is also considered a psychosocial condition associated with mental health issues. It is important to conduct an in-depth examination of the career indecision experienced by university students so that career counseling services can develop appropriate interventions and strategies for university students, taking into account changing technological and social transformations. This study aims to examine in depth, using the phenomenological approach—a qualitative research method—the career indecision experiences of university students, the factors contributing to career indecision, and its reflections in the individual's life. The study sample consists of 16 university students—three men and 13 women, aged between 18 and 25—currently enrolled in various faculties at a state university in Turkey. The criterion sampling method, one of the purposeful sampling techniques, was used to determine the study sample. First, students with the highest total scores on the "Career Decidedness Scale" were contacted and informed about the study. Semi-structured interviews were conducted between September 2025 and March 2026 using a semi-structured interview form developed by the researchers. The interviews lasted an average of 25 minutes and 27 seconds. Data analysis was conducted using NVivo 15, following the steps of data coding, theme generation, organizing the data according to themes and codes, describing the data, and interpreting the findings. The themes identified through data analysis (1) "areas or topics where career indecision is experienced," (2) "experiential foundations of career indecision," (3) "reflections of career indecision," (4) "ways of coping with career indecision," and (5) "topics needed for coping." According to the findings, university students' experiences of career indecision are viewed not merely as a problem of making a career choice, but as a multidimensional crisis area that also impacts academic motivation, mental health, and social relationships. Furthermore, career indecision is not merely an individual challenge of choice but a process in which relational and contextual factors contribute, and the lack of environmental support systems also plays a role. One of the key findings of this study is that, rather than merely identifying the conditions that give rise to career indecision, it highlights the roles of career counselors and educational institutions in constructing functional coping strategies by exploring the current coping strategies of university students.

Keywords: Career Indecision, Career Counseling, Coping Skills

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Generative AI for Responsible Use in Teacher Education: Sex Differences in Perceived Usefulness and the Role of Cognitive and Metacognitive Factors

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Generative artificial intelligence (GenAI) is increasingly transforming higher education, particularly in teacher training, where future educators must critically evaluate its pedagogical potential. Despite growing interest in perceived usefulness as a key factor in technology adoption, limited research has examined how cognitive and individual variables jointly influence these perceptions. This study aims to analyze the role of sex in the explanatory model of pre-service teachers' perceived usefulness of GenAI, considering cognitive load, problem-solving skills, metacognitive skills, and prior knowledge. A non-experimental, cross-sectional design was employed with a sample of 451 pre-service teachers from the University of Málaga. Results showed no significant sex differences in cognitive load or perceived usefulness. However, significant differences were found in metacognitive skills, problem-solving skills, and prior knowledge, with higher scores among female participants, although effect sizes were small. These findings suggest that, while perceived usefulness of GenAI is similar across sexes, underlying cognitive and metacognitive factors differ. Implications highlight the need to design teacher training programs that address sex-based cognitive and metacognitive differences to promote a more effective and responsible use of GenAI.

Keywords: Generative Artificial Intelligence; Perceived Usefulness; Cognitive Load; Metacognitive Skills; Pre-service Teachers; Sex Differences; Responsible Use.

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Behavioral Student Profiling Using an Unsupervised Machine Learning Approach in Adaptive Learning Platforms

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This study presents a comprehensive unsupervised machine learning analysis aimed at systematically classifying the behavioral patterns of 36,296 students interacting with the ASSISTments adaptive learning platform. The dataset consists of 33,094,332 student-problem interaction records from the EDM 2023 competition—the most extensive ASSISTments dataset published to date.

The methodological design rests on three key decisions. First, all students—regardless of whether they had achievement scores—were included in a single clustering pipeline, preventing selection bias. Second, achievement scores were excluded from clustering features and used solely for post-hoc validation. Third, a complete analytical pipeline was designed spanning from raw interaction logs to interpretable profiles. During feature engineering, eleven behavioral indicators were derived: hint usage rate, direct answer request frequency, explanation request rate, total help dependency index, passivity rate, error frequency, daily problem-solving intensity, problem depth per sequence, and average assignment duration. RobustScaler normalization and Principal Component Analysis (PCA) were then applied; the optimal cluster count of K=7 was determined via a K=2–12 parameter scan evaluated jointly using Silhouette score, Davies-Bouldin index, and Calinski-Harabasz criteria.

Seven behaviorally distinct student profiles were identified. The Basic Student cluster (K0, 62.9%) represents the platform's default low help-seeking pattern. The Autonomous Solver cluster (K4, n=4,042) demonstrates the highest academic performance, with daily problem-solving speed approximately seven times the platform average and the lowest help dependency. The Answer-Dependent (K2, n=5,224) and Answer-Flood (K6, n=1,267) clusters correspond to "gaming the system" behavior documented in the EDM literature—systematic direct answer-seeking without engaging hints or explanations. The Maximum Help-Seeking (K1), Mixed Help-Seeking (K5), and Moderate Questioner (K3) clusters collectively indicate high error rates and persistent content difficulty despite varying help-seeking levels. Post-hoc Kruskal-Wallis tests confirmed significant between-cluster differences across all features ($p<0.001$), and an Agglomerative Clustering model on a 20,000-student subsample achieved over 85% agreement with the K-Means solution, confirming external validity.

The findings demonstrate that meaningful student typologies can be generated from behavioral traces alone, without achievement scores. Cluster-specific pedagogical interventions—ranging from content enrichment and hint quality improvement to anti-gaming detection and real-time instructor alerts—directly inform adaptive learning platform design. The study contributes original methodological and practical insights to learning analytics, AI-supported adaptive environments, and evidence-based decision-making in education.

Keywords: Learning Analytics; Behavioral Clustering; K-means; Adaptive Learning; Unsupervised Machine Learning; Student Profiling; Educational Data Mining, EDM 2023, ASSISTments

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RAG-Based Extractive Summarization and Automatic Classification of Educational Data Mining Literature

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The academic literature in educational data mining (EDM) has expanded rapidly over the past decade, both in volume and methodological diversity. This growth makes it increasingly difficult for researchers to efficiently access relevant studies and systematically monitor the field. This study presents the design and comprehensive evaluation of a Retrieval-Augmented Generation (RAG)-based system that automatically classifies and summarizes academic papers in the EDM literature.

The developed system consists of three core components. In the first component, PDF-formatted papers are processed using PyMuPDF, with an OCR fallback mechanism applied when necessary. In the second component, texts are segmented into chunks via a sliding window approach, transformed into vector representations using the all-MiniLM-L6-v2 model, and indexed in a ChromaDB vector database. In the third component, a hybrid architecture combining a DeBERTa v3 zero-shot classifier with keyword-based heuristics assigns each paper to one of five methodological categories: Time Series, Statistical Methods, Deep Learning/ANN, Classical Machine Learning, and Review/Survey. For summarization, the facebook/bart-large-cnn model is applied through a sliding window strategy, with partial summaries subsequently merged to produce a coherent final summary for each paper.

The system was evaluated on a corpus of 53 papers reflecting the actual methodological distribution of the field. Classification performance improved notably in the latest version, following the introduction of systematic review articles as an independent category. To validate summarization quality and source fidelity, a multi-metric evaluation framework encompassing ROUGE, BERTScore, NLI faithfulness, and question-answering-based faithfulness scoring was applied. To further substantiate the system's reliability, a comparative analysis was conducted on the same corpus against a large generative language model (Gemini). This analysis revealed that the RAG-based system consistently outperformed the generative model in terms of source fidelity across multiple metrics. The substantial differences observed in trigram overlap and QA faithfulness scores in particular confirm that the extractive approach conveys source information more reliably and significantly reduces hallucination risk.

The primary contribution of this work is an extensible and reusable pipeline capable of dynamically monitoring EDM literature without requiring manual intervention. Additionally, by systematically demonstrating the source fidelity gap between generative models and extractive RAG systems through a multi-metric framework, the study offers meaningful implications for the responsible use of such systems in educational research. The proposed approach holds considerable potential for accelerating literature review processes, supporting systematic synthesis efforts, and providing researchers with an evidence-based decision support tool.

Keywords: Retrieval-augmented Generation, Extractive Summarization, Educational Data Mining, Automatic Classification, Academic Literature Analysis

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Investigating the Lived Experiences of Instructors Developing AI Supported Podcasts in HE Pedagogy

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The integration of Generative AI (GenAI) tools into higher education pedagogy has become a critical agenda for faculty professional development. This study examines the lived experiences of faculty members who experimented with producing GenAI-supported educational podcasts, the obstacles they encountered, and their perceptions of the technology's pedagogical transformative potential.

The research was conducted following an open call for volunteers. Of the applicants, 20 faculty members with no prior experience in GenAI-supported podcast development were selected. Of the 20 who participated in the workshop, 17 contributed to the study by providing data. Prior to the workshop, a Mentimeter survey assessed participants' podcast listening habits, preferred environments, topics of interest, channels followed, and prior experience in podcast creation. The vast majority reported rarely listening to podcasts, typically while multitasking (e.g., commuting), and focusing primarily on personal development content; none reported prior experience creating podcasts.

Following this, a two-day training workshop named as “GenAI-supported educational podcast production” was provided, consisting of 8 hours of theoretical and practical sessions. Data were collected via a questionnaire administered after the workshop, once participants had gained this lived experience. The survey consisted of closed-ended and open-ended questions covering demographic information, experience with GenAI and audio material production, perceived obstacles, sources of motivation, perception of pedagogical contribution, areas of difficulty, resolved obstacles, course integration plans, self-assessment, and intention for future use. The obtained data were analyzed through descriptive statistics and content analysis.

The findings indicate that only 11.7% of the participants had received any training on GenAI prior to the workshop, and 94.1% had not received training on audio material production. The most frequently cited pre-existing obstacles were lack of knowledge regarding audio recording/editing software (70.6%), inability to convert academic content into audio scripts (52.9%), and lack of awareness of GenAI (47.1%). At the end of the workshop, the participants' pedagogical self-assessment score averaged 8.06/10, and 76.5% expressed an intention to use podcasts regularly in their courses. GenAI tools have largely eliminated the perceived obstacles, particularly in the processes of storytelling academic content and text-to-speech conversion. The findings reveal that GenAI-supported podcast production can be an effective professional development model for improving faculty members' digital pedagogical competencies; however, they also highlight the need for establishing technical support at the institutional level, access to premium software, and pedagogical mentoring structures for sustainability.

Keywords: Generative Artificial Intelligence, Educational Podcasts, Higher Education, Professional Development, Digital Pedagogy

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Leading Generative Artificial Intelligence in Public Sector Universities: Sensemaking, Adaptive Leadership, and Institutional Governance in a Developing Country Context

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Generative artificial intelligence (GAI) has shifted the central institutional question for universities from adoption to governance. Generative AI is already being used in universities, so the main issue is no longer whether to adopt it, but how to manage it responsibly.
This is because GAI possess ambivalence in terms of offering opportunities for efficiency, creativity, and support, while also raising concerns about academic integrity, authorship, professional judgement, equity, and human oversight. This means universities must decide how teachers can use in teaching and learning, how researchers should disclose its use, how students may use GAI in assignments, and how staff can use it in administration while maintaining fairness and academic standards. These decisions place university leaders at the center of GAI governance, as they are responsible for interpreting its opportunities and risks and translating them into institutional guidance, policies, and practices. While existing research on GAI in higher education often focus on teachers and student use, academic integrity, and classroom practices, less attention has been given to how university leaders interpret GAI and translate those interpretations into institutional governance. This gap is especially important in public sector universities least developing countries such as Pakistan, where responses to GAI are shaped by uneven infrastructure, limited policy clarity, and unequal institutional capacity. This study examines how leaders in public universities interpret GAI and how those interpretations shape institutional responses across teaching, research, and administration. Using a phenomenological qualitative design, the study draws on semi-structured interviews with 43 vice chancellors, deans, and department chairs from the public sector universitas in Pakistan. The findings show that leaders do not approach GAI through a single frame. Rather, they construct it simultaneously as an administrative aid, a challenge to authorship and professional judgement, and a new source of institutional and educational inequality. Their responses are correspondingly cautious and adaptive, characterized by deliberation before rule-making, principle-based guidance, bounded experimentation, and an emphasis on human oversight. At the same time, these responses are shaped and constrained by uneven infrastructure, policy ambiguity, and competing expectations from academic staff, students, and the labor market. The paper argues that GAI governance is produced through interpretive, relational, and resource-conditioned work within institutions rather than through policy declaration alone. In doing so, it contributes to debates on higher education policy and management by showing how leadership mediates technological changes under conditions of uncertainty and unequal institutional capacity.

Keywords: Generative Artificial Intelligence (GAI), Higher Education (HE), Leadership, Sensemaking, Adaptive Leadership, Institutional Governance.

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Student and Parents' Perspectives on Information Security Awareness

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In today's world, the rapid advancement of internet usage and progress in the digital age is strikingly evident in reports. The International Telecommunication Union (ITU) report of November 27, 2024, states that approximately 5.5 million people worldwide are online, representing 68% of the world's population (previously reported at 65%). Specifically in Turkey, according to the Turkish Statistical Institute (TURKSTAT) report on the use of Information Technologies in households, the internet usage rate among individuals aged 16-74 was 87.1% in 2023 and 88.8% in 2024. According to 2025 data, this rate reached 90.9%. This rapid rise of information technologies and the internet usage in many areas also brings with it threats and information security issues. For the beneficial use of information technologies, "security" is inevitable in order to avoid harmful effects and ensure access to accurate information. Having information security awareness is paramount among these measures, playing a crucial role in safeguarding information before a threat arises and resolving cyber threats in the most secure way. The aim of this research is to reveal the perspectives of secondary school students and their parents regarding information security awareness. The research will highlight both differing and converging aspects. The study was conducted on 5th, 6th, 7th, and 8th grade students and their parents attending an Anatolian Imam Hatip High School in the Üsküdar district of Istanbul. 34 students and 46 parents participated in the study. A questionnaire consisting of 12 questions specifically for parents and 12 questions specifically for students regarding information security awareness was used as a data collection tool. The questionnaire questions were designed to be parallel and appropriate for the target audience. Findings were calculated as percentages, and ratio comparisons were made. According to the research results, while the responses were similar on 7 questions, the perspectives of students and parents differed on 5 questions. As a result of the research question, a difference was observed in the perspectives of students and parents regarding information security awareness.

Keywords: Information Security; Cybersecurity;

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Mathematics Education in the Age of AI: Assessing Multidimensional Orientations and Readiness of Pre-service Teachers

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The rapid evolution of Generative Artificial Intelligence (GenAI) is catalyzing a fundamental shift in the educational landscape, particularly in the field of mathematics. To foresee how future mathematics classrooms will be reshaped, it is essential to explore not only the general attitudes but also the underlying perceptions, competencies, and anxieties of today's mathematics pre-service teachers. This study aims to determine pre-service teachers' multifaceted orientations toward GenAI and to deeply examine the latent factors driving these perspectives.

The research employs an explanatory sequential mixed-methods design. In the quantitative phase, the "Scale for Attitudes towards Generative AI (SAGAI)" was administered to approximately 300 mathematics pre-service teachers. The SAGAI scale is robustly grounded in four major theoretical frameworks: the Technology Acceptance Model (TAM), Theory of Planned Behavior (TPB), Social Identity Theory (SIT), and Diffusion of Innovations Theory (DIT). This phase maps the participants' profiles across the dimensions of perceived usefulness, anxiety, future expectancy, and competency, while considering various demographic variables.

In the qualitative phase, individual interviews will be conducted with participants exhibiting extreme scores (outliers) through extreme case sampling. These sessions, structured around the study's theoretical foundations, aim to decode the specific beliefs and experiences behind polarized views. Quantitative data are analyzed via SPSS, while qualitative data undergo content analysis. The findings seek to provide a diagnostic roadmap for integrating GenAI into mathematics teacher education, balancing technological enthusiasm with pedagogical responsibility.

Keywords: Mathematics Education, Pre-service Teachers, GenAI Readiness, SAGAI Scale, Technological Perceptions.

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Between Adoption and Resistance: Teachers' Experiences with Artificial Intelligence in the Classroom

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The integration of AI tools into educational settings has different responses from teachers. While some educators have adopted these technologies immediately, others have experimented with them before withdrawing, and a few have not engaged at all. The factors influencing these diverse reactions remain largely unexplored, particularly beyond extensive survey research.

This study investigates how teachers perceive and interpret AI in their daily teaching practices. Through semi-structured interviews with 10 to 12 teachers across various grade levels and fields, the research aims to comprehend the determinants of their decisions regarding AI usage. Thematic analysis will be used to identify patterns within both groups of teachers.

Instead of treating adoption and resistance as opposites, this study sees them as part of the same process. This process covers practical considerations, professional routines, and personal assessments of effective teaching. By integrating both perspectives within a single study, the research aims to provide a more comprehensive understanding of AI's implementation in classrooms and its implications for teacher support and training.

Keywords: Artificial Intelligence in Education, Technology Resistance, Teacher Adoption, Technology in Education

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The Effect of Content-Grounded SpeakToPDF Educational Chatbot on Pre-Service Teachers' Generative Artificial Intelligence Attitudes and Online Self-Regulation Skills

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Content-grounded educational chatbots based on Retrieval-Augmented Generation (RAG) offer reliable learning support anchored to course material while mitigating the risk of hallucination. This study examined the effects of a RAG-based chatbot (SpeakToPDF), integrated into a learning management system, on pre-service teachers' attitudes towards generative artificial intelligence and their online self-regulation skills. Using a single-group pre-test/post-test design, the research was conducted over a semester with pre-service teachers at a Turkish state university. Data were collected through the Generative Artificial Intelligence Attitude Scale and the Online Self-Regulation Questionnaire; paired-samples t-tests, Pearson correlation analyses, and Fisher's z-transformation were employed in the analyses. Chatbot use did not produce statistically significant changes in either construct; importantly, however, no decline was observed in self-regulation. The positive relationship between AI attitudes and self-regulation remained stable throughout the study, with environment structuring emerging as the sub-dimension most strongly associated with AI attitudes. The absence of measurable change is interpreted not as ineffectiveness but as resilience; the findings indicate that the success of AI integration depends less on the technology itself than on the quality of its pedagogical design. Accordingly, the integration of metacognitive support components into RAG-based systems and the equipping of instructors with targeted professional development on pedagogical use are recommended.

Keywords: Educational Chatbot, RAG, Generative Artificial Intelligence, Pre-service Teachers, AI Attitudes, Online Self-regulation

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Beyond Assistance: Rethinking Artificial Intelligence in Special Education Through a Systematic Review

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The rapid proliferation of artificial intelligence (AI) has positioned it as a central focus of research across multiple domains, including education. This widespread adoption has also led to increasing scholarly attention on AI applications in special education. However, a closer examination of the literature reveals a fragmented landscape, where many studies prioritize clinical, diagnostic, or outcome-based perspectives rather than pedagogical processes. This tendency limits a deeper understanding of how AI can effectively support diverse learning needs and cognitive profiles within special education contexts. Addressing this gap, the present study aims to examine AI applications in special education by focusing on their impact on learning performance, inclusivity, and personalized learning, while also identifying ethical concerns, practical challenges, and teachers' tendencies toward AI use.

The study employs a systematic literature review (SLR) design, drawing on data collected from the Web of Science (WoS) and Scopus databases. The combined use of these two databases provides a broader interdisciplinary coverage, enhances the representation of high-impact journals, and contributes to a more balanced and reliable synthesis of the literature. Studies were selected in accordance with PRISMA guidelines and filtered through clearly defined inclusion and exclusion criteria. Data were analyzed using inductive content analysis and thematic synthesis approaches.

This study contributes to the literature by conceptualizing AI in special education as a multidimensional construct linked to pedagogical and cognitive processes rather than merely a technological advancement. By moving beyond the fragmented nature of existing research, it clarifies the distinction between education-focused AI applications and non-educational uses, thereby addressing a critical conceptual gap in the field. Findings will be presented through thematic trends and application domains derived from the adopted methodological framework. In this respect, the study is expected to offer a guiding framework for future research and practice in special education.

Keywords: Artificial Intelligence, Special Education, Systematic Literature Review, Inclusive Education, Personalized Learning, Learning Performance, Educational Technology, Thematic Analysis

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Reading Between the Lines of UK AI Policy: National Security, Geopolitics, and the Strategic Reframing of Education

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Since the emergence of generative AI in 2022, global discourse has largely oscillated between its transformative potential in pedagogy and concerns over academic integrity. However, a closer examination of the United Kingdom's policy landscape reveals a more profound shift: the conceptualization of AI not merely as an educational tool, but as a critical factor in national survival and security. The UK government moved with unprecedented speed to establish the AI Safety Institute, signaling a paradigm shift that prioritizes national strategic interests over localized educational concerns. This "National Strategy First" approach suggests that the discourse surrounding AI in higher education is increasingly being subsumed under a broader geopolitical framework. By analyzing the "gaps" within UK policy documents—what is left unsaid and what is prioritized—this presentation argues that the securitization of AI has become a dominant force in shaping the future of knowledge and institutional autonomy. Furthermore, the national attitude is reflected in educational documents. The AI's opportunity is hinted at, the policy paper, Generative artificial intelligence (AI) in education, clearly states the responsible use of AI, with due attention to data protection and intellectual property. This study aims to provide a critical framework for examining the geopolitical dimensions of education, situating the current "AI crisis" in education within the larger context of state-led survival strategies in the age of global competition. Policy documents in the UK, released following the emergence of generative AI, are investigated as a critical discourse of policy. This study examines key texts, such as the Artificial Intelligence Sector Study 2023 (published October 2024) and the 2026 press release, Britain Must Secure Greater Control and Leverage Over AI to Protect Our National Security in a Fractured World. Through a thematic close reading, the analysis explores: (1) how AI is ontologically defined; (2) the dialectic between its transformative potential and inherent risks; and (3) the national strategies employed by the UK to mitigate these risks. The research reveals how the UK constructs its policy narrative to maintain strategic agency within an increasingly fragmented global landscape. The thematic analysis reveals that: (1) while potential benefits are acknowledged, AI is increasingly framed as a fundamental threat to the nation; (2) early discourse focused on AI as an extension of human knowledge, whereas recent documents shift toward "security" and the preservation of national "power"; (3) to mitigate these risks, the UK employs diverse strategies: legislative frameworks (e.g., Online Safety Act), R&D funding, international collaboration, and strategic public-private partnerships. This study concludes that UK AI policy has undergone a significant "securitization" shift, moving from a focus on educational enhancement to a doctrine of national survival. The analysis demonstrates that as AI is increasingly framed as a fundamental threat, the state prioritizes geopolitical leverage and institutional control over pedagogical autonomy. Ultimately, these findings suggest that the future of higher education in the UK is no longer merely an academic concern but is being fundamentally redefined as a strategic asset within a broader state-led survival strategy in an era of global fragmentation.

Keywords: AI, UK's AI Policy, Terrorism

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The Effectiveness of Online Learning After the Pandemic

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This study investigates the effectiveness of online learning in the post-COVID-19 period, with a particular focus on its impact on student engagement, learning outcomes, and overall educational experience. The rapid and large-scale transition to online education during the pandemic has permanently influenced higher education systems, making it essential to critically evaluate the continued role of digital learning environments in contemporary education.

The research adopts a qualitative approach, combining a structured literature review with reflective analysis based on the author's direct experience as a student engaged in both online and traditional learning environments. Data sources include recent peer-reviewed studies, institutional reports, and documented case studies on online education practices. The study examines key components of online learning systems, including learning management platforms, synchronous video-based instruction, asynchronous learning materials, and digital assessment tools.

The findings indicate that online learning provides significant pedagogical benefits, particularly in terms of flexibility, accessibility, and individualized pacing. These advantages contribute to improved autonomy in student learning and increased access to educational resources. However, the analysis also identifies persistent challenges, including reduced interpersonal interaction, variations in student motivation, difficulties in maintaining sustained attention, and disparities in access to reliable digital infrastructure.

The results suggest that online learning is most effective when implemented as part of a blended learning model that integrates both digital and face-to-face instructional strategies. Such an approach enhances student engagement while preserving the social and collaborative dimensions of traditional education. From the author's perspective, the integration of structured digital tools with in-person instruction significantly improves learning continuity and academic performance.

In conclusion, online learning has become a permanent and valuable component of modern education systems following the pandemic. Its effectiveness depends on thoughtful instructional design, technological accessibility, and balanced integration with traditional teaching methods. Future educational strategies should prioritize hybrid models that optimize both digital and physical learning environments.

Keywords: Online Learning, Post-Pandemic Education, Blended Learning, Student Engagement, Educational Technology

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Micro-Credential as an Architect of The Educator's Professional Brand: From "Diffuse Brand" to Resilient Identity in the Age of Uncertainty

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This paper theorises and empirically validates the micro-credential "Image Communications and Brand Management" as a structural instrument for forming the professional brand of future educators in conditions of digital transformation and societal uncertainty. Drawing on the original concept of the "diffuse brand" of the educator — an integrated professional image combining habitual identity, digital presence and institutional ambassadorship — the authors demonstrate how a purpose-designed micro-credential architecture can operationalise lifelong learning competencies for the teaching workforce. The study was conducted at Kryvyi Rih State Pedagogical University and anchored in analysis of recent scholarly literature (2024–2026). Empirical findings reveal significant gaps in digital identity formation among prospective teachers (only 26.7% report confident professional competency self-assessment), while 36.7% acknowledge the importance of habitual brand components. The paper presents a seven-module micro-credential structure, interactive modelling methodology (role-play, AI-assisted brand-book creation) and a three-level assessment framework. The discussion situates these findings within the ICETOL 2026 theme of building resilience through micro-credentials and lifelong learning, arguing that the educator's professional brand is not a cosmetic add-on but a core resilience competency in an uncertain information landscape.

Keywords: Micro-certificates, Teacher’s Professional Brand, Diffuse Brand, Digital Identity, Personal Branding in Education, Lifelong Learning, Professional Competencies, Artificial Intelligence in Education, Professional Resilience, Brand Book.

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Technological Innovations and Personalization in Distance Learning: Adaptive Environments as A Response to the Limitations of the Self-Instructional Model

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Distance Education (DE) has established itself as an indispensable strategic tool for corporate education, being extensively adopted by the Brazilian Army through the Army Institute of Economics and Finance (IEFEx) to train thousands of administrative agents via fully self-instructional courses. Although this format ensures training continuity by valuing autonomy and reducing institutional costs, the model is significantly hindered by the limitations of instructionism. In the absence of continuous human mediation, teaching frequently reverts to the passive and standardized transmission of information, anchored in extensive PDF readings and static video lectures that fail to bridge the gap between theory and daily practice. This approach restricts critical thinking capacity, ignores the diversity of student profiles, and generates cognitive overload, thereby compromising engagement and deep learning. In light of this scenario, this study aimed to investigate how teaching personalization and the use of emerging technologies can promote more dynamic, contextualized, and student-centered learning experiences. The research adopted a qualitative, exploratory, and applied approach, using the courses offered by the IEFEx—responsible for the training of Brazilian Army administrative agents—as the empirical field. Empirical data collection occurred in 2025 through questionnaires distributed to a significant sample, resulting in 4,307 student responses and the participation of 28 teaching agents affiliated with the IEFEx. The responses, which combined Likert scale assertions and open-ended questions, were processed using Bardin's Content Analysis technique, supported by Artificial Intelligence for the initial categorization of the vast volume of textual data. The results demonstrated that while the self-instructional model favors autonomy and expanded access to training, persistent issues remain regarding low engagement, excessive dependence on textual materials, a lack of personalization, and limited practical and interactive activities. Both students and teaching agents expressed a significant demand for active methodologies, adaptive pathways, simulators, AI-based virtual tutors, and greater multimedia diversification. The findings further indicate that the mere digitization of content is insufficient to guarantee meaningful learning in complex corporate contexts. It is concluded that the evolution of corporate DE in the Brazilian Army requires transcending the instructionist paradigm toward more flexible, personalized, and connectivist educational models. Therefore, it is recommended to incorporate adaptive environments, AI tools, operational simulators, and multimedia strategies aligned with contemporary learning theories to strengthen student protagonism, reduce transactional distance, and promote more effective and contextualized formative experiences in the digital age.

Keywords: Distance Education. Technological Innovation. Artificial Intelligence. Adaptive Environments. Self-Instructional Model.

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The Shadow Side of Employability: Emotional Vulnerability within the USEM Landscape of EFL Teaching

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This study examines EFL teachers' employability through the USEM model and its relationship with their emotional vulnerability. Employing a qualitative research approach, a thematic analysis was used out of USEM model and positive and negative emotional vulnerability. Data from autobiographical narratives and semi-structured interviews with 25 purposefully selected EFL teachers were analyzed using deductive thematic analysis, guided by a MAXQDA24-generated Code Map that illustrated interrelationships. The findings revealed that while the USEM model generally enhances employability, certain components can paradoxically contribute to negative emotional vulnerability under specific conditions. The findings from the Code Map indicated that: (a) deep **Understanding** can lead to negative vulnerability through awareness of limitations and complex challenges; (b) rigid application or obsolescence of **Skills** can foster anxiety and a sense of inadequacy; (c) **Efficacy Beliefs**, if fragile or overextended, are potent sources of negative vulnerability, including imposter syndrome and burnout risk; and (d) **Metacognition**, particularly when it devolves into self-critical rumination, directly amplifies negative vulnerability such as anxiety and emotional exhaustion. Conversely, when well-developed and applied reflectively, Understanding and Metacognition were found more likely to contribute to positive vulnerability by enabling intellectual humility, adaptive learning, and constructive self-awareness. The findings bear implications for teacher educators to foster the development of resilient Efficacy Beliefs and adaptive Metacognitive strategies, thereby equipping EFL teachers to navigate their emotional landscapes constructively and enhance their overall employability.

Keywords: Employability ; USEM Model; Emotional Vulnerability ; EFL Teachers

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Designing Interactive Simulation-Based Laboratories for Teaching Prepress Colour Management in Technical and First-Year Higher Education

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Teaching prepress colour management is challenging in technical/vocational and first-year higher education because many professional colour-management systems operate as computational “black boxes”. Learners often receive RGB-to-CMYK conversions, gamut warnings, proofing results, or tone-reproduction outputs without being able to inspect the intermediate colourimetric logic that produces them. This design-and-development study presents an openly accessible, browser-based learning environment intended to make these hidden processes visible through interactive simulation-based laboratories for graphic arts, printing, and visual communication education. The platform was developed as a client-side HTML5, CSS, and JavaScript application and consists of nine interactive laboratories covering additive colour synthesis, subtractive colour synthesis, CMYK separation with screen angles, Total Area Coverage, colour spaces and gamut boundaries, achromatic reproduction through Grey Component Replacement (GCR) and Under Colour Removal (UCR), Tone Value Increase, ICC rendering intents with Black Point Compensation, and ISO-oriented soft-proofing logic. The instructional design is informed by Cognitive Theory of Multimedia Learning and simulation-based science education, with emphasis on spatial contiguity, signalling, segmenting, guided inquiry, and immediate visual feedback. Instead of using production-grade ICC profile look-up tables, the platform applies lightweight heuristic transformations in CIELAB space so that learners can manipulate variables and observe the consequences of modelling decisions in real time. An internal reference-guided technical audit was conducted using selected sRGB samples and Adobe Color Engine (ACE) settings in Adobe Photoshop under an ISO Coated v2 / FOGRA39 comparison context. The audit indicated that the heuristic model preserves in-gamut colours in its teaching mode and applies hue-preserving chroma compression to out-of-gamut colours. These results are interpreted as evidence of educational plausibility rather than metrological equivalence to professional colour-management engines. The platform also includes an integrated scientific manual, inquiry prompts, local observation notes, and transparency notes that explicitly document modelling simplifications and pedagogical trade-offs. The study contributes a transparent educational architecture for teaching complex prepress colour concepts without requiring costly professional software. It is designed to support classroom demonstration, guided laboratory work, and self-paced exploration in technical/vocational and first-year higher education contexts. Future work should evaluate learner outcomes through classroom-based studies comparing conceptual understanding, usability, and transfer of colour-management knowledge before and after interaction with the simulation environment.
A browser-based demonstration is available at: https://prepress-colour-labs.netlify.app/

Keywords: Prepress Colour Management; Simulation-based Learning; Technical Education; First-year Higher Education; Graphic Arts Education; Interactive Visualisation

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An Analysis of Graduate Theses on Digital Literacy in Higher Education

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This study aims to analyze, from a multidimensional perspective, the sampling preferences and distributional dynamics of graduate theses on digital literacy within the context of Turkish higher education. Adopting a qualitative research design, the study utilizes document analysis to examine 115 graduate theses (95 master's and 20 doctoral) retrieved from the Council of Higher Education (CoHE) National Thesis Center database. During the analytical process, data were subjected to frequency analysis using a comprehensive classification framework that enabled the multivariate representation of individual theses.

The findings reveal that sample selection in the digital literacy literature is predominantly clustered within student populations. While over 90% of the examined studies focus on university students, the highest representation within this cohort is undergraduate students (f=100, 86.96%) and preservice teachers in faculties of education (f=47, 40.87%). Conversely, students in health sciences (5.22%), associate degree programs (4.35%), English preparatory programs (2.61%), and graduate-level students are represented only minimally. Notably, the inclusion of core stakeholders in the university ecosystem, such as faculty members (7.83%) and administrative staff (1.74%), remains significantly low. Furthermore, a substantial portion of the theses demonstrates a trend toward mixed sampling designs, reflecting an interest in interactions between different stakeholders.

In conclusion, this study provides a systematic mapping of current research trends in digital literacy within higher education. The results suggest that future research should move beyond a student-centric focus to address digital transformation through a holistic university ecosystem perspective—one that encompasses faculty, administrative units, and diverse disciplines. Such an expansion is critical for comprehending the multi-layered impacts of digitalization processes within the higher education landscape.

Keywords: Digital Literacy, Higher Education, Document Analysis, Graduate Theses

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Pre-Service Teachers' Critical Reflections on AI-Supported Assessment Redesign

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The widespread integration of generative artificial intelligence (GenAI) technologies into educational contexts has generated substantial debates regarding the validity, authenticity, and pedagogical sustainability of traditional assessment practices. As AI systems increasingly demonstrate the capacity to generate sophisticated written outputs, conventional assessment approaches centered on memorization, standardized responses, and product-oriented evaluation have become increasingly insufficient for capturing meaningful learning processes. Consequently, there is a growing need to reconceptualize assessment practices in ways that foreground higher-order thinking, reflective learning, ethical AI use, and process-oriented evaluation. Within this context, the present qualitative case study aimed to investigate pre-service teachers' critical reflections on the redesign of assessment and evaluation practices in AI-supported educational environments. The study was conducted with 19 undergraduate students enrolled in a faculty of education at a public university in Türkiye. The participants were pre-service teachers from different teacher education programs, including Turkish Language Education, Mathematics Education, Science Education, Social Studies Education, and Primary School Education. Prior to the data collection process, participants completed a structured instructional program consisting of 15 sessions delivered over approximately three months, with each session lasting two hours. Throughout the instructional process, students engaged with the pedagogical, ethical, and practical implications of AI integration in educational assessment through ten AI-era assessment design principles emphasizing authentic assessment, higher-order thinking, scaffolding, metacognitive reflection, process visibility, multimodal assessment, collaboration, academic integrity, and responsible AI integration. Following the instructional phase, participants completed an open-ended assessment task requiring them to identify a contemporary assessment-related problem, develop an AI-supported pedagogical solution, and critically evaluate the strengths, limitations, and ethical implications of their proposed approach. The data were analyzed through thematic analysis. The findings revealed six overarching themes: (1) critique of traditional assessment practices, (2) AI-supported transformation of assessment, (3) process-oriented and reflective learning, (4) flexible, inclusive, and multimodal assessment, (5) ethical concerns and academic integrity, and (6) human–AI collaboration in educational assessment. The participants critically problematized traditional assessment approaches for prioritizing memorization, standardized performance, and summative outcomes while inadequately addressing learners' cognitive processes and individual differences. In contrast, students emphasized the pedagogical potential of AI-supported assessment practices in facilitating personalized feedback, adaptive learning pathways, continuous formative evaluation, and more inclusive assessment environments. Simultaneously, the findings also revealed substantial concerns regarding academic dishonesty, excessive dependency on AI systems, reliability and validity issues, and the necessity of preserving teacher agency and pedagogical judgment within AI-mediated learning environments. Overall, the study suggests that pre-service teachers conceptualize AI not merely as a technological innovation but as a transformative pedagogical catalyst necessitating the critical redesign of assessment practices. The findings contribute to the emerging body of literature on AI in education by demonstrating how future educators

critically negotiate the pedagogical, ethical, and human-centered dimensions of assessment transformation in the age of artificial intelligence.

Keywords: Generative Artificial Intelligence; AI-supported Educational Assessment; Pre-service Teachers; thematic Analysis

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Gamified Hospitality Learning and Employability Readiness among Hospitality and Tourism Students: The Mediating Role of Student Engagement and Moderating Role of Perceived Usefulness

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This study analyzes the effect of gamified hospitality learning on employability readiness of hospitality and tourism students in Pakistan. The study adopts the experiential learning theories and self-determination theories to explore the mediating role of student engagement and moderating role of perceived usefulness between gamified learning and employability readiness. The methodology utilised is quantitative and adopted a cross-sectional survey with 108 undergraduate and post graduate students studying at three universities in Islamabad, Pakistan in Hospitality and Tourism related courses. Structured questions were used to collect data and analysed using reliability analysis, correlation analysis and moderated mediation regression. The findings show that gamified learning in the hospitality sector has a positive effect on employability readiness. Student engagement has a significant mediating effect in this relationship, and perceived usefulness enhances the indirect effect of gamified learning on employability readiness via student engagement. The results indicated that the application of pedagogical models in hospitality education which are based on the principles of the game can improve the professional abilities, practical skills and work readiness of students. The study offers a practical recommendation for hotel educators and program designers considering incorporating gamification and interactive learning techniques into the curriculum for employability of graduates in the hospitality industry. This study is one of the first empirical studies that examined the relationship between gamified learning, student engagement and employability readiness in Pakistan's hospitality education setting in a moderated mediation mechanism approach.

Keywords: Gamified Hospitality Learning, Employability Readiness, Student Engagement, Perceived Usefulness, Hospitality Education, Tourism Education, Pakistan

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Digital Educational Technologies and Resilient Learning in Cameroon's Public Education System

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The rapid development of digital technologies has transformed educational systems worldwide, particularly after the disruptions caused by global crises and the growing need for resilient learning environments. In Cameroon, the integration of educational technologies into public education remains uneven due to infrastructural limitations, insufficient teacher training, limited digital resources, and disparities between urban and rural schools. Despite these challenges, digital learning tools offer significant opportunities to improve access to education, strengthen learning continuity, and enhance students' engagement.

This study examines the role of digital educational technologies in promoting resilient learning within Cameroon's public education system. The main objective is to analyze how digital tools can support inclusive, adaptive, and sustainable educational practices in contexts characterized by uncertainty and limited resources. The research also seeks to identify the main barriers affecting the effective implementation of educational technologies and to propose strategies for improving their use in schools.

The study adopts a qualitative and descriptive research approach based on documentary analysis, policy review, and observations related to educational practices in Cameroon. Particular attention is given to online learning platforms, multimedia learning resources, mobile technologies, and teacher digital competencies. The study explores how these tools contribute to maintaining educational activities during periods of disruption while supporting long-term educational resilience.

The findings indicate that digital educational technologies can significantly improve access to learning opportunities, encourage learner autonomy, and facilitate communication between teachers and students. However, the research also reveals persistent challenges related to internet connectivity, inadequate technological infrastructure, insufficient digital literacy, and unequal access to devices among learners. The study highlights the importance of government support, institutional investment, teacher capacity building, and inclusive digital policies in strengthening technology-enhanced education.

In conclusion, resilient learning in Cameroon requires a more strategic integration of educational technologies into the national education system. Strengthening digital infrastructure, promoting teacher training, and encouraging equitable access to technological resources are essential for improving the quality and continuity of education.

Keywords: Educational Technology, Resilient Learning, Digital Education, Cameroon, Online Learning

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Educational Technology and Learner Engagement in Secondary Education in Cameroon

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The rapid development of educational technologies has transformed teaching and learning practices worldwide, especially in secondary education. In many developing countries, including Cameroon, digital learning tools are increasingly viewed as essential instruments for improving learner engagement, academic performance, and educational resilience. However, despite growing investments in educational technologies, many secondary schools in Cameroon continue to face significant challenges related to infrastructure, internet connectivity, teacher preparedness, and unequal access to digital resources. These limitations affect the effective integration of technology into classroom practices and reduce opportunities for interactive and student-centered learning.

This study examines the role of educational technology in promoting learner engagement in secondary education in Cameroon. The main objective is to analyze how digital learning tools can support active participation, collaboration, motivation, and academic interaction among students in both urban and rural school environments. The study also seeks to identify the major barriers affecting the implementation of technology-enhanced learning in secondary schools and to propose strategies for improving educational outcomes through digital innovation.

The research adopts a qualitative and descriptive approach based on document analysis, observations of educational practices, and a review of current educational policies related to technology integration in Cameroon. Particular attention is given to online learning platforms, multimedia teaching resources, mobile learning technologies, and digital communication tools used by teachers and students. The study explores how these technologies contribute to learner engagement by encouraging participation, creativity, independent learning, and continuous interaction between teachers and learners.

The findings indicate that educational technologies can significantly improve student engagement and participation when adequate digital infrastructure, teacher training, and institutional support are available. The research also highlights persistent challenges, including insufficient technological equipment, unstable internet access, limited digital competencies among teachers, and disparities between schools located in urban and rural areas. The study emphasizes the importance of inclusive digital policies, investment in educational infrastructure, and continuous teacher professional development to strengthen technology-enhanced secondary education in Cameroon.

In conclusion, educational technology has considerable potential to improve learner engagement and support more inclusive and resilient secondary education systems in Cameroon. Strengthening digital access, promoting teacher capacity building, and encouraging innovative teaching methods are essential for enhancing the quality and continuity of secondary education in the digital era.

Keywords: Educational Technology, Learner Engagement, Secondary Education, Digital Learning, Cameroon

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From the Industrial Laboratory to the Browser: An Open-Access Halftone Simulator for Vocational and Distance Graphic Arts Education

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Technical and vocational graphic arts education increasingly requires learners to understand how digital imaging algorithms shape printed and screen-based visual communication. In prepress education, concepts such as halftoning, colour separation, rosette formation, tone value increase, screen ruling, resolution and viewing-distance effects are central to professional competence, yet they are difficult to teach through static textbook images or conventional online materials. This challenge becomes more pronounced in distance and hybrid learning, where learners need ways to observe, manipulate and discuss technical phenomena without direct access to a shared print laboratory. The problem is both technical and pedagogical: learners often see final printed results without being able to vary the numerical parameters that generate them, limiting their ability to connect visual judgement with algorithmic, perceptual and production-related decisions.

This design-and-development case study presents Raster Halftone Lab, an open-access, browser-based simulation environment developed for upper-secondary technical and vocational education and training (TVET) and introductory tertiary programmes in graphic arts, graphic design and visual communication. The purpose of the project is to support flexible, resilient and responsible learning by transforming industrial halftone processes into interactive, parameter-driven learning experiences suitable for classroom use, online courses and blended delivery. The study also frames parametric literacy as an instructional goal: the learner's ability to translate visual intentions into explicit numerical and algorithmic choices.

The development method combined instructional design analysis, modelling of core prepress phenomena and iterative implementation as a zero-installation client-side web application using HTML5, CSS and the Canvas API. The current version includes eight interactive panels covering amplitude- and frequency-modulated screening, Floyd-Steinberg serpentine error diffusion, Bayer ordered dithering, CMYK image separation, rosette generation with automatic rosette-type detection, halftone cell quantisation, substrate-specific tone value increase, the Mannos-Sakrison contrast sensitivity function and viewing-distance illusion. Learners can adjust resolution, screen ruling, angles, colour values, substrate profiles, dot shapes and viewing parameters while receiving immediate visual and numerical feedback. The interface also provides display-sampling guidance, helping users recognise when screen pixel pitch may create artefacts that should not be confused with genuine halftone behaviour.

The main design findings indicate that web-based simulation can make complex prepress relationships visible, adjustable and discussable across different cognitive levels. In upper-secondary TVET, the tool supports exploratory visual inquiry and teacher-guided demonstration. In first-year applied programmes, the same modules can support more quantitative analysis of screening geometry, perceptual thresholds and reproduction constraints. In distance education, the browser-based format allows the same parameter set, visual feedback and explanatory language to be shared across teacher-led demonstrations, individual practice and asynchronous learning activities.

The paper concludes that lightweight browser-based laboratories can complement studio teaching and strengthen technical experimentation in online learning environments. The application is publicly available at https://raster-halftone-lab.netlify.app/. It recommends

using Raster Halftone Lab as a guided inquiry resource within learning management systems and developing future classroom evaluations to examine learning outcomes, usability and transfer of parametric reasoning to authentic graphic arts tasks.

Keywords: Open And Distance Learning, Technical And Vocational Education And Training (TVET), Web-based Simulation Laboratory, Parametric Literacy, Halftone Prepress, Graphic Arts Education

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Fabry-Perot interferometry interactive simulator: A web-based tool for experimental learning of optical communication dispersion compensation

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This work presents a web-based education tool that allows students to simulate and visualize chromatic dispersion compensation in long-distance optic-fibers using the Fabry-Perot interferometer. The tool has interferometer parameters as inputs that update the simulation in real time (e.g. reflectivity, time delay) which let the student learn by exploring and experimentating virtually. The Fabry-Perot cavity length can be changed by the user which directly modifies the resonance frequency. The input pulse parameters can also be changed, including the Pulse Initial Width (PIW), laser chirp, link length, central frequency, etc. The implementation results in an online web-based graphical tool (Python/JS) with signal plots that students can use to improve their understanding in class or at their respective learning environments. Results can be obtained in real time where the bandwidth-distance product, the widening rate and the time difference between input signal and output signal can be analytically and graphically observed. This work addresses the gap of how teaching complex concepts can be made accessible to students using simulation virtual platforms that narrow the gap between optical theory and practical implementation in real communication systems.

Keywords: Online Education, Distance Learning, Fiber Optics, Channel Equalization, Interferometer Design, Simulation Tool.

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Mach-Zehnder optical equalizer implementation on virtual learning environment: Fostering optical fiber communication optimization learning

Carlos Hidalgo Luque [1], Rocío Pérez de Prado [1]

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There is a gap for educational tools that allow instructors and students to graphically interact with advanced optical filter design. This paper presents an interactive simulator for Mach-Zehnder interferometer (MZI) signal equalization where chromatic dispersion compensation in long-distance optical fiber is the main focus. It has been developed for online education with a dynamic interface (Python/JS) that lets students and educators configure the optical filter with cascading stages and time delays which allows getting real time visual feedback on link performance. Simulation results are offered graphically and analytically with the bandwidth-distance product, the widening rate and the time difference between the input signal and the resulting one after being filtered. Optical hardware design can now be adapted to online learning environments that can enhance knowledge retention and prepare students for future digital challenges.

Keywords: Online Education, Educational Assessment, Simulation, Dispersion Correction, Distance Learning, Interferometer Design, Fiber Optics.

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Dispersion compensation with learning analytics on a web platform that enables comparison between linear and non-linear techniques

Carlos Hidalgo Luque [1], Rocío Pérez de Prado [1]

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The transition toward digital learning ecosystems requires evidence-based approaches to ensure the acquisition of complex technical competencies. Optical filter design for long-distance optical fiber is an area where no interactive tools have been developed for introductory optical communication courses. Faced with the pressing need to educate for resilience and responsibility, this study presents a comparative platform that evaluates three signal dispersion compensation methods: Fabry-Perot interferometers (FPI), Mach-Zehnder interferometers (MZI), and the non-linear Self-Phase Modulation (SPM) effect. By integrating high-precision simulation tools, the platform acts as a pedagogical scaffold that allows researchers and educators to foster student performance and curiosity across different optical scenarios. The simulation results are presented with a web-based graphical interface where signal plots and result analytics can be easily consulted. Specific input parameters for every dispersion correction technique allowing multiple configurations for highly flexible scenario design. This approach facilitates the adaptation of learning pathways in hybrid contexts, encouraging the student's critical analysis of technological efficiency in next-generation communications.

Keywords: Distance Learning, Phase Modulation, Interferometer Design, Dispersion Compensation, Fiber Optics, Simulation Tool.

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Step Into the Future: How VR and AI Are Reshaping the Public Speaking Classroom

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The purpose of this study was to examine the impact of virtual reality and artificial intelligence technology on student confidence, preparation, and speech performance in an Introduction to Public Speaking course at a large University in Ohio. As communication educators seek innovative ways to enhance student learning and engagement in the Basic Communication Course, emerging platforms like Ovation offer new possibilities for low-stakes, immersive rehearsal that traditional classroom instruction alone cannot provide. This presentation reports on the implementation and outcomes of a full-scale VR integration conducted during the spring 2025 semester.

Students enrolled in the course were each equipped with a virtual reality headset and used Ovation — an AI-powered platform designed specifically for public speaking practice — to rehearse speeches at multiple stages of outline development. Rather than reserving practice for a final run-through, students delivered their presentations repeatedly to a virtual AI audience throughout the preparation process, receiving content-specific questions from AI audience members following each rehearsal and detailed written performance summaries identifying strengths and concrete areas for improvement. This iterative rehearsal model was scaffolded directly into the existing course curriculum, functioning as a structured complement to traditional instruction and coaching. The students answered their honest feedback in ten journals throughout the semester, noting what worked and did not work to help them feel more confident with their public speaking skills.

Findings suggest that repeated low-stakes VR rehearsal positively influenced student confidence and willingness to take communicative risks in front of a live audience. Students reported valuing the immediate, personalized feedback generated by the software and appreciated the ability to practice without the social pressure of peer observation. Challenges related to technology access, software navigation, and the limitations of AI feedback were also identified and will be discussed candidly.

The implications of this study are relevant for Basic Communication Course directors, public speaking instructors, and communication educators interested in the practical application of emerging technology in the classroom. By demonstrating how VR and AI tools can be meaningfully integrated into an existing course framework, this presentation offers a replicable model for enhancing speech preparation and student engagement. Attendees will leave with actionable strategies, an honest assessment of the technology's strengths and limitations, and a clearer vision of how innovative tools can support the future of communication pedagogy.

Keywords: Virtual Reality; Artificial Intelligence; Communication Pedagogy

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Cultivating Logical Reasoning and Fallacy Detection in Junior High Students: An Action Research Focused on Iterative Curriculum Optimization

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In the contemporary educational landscape, younger learners frequently face cognitive challenges in developing high-order reasoning. They often exhibit superficial problem-solving tendencies, express thoughts through fragmented sentences, and manifest cognitive biases such as hasty generalizations and slippery slope fallacies within digital environments.

To address these critical pedagogical challenges, this study utilizes a two-cycle Action Research design to investigate how iterative instructional scaffolding can enhance the fallacy-detection and systematic argumentation skills of seventh-grade students within an elective course at an experimental junior high school in Taipei.

The research systematically followed the four-step action research spiral across two instructional cycles. First, in the Plan phase, the instructional framework was redesigned after Cycle 1 to resolve student cognitive overload by adopting a progressive curriculum structure integrated with the Frayer Model Second, in the Act phase, this revised intervention was implemented, incorporating a three-step online feedback loop consisting of teacher guidance, peer evaluation, and final student revisions. Third, in the Observe phase, various qualitative data were gathered, including students' digital platform entries, classroom observation logs, and teacher's reflective journals. Fourth, in the Reflect phase, the researcher evaluated the pedagogical efficacy and the evolution of students' reasoning pathways. For data analysis, qualitative content analysis was employed to systematically code and analyze the qualitative artifacts to identify shifts in students' logical thinking characteristics.

Preliminary findings revealed a substantial qualitative shift in student learning outcomes between the two cycles. Supported by the iterative scaffolding, students successfully transitioned from superficial and biased expressions to autonomous, logically sound arguments characterized by cohesive causal reasoning.

This study demonstrates that structured conceptual models combined with iterative feedback loops can effectively empower junior learners to overcome cognitive blind spots and cultivate robust critical thinking competencies.

Based on these findings, it is recommended that critical thinking curricula in the AI era shift their focus from mere knowledge delivery to the design of robust cognitive scaffolding and multi-layered feedback. Educators should implement mechanisms that actively require students to slow down, analyze concepts deeply, and refine their own voices, thereby cultivating genuine intellectual independence in technology-enhanced learning ecosystems.

Keywords: Curriculum Iteration, Instructional Scaffolding, Critical Thinking, Logical Reasoning

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Students' Experiences and Needs Regarding Online and Alternative Assessment in Distance Higher Education: Emerging Digital Challenges

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Purpose:
Technology-mediated assessment plays an increasingly important role in online and distance higher education, particularly within digitally mediated learning environments. Despite the growing use of online examinations and alternative assessment formats, students' perspectives on these approaches remain underexplored, especially in humanities-oriented postgraduate programs. This study examines postgraduate students' experiences and perceived needs regarding online written examinations and project-based assessment in distance higher education. It also explores how issues related to fairness, emotional experience, digital conditions, and the growing use of artificial intelligence shape students' perceptions of assessment in online learning environments.
Methodology:
A qualitative research design was adopted. Data were collected through three online focus groups with postgraduate students enrolled in humanities-oriented distance education programs at the Hellenic Open University. Purposive sampling ensured that all participants had experience with both online written examinations and project-based assessment formats. The discussions were conducted via videoconferencing using a semi-structured format focused on students' emotional experiences, perceptions of learning value and fairness, support needs, and views regarding the role of digital technologies and AI in assessment practices. The data were analyzed using inductive thematic analysis.
Findings:
The findings revealed clear differences between assessment approaches. Online written examinations were mainly associated with anxiety, time pressure, and technical uncertainty, with students expressing concerns about fairness and unequal digital conditions. Participants also described online examinations as limiting opportunities for deeper reflection and meaningful demonstration of understanding.
In contrast, project-based assessment was perceived as more supportive of meaningful learning, autonomy, reflection, and sustained engagement with course content. Students emphasized that project-based tasks allowed them to work at their own pace and develop analytical and critical thinking skills more effectively. Participants also highlighted the importance of clear assessment guidelines, communication with instructors, and timely feedback in online learning environments.
Students additionally referred to the growing influence of digital tools and artificial intelligence in shaping assessment practices, raising questions related to authenticity, transparency, and equitable evaluation.
Implications:
The study highlights the need for more pedagogically grounded and digitally responsive assessment practices in online higher education. The findings contribute to current discussions on educational technology, online learning design, authentic assessment, and assessment practices in the age of AI. The study suggests that assessment in digitally mediated learning environments should prioritize meaningful learning, student agency, fairness, and inclusive digital pedagogy.

Keywords: Distance Higher Education; Online Assessment; Project-based Assessment; Educational Technology; Student Experience; Digital Learning

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Roles of Generative AI in Academic Practice: A Phenomenological Study on Faculty Mentoring in Higher Education

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Generative artificial intelligence (GenAI) is reshaping higher education by transforming research practices, teaching design, assessment, and technical problem-solving. This transformation has also created an emerging "AI divide": students increasingly use GenAI tools, whereas many faculty members remain uncertain about their pedagogical value, ethical boundaries, and implications for academic integrity. Conventional professional development is often too general to address discipline-specific routines, verification practices, and responsible use. Therefore, this study examines how a structured reverse mentoring model can support faculty AI literacy through practice-based and reflective engagement with GenAI. Methodologically, the study was designed as a qualitative phenomenological inquiry focusing on faculty members' lived experiences during a 12-week reverse mentoring process. Two participants from Turkish universities took part in the study: a faculty member in an undergraduate Science Education program and an information technologies lecturer. The program was organized in three phases. In Weeks 1–2, the mentor and mentees clarified goals, established working norms, and agreed on ethical boundaries for AI use. In Weeks 3–10, mentoring sessions focused on authentic academic tasks, including research reading and synthesis, instructional design, assessment redesign, coding support, and debugging. These sessions followed iterative cycles of prompting, evaluating outputs, revising results, and reflecting on reliability. In Weeks 11–12, participants consolidated their routines and articulated principles for sustainable and responsible GenAI use. Data were triangulated through weekly semi-structured interviews, field observations, and AI artifact logs containing prompts, outputs, and faculty revisions. Analysis followed iterative phenomenological coding and thematic clustering.

Findings revealed three interrelated themes. First, participants integrated GenAI into research workflows more systematically when mentoring emphasized verification, source checking, and alignment with academic routines. Their use moved from exploratory testing toward deliberate practices such as literature scanning, drafting, and checking the consistency between claims and sources. Second, GenAI was positioned as a teaching assistant rather than a replacement for professional expertise. Participants used it to generate alternative explanations, examples, and instructional outlines; however, they emphasized that all outputs required revision according to learning objectives, disciplinary accuracy, and student context. They also became more aware of the need to redesign assessment tasks in response to students' access to GenAI. Third, GenAI functioned as a technical assistant, particularly for coding and debugging. Small, clearly defined code segments produced more reliable outputs, while systematic testing and human oversight remained essential.

A cross-cutting finding was the transformation of trust. Initial hesitation caused by inaccurate outputs and hallucinations gradually evolved into controlled and critical use as participants developed more precise prompting strategies, stronger verification routines, and improved error-detection skills. Reverse mentoring operated as a scaffolded learning mechanism by modeling effective practices, supporting reflection, and gradually increasing participants' autonomy. The results suggest that faculty development for GenAI should move beyond one-

off tool demonstrations and prioritize situated, discipline-sensitive, ethically grounded, and critically reflective learning experiences. Institutional recognition of AI coaching roles and responsible-use guidelines may support sustainable and accountable GenAI integration in higher education.

Keywords: AI Literacy; Reverse Mentoring; Generative Artificial Intelligence

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Exploring Students' Reflections and Opinions on AI Feedback during the Project Proposal Development Process

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Reflective practice is an essential catalyst for self-regulated learning in project-based environments, yet scaffolding critical reflection during project proposal development remains a major pedagogical challenge. This qualitative-driven study investigates the procedural dynamics of human-AI interaction by exploring undergraduate students' reflections, opinions, and experiences regarding real-time generative AI feedback as a formative scaffold. Methodologically, case study qualitative design was employed within an undergraduate project development and management course (N=13) over three weeks, utilizing handwritten reflective diaries, AI-interaction log (screenshots) using a specific prompt, and questionnaires with open-ended questions to track learning trajectories longitudinally. Qualitative data were decoded using thematic analysis including supported by the GRAFFAIN graph-mapping framework to trace relational shifts in student thinking.

The findings reveal a clear evolutionary trajectory in how students cognitively negotiate AI feedback through iterative dialogue. Initially, students approached AI with high baseline trust, utilizing its context-sensitive prompts primarily for structural planning and identifying missing proposal components. As the project progressed, students' reflections shifted from surface-level descriptive documenting to analytical evaluation, moving away from passive acceptance toward active modification. Students increasingly treated the AI as a peer-level cognitive partner and external reviewer, adapting suggestions to fit their specific project contexts. Relational graph networks underscore that the success of reflective thinking was heavily mediated by a developing critical awareness of feedback superficiality and AI perfectionism during advanced planning phases. Emotional tracking confirmed that students maintained a pragmatic, balanced stance toward the technology. Nevertheless, these findings have significant future implications, suggesting that AI feedback should be positioned as a supplementary cognitive resource rather than a replacement for human reasoning.

Ultimately, the significance of this study lies in its shift toward a process-oriented understanding of human–AI collaboration, concluding that generative AI serves as an effective dialogic tool that prompts deeper metacognitive regulation while preserving student autonomy. However, future research should employ longitudinal designs over entire academic semesters to trace the evolution of human–AI co-construction in larger-scale quantitative studies to investigate the specific interaction patterns. Researchers should also diversify the types of generative AI tools studied to evaluate how varying feedback styles (e.g., directive versus Socratic) influence student metacognition.

Keywords: Generative AI, Reflective Practice, Project-proposal Development, AI Feedback, Human-AI Collaboration, AI in Education

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Digital Materials for Supporting Primary School Students' Reading Skills*

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When the PISA results are examined, it can be seen that Türkiye has shown a limited but noticeable improvement in the field of reading skills in recent years. While Türkiye ranked 40th among 79 countries in the field of reading skills in the PISA 2018 assessment, it rose to 36th place among 81 countries in the PISA 2022 results. Similarly, among OECD countries, Türkiye ranked 31st in 2018 and increased to 30th place in 2022. Although these results indicate that Türkiye has shown progress in the field of reading skills, they also demonstrate that there is still a continuing need for studies aimed at supporting students' reading skills. PISA assessments are conducted with students in the 15-year-old age group. However, reading skills are among the important skills whose foundations should be established at early ages. In this context, it is important to develop learning environments and materials that support students' reading skills during primary school years. Within the scope of this study, digital materials aimed at supporting primary school students' reading skills were developed. The research was conducted as a development study based on the ADDIE instructional design model. The process was planned and carried out in accordance with the stages of analysis, design, development, implementation, and evaluation.

During the analysis stage, the characteristics of the target audience were examined, and students' needs regarding reading skills were identified. In the design stage, the content structure was created in line with the learning outcomes, storyboards related to the materials to be developed were prepared, and the design principles to be used were determined. In the development stage, animation-, audio-, and text-based materials were produced using various digital tools and software. In the implementation stage, the developed materials were piloted with primary school students, and feedback regarding the implementation process was collected. In the evaluation stage, both the development process and the produced materials were examined in terms of functionality, usability, and meeting students' needs, and necessary revisions were made in line with the feedback obtained. As a result, it is thought that the digital materials developed based on the ADDIE instructional design model may provide effective and functional resources for supporting primary school students' reading skills.

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Keywords: Reading Skills, Digital Materials, ADDIE

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Needs Analysis for the Online Monitoring and Evaluation of Primary School Students' Reading Skills*

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Reading skill is one of the fundamental skills that plays a significant role in an individual's academic, social, and cognitive development. Today, with technological developments, reading processes have gone beyond being individual activities carried out only through printed materials; they can now be performed in different ways through digital environments, audio content, and interactive applications. However, sustaining reading habits and supporting individuals' intrinsic motivation toward reading remain important necessities. Especially during the primary school period, it is important to regularly monitor students' reading processes, evaluate their reading comprehension levels, and develop applications that support students' interest in reading. In this context, it is thought that online systems developed by utilizing technological opportunities may contribute to the monitoring and evaluation of the reading process.

The aim of this study is to determine the requirements for the online monitoring and evaluation of primary school students' reading skills. In addition, it was aimed to identify the features that should be included in an online monitoring and evaluation system to be developed. In the study, a qualitative research method was adopted, and a semi-structured interview technique was used during the data collection process. The participants of the study consisted of 8 classroom teachers and 3 school administrators. The semi-structured interview form used as the data collection tool was revised in line with expert opinions. One of the example questions included in the interview form was: "How do you monitor students' book reading processes?" As a result of the study, in line with the views of classroom teachers and school administrators, the requirements regarding the features that should be included in an online system to be developed for monitoring the books read by primary school students and evaluating their reading comprehension levels were revealed.

* This study was supported by The Scientific and Technological Research Council of Türkiye (TÜBİTAK) under Project Number 123K618.

Keywords: Reading Skills, Online Monitoring And Evaluation, Needs Analysis

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Examining Changes in Pre-Service Elementary Mathematics Teachers' Perceptions of Gifted Learners and Mathematics Instruction for Gifted Learners through Metaphor Analysis

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The aim of this study is to examine changes in pre-service elementary mathematics teachers' perceptions regarding gifted learners and the process of mathematics instruction for gifted learners through metaphor analysis. The study was conducted with 22 senior pre-service teachers enrolled in the Elementary Mathematics Teacher Education Program at the Faculty of Education of a public university located in the Western Black Sea Region and taking the course Mathematics Education for Gifted Learners, which was instructed by the researcher. The theoretical component of the course focused on the cognitive developmental characteristics of gifted individuals, their learning pace, problem-solving tendencies, affective needs, and identification processes. In addition, various pedagogical discussions were conducted within the framework of differentiated instruction practices, enrichment approaches, layered curriculum designs, and creativity-based learning perspectives. During the implementation phase, pre-service teachers were divided into four working groups and developed as well as implemented mathematics activities for middle school gifted learners studying at the Science and Art Center (BİLSEM). The activities incorporated mathematical modeling problems, STEM-based tasks, gamification-based activities, and dynamic geometry software applications. Each group implementation lasted approximately two class hours. Throughout the process, pre-service teachers gained experience in designing instructional activities, observing student responses, and reconsidering instructional practices.

The data were collected through Google Forms consisting of metaphor-based open-ended questions designed to identify participants' views before and after the implementation process. Participants were asked to explain the concepts of gifted learners, mathematics instruction for gifted learners, the activity design process, students' mathematics learning experiences, and teacher roles by using metaphors. Particular attention was paid to maintaining the same design before and after the implementation so that metaphors could be compared across identical dimensions in both phases. The qualitative data were analyzed using MAXQDA 2022 software. During the analysis process, the data were first coded, and thematic structures were subsequently developed according to similar meaning patterns. Relationships among codes were examined through various visualization tools, and changes in metaphorical perceptions were evaluated from a holistic perspective.

The findings revealed that prior to the implementation process, pre-service teachers predominantly conceptualized gifted learners as valuable entities waiting to be discovered (e.g., pearl, diamond, gold, gemstone), whereas learning processes were perceived as rapidly functioning systems (e.g., running horse, flowing river). Following the implementation, these metaphors largely shifted toward representations emphasizing inquiry and deeper understanding (e.g., diver, sapling, labyrinth). Moreover, perceptions of teacher roles moved from that of a knowledge transmitter toward a facilitator guiding the instructional process. However, some participants continued to maintain technical and mechanical perspectives together with authoritarian teacher perceptions independent of the experiential process. These findings suggest the indispensable role of structured practical experiences in fostering pedagogical awareness. In this regard, the study is expected to provide practice-oriented and

multidimensional contributions to teacher education processes in the field of mathematics education for gifted learners.

Keywords: Gifted Learners, Mathematics Education for Gifted Learners, Metaphor Analysis, Pre-Service Teachers

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Adaptation Study of the Artificial Intelligence Motivation Scale into Turkish

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As artificial intelligence continues to rise as one of the most interesting technological products of our time, its widespread use in education is important for making teaching engaging and effective. In this study, the aim was to adapt the Artificial Intelligence Motivation Scale (AIMS), developed by Jiajing Li et al. (2025) and consisting of 20 items with a 7-point Likert scale, into Turkish. The scale aims to determine the motivation of university students regarding artificial intelligence. The sample of the study consists of 537 university students studying in the faculty of education at a university located in western Türkiye who are willing to participate in the study. The sample was determined using a convenient sampling method based on accessibility. Originally grouped into five factors—intrinsic motivation, identified regulation, introjected regulation, external regulation, and amotivation—the scale was adapted into a five-factor model, consistent with the original. Analysis of the research data revealed a Cronbach's alpha internal consistency coefficient of 0.82. The average AI motivation score of the university students in the sample, using a 7-point Likert scale, was calculated as 4.16. This value indicates that university students have a moderate level of motivation towards artificial intelligence. In the goodness-of-fit assessment, threshold values of ≥ .90 for CFI and TLI, and ≤ .08 for RMSEA and SRMR were used, and the CFI (.953) and TLI (.942) values for the five-factor model were found to meet these thresholds. AVE values (.700–.889) for all five dimensions exceed the standard acceptance threshold of 0.50. The highest AVE value was observed in the Intrinsic Motivation dimension (.889), and the lowest value in the Extrinsic Regulation dimension (.700). When all findings are evaluated together, it is seen that each dimension of AIMS exhibits high convergent validity. In light of all these evaluations, it was concluded that the five-factor AIMS model validates the factor structure of the original scale to an acceptable degree in the sample of Turkish university students studying in the faculty of education.

Keywords: Artificial Intelligence, Education Faculty Student, Motivation, Scale Adaptation

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Evaluating the Suitability of Digital Materials on Light Reflection and Colors with the React Strategy

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This study aimed to evaluate the suitability of digital materials prepared for the sixth-grade Science lesson's "Reflection of Light and Colors" unit, enriched with meta-conceptual activities, for the REACT strategy. For this purpose, three materials were prepared using genially.com, Chat GPT, and Canva applications. The prepared materials were designed to enable interactive student participation and collaboration in the classroom. Worksheets containing questions that reveal students' prior knowledge and are suitable for the "meta-conceptual awareness," "meta-conceptual monitoring," and "meta-conceptual evaluation" processes were prepared during the application of the digital materials. A "Material Evaluation Form" was prepared by the researchers to conduct the evaluation. This form includes items evaluating the suitability of the material for the REACT strategy, its suitability for meta-conceptual activities, and its applicability in the classroom. The items evaluating the suitability of the material for the REACT strategy were prepared in accordance with the characteristics of the strategy's stages: association, experiencing, application, collaboration, and transfer. The items evaluating the suitability of the material for meta-conceptual activities were prepared in accordance with the meta-conceptual awareness, meta-conceptual monitoring and meta-conceptual evaluation processes. After the material evaluation form was prepared, the opinions of three field experts were obtained to ensure its validity. After the expert opinions, the final form was given with the necessary adjustments. The materials prepared according to the REACT strategy enriched with meta-conceptual activities were submitted to the evaluation of ten (10) researchers who are experts in the field of science education with the same characteristics, using the evaluation form. In order to examine the reliability of the rubric in the evaluation process, the scores given by the field experts were compared and analyzed, and after the necessary adjustments were made, it was made ready for use by science teachers.

Keywords: Colors, Digital Materials, Light Reflection, Meta-conceptual Activities, REACT.

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Gamification and Digital Tools as Means of Engaging Students in Scholarly Publishing Activities

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The report examines ways of engaging Ukrainian school students in scholarly publishing activities as a component of modern research-oriented education within the context of the digitalization of the educational environment. The relevance of the topic is determined by the need to develop students' research, informational, academic, and communication competencies, as well as by the necessity of integrating them into authentic practices of scholarly communication. Particular attention is paid to the role of gamification and digital tools in increasing student engagement in publishing activities.

The author's model for engaging students in scholarly publishing activities is presented through the lens of structural and systemic gamification. First, the model creates a sense of progression, allowing students not only to prepare and publish an article but also to follow a clear developmental trajectory: completing an author training course, submitting a manuscript, undergoing peer review, publishing the work, progressing to the role of reviewer, and eventually to that of editor. Second, the model provides a tangible social outcome, as publication in a journal is a much stronger motivator than a conventional grade. This feature aligns the proposed model with international educational practices, in which audience authenticity and participation in authentic editorial practices are considered key factors in student engagement. Third, the model combines gamification with a digital record of activity: Moodle tracks teachers' progress, NEO LMS enables students to earn points, badges, certificates, and leaderboard positions, while OJS transforms preparatory activity into a publicly visible result. Thus, these digital tools do not duplicate one another; rather, they function as interconnected levels within a unified ecosystem. The neurophysiological basis of student motivation helps explain the observed outcomes; consequently, gamification functions not as mere "entertainment," but as a means of organizing an emotionally meaningful learning experience. Unlike many contemporary studies on gamification in education, which may produce undesirable effects ranging from demotivation to decreased performance, the author's model avoids this limitation because its primary "reward" is participation in authentic research practice rather than the accumulation of points.

The study demonstrates that teacher preparation is a critical factor in the successful implementation of this model. Experimental results indicate that without dedicated methodological training, teachers are unable to effectively moderate students' participation in editorial and peer-review processes. The paper presents findings that confirm positive dynamics in the development of students' readiness for scholarly publishing activities. The most significant improvement was observed in organizational, informational, and academic competencies, as well as in critical thinking skills.

It was demonstrated that the outcomes of the OJS journal Young Researcher provide grounds for viewing it not merely as a platform for publishing texts, but as an instrument for developing a student culture of scholarly communication. Particular emphasis is placed on the importance of an open student journal as an authentic educational environment in which students participate not only as authors, but also as reviewers and contributors to editorial interaction.

The study concludes that the integration of digital tools and gamified approaches into research-oriented education creates an effective framework for the development of

students' research culture, academic integrity, critical thinking, and engagement in contemporary open science practices.

Keywords: Gamification; Digital Tools; Scholarly Publishing; Research-oriented Education.

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Sustainable AI Use to Transform Teaching: Design and Evaluation of a Blended Professional Development Programme

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As artificial intelligence becomes increasingly present in educational settings, a pressing question faces teacher educators: how can structured professional development move practising teachers from initial AI awareness toward confident, responsible, and sustainable classroom use? This paper addresses that question through the design, delivery, and evaluation of a seven-week blended programme — Sustainable AI Use to Transform Teaching — conducted with practising primary and secondary educators in Almaty, Kazakhstan.

The programme was built around a purpose-designed nine-domain AI competency framework covering AI literacy, prompting and task design, AI-enhanced learning design, student-facing AI use, assessment, tool integration, ethics, professional growth, and reflective practice. Its core pedagogical principle was practice-first: every week, participants were required to apply that week's content to an actual lesson in their own subject, producing a concrete artefact rather than a reflective summary. Synchronous live sessions provided conceptual framing and worked examples; asynchronous platform activities carried the application work. The programme culminated in a full AI-integrated lesson plan — including prompts used, materials produced, and a responsible-use rationale — submitted for structured peer review against a five-criterion rubric.

The evaluation employed a mixed-methods design. Participant competency was tracked through a nine-domain self-assessment instrument administered before and after the programme, where each domain was mapped to a five-level progression from Awareness to Leadership. Final projects were assessed by peers using a structured rubric. Participant experience was captured through satisfaction surveys at mid-course and programme end, and open-ended feedback was systematically coded for recurring themes.

Findings indicate meaningful self-reported competency growth across all nine domains, with the strongest gains in applied areas — AI-assisted instructional design and the organisation of student AI use to support critical thinking. Participant satisfaction was consistently high. Qualitative analysis surfaced recurring tensions around workload, access to AI tools, and the theory–practice balance, pointing to structural conditions that shape engagement in short-cycle PD.

This study contributes an empirically evaluated curriculum model for building AI teaching competency in practising educators, alongside evidence of what enables and constrains that development. The findings speak to a growing need for scalable, practice-centred PD approaches that can close the gap between AI's availability in schools and teachers' readiness to use it purposefully.

Keywords: Teacher Professional Development; AI Literacy; Blended Learning; AI Integration in Education; Competency Self-assessment; Mixed Methods

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Children's Mental Models of Generative AI in Upper Elementary Classrooms: A Case Study

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The growing integration of Generative Artificial Intelligence (GenAI) into educational environments has intensified interest in how younger learners understand and interpret AI-powered technologies. While prior research has largely focused on the effectiveness of educational chatbots in supporting engagement and learning outcomes, considerably less attention has been devoted to how children conceptualize artificial intelligence itself through classroom interaction. This qualitative case study investigates the mental models and emerging AI literacy of upper elementary students (ages 10–11) during sustained interaction with a customized educational chatbot in an authentic classroom setting in Greece. Drawing on semi-structured interviews, open-ended questionnaire responses, and classroom observations, the study explored how students understood AI, how these understandings evolved through interaction, and which misconceptions persisted throughout the intervention. The findings indicate that students' understandings of AI were dynamic, developmental, and frequently hybrid, combining anthropomorphic, functional, and emerging technological interpretations. Although chatbot interaction appeared to support initial forms of conceptual refinement, many students continued to attribute human-like characteristics, authority, and intelligence to the system. At the same time, some learners began demonstrating early forms of critical awareness by questioning the reliability and limitations of chatbot responses. The findings further suggest that educational chatbot interaction may function not only as an instructional support, but also as a form of cognitive and conceptual mediation through which learners actively negotiate meaning regarding AI systems themselves. Importantly, the study highlights that interaction with AI alone is insufficient for fostering coherent and critical understanding. Rather, pedagogical mediation, guided inquiry, and developmentally appropriate scaffolding emerged as central for supporting conceptual change and early AI literacy. Overall, the study contributes to current discussions on AI integration in primary education by foregrounding the importance of conceptual understanding, epistemic reflection, and teacher mediation in children's engagement with educational AI systems.

Keywords: Generative Artificial Intelligence, AI Literacy, Educational Chatbots, Mental Models, Conceptual Change, Primary Education, Qualitative Case Study, Human–AI Interaction, Educational Technology

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Where AI Helps and Where It Harms: EFL Preparatory Students' Stage-Specific Ethical Perceptions of Generative AI Use in a Hybrid Writing Environment

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The rapid adoption of generative artificial intelligence (AI) tools in higher education has intensified debates about academic ethics, particularly in English as a Foreign Language (EFL) writing instruction where authentic skill development and language acquisition are central pedagogical aims. Existing research typically frames student AI use as a binary phenomenon — acceptable or unacceptable — yet little is known about how EFL learners differentiate their ethical judgements across specific writing process stages, especially in hybrid learning contexts where digital assignment submission makes AI use structurally convenient and difficult to monitor.

This mixed-methods study investigated the stage-specific ethical perceptions of EFL preparatory students toward generative AI use across ten sequential writing stages, and examined the qualitative reasoning underpinning those perceptions.

A total of 323 EFL preparatory students from two Turkish universities — Muğla Sıtkı Koçman University (n=268) and Aksaray University (n=55) — participated in a structured survey comprising a ten-item ethical permissibility checklist (Yes/No/Hesitant), an AI tool and purpose profile, and two open-ended justification questions. Quantitative data were analysed using descriptive statistics, Bonferroni-corrected chi-square tests (adjusted α=.005), and non-parametric group comparisons (Mann-Whitney U; Kruskal-Wallis H). Open-ended responses (n=283 acceptance; n=228 objection) were subjected to hybrid inductive-deductive thematic content analysis with inter-rater reliability established via Cohen's Kappa.

Results revealed a consistent permissibility gradient: ethical acceptance was highest at technical peripheral stages (proofreading: 81.4%; research guidance: 80.2%) and declined monotonically toward authorial stages (complete essay writing: 49.2%), the only stage approaching equal acceptance and rejection. No statistically significant institutional differences emerged across any writing stage (all p>.005), indicating cross-contextual consistency. Students who used AI for educational purposes demonstrated significantly higher permissibility scores than non-educational users (U=2640.00, p=.006). Qualitative analysis identified that students' dominant objections were grounded in a learning ethic, concern for developmental harm, rather than rule-based compliance, with academic dishonesty ranking fifth among eight objection themes. An emergent temporal primacy principle was identified: AI assistance is deemed most acceptable when it follows rather than precedes substantive independent student work.

EFL preparatory students hold a coherent, stage-sensitive ethical framework for AI use in writing. Rather than treating AI use as globally acceptable or unacceptable, they draw implicit boundaries tied to the degree of authorial displacement. These findings call for stage-sensitive AI policy design, AI literacy curricula that engage students' existing developmental concerns, and process-oriented assessment designs in hybrid learning environments that make the temporal sequence of student engagement visible and verifiable, and reframe AI literacy as a developmental rather than compliance-oriented concern.

Keywords: Generative AI, EFL Writing, Academic Ethics, Writing Process Stages, Hybrid Learning, Permissibility Gradient, AI Literacy

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Cognitive Alignment in Online Teaching Based on the Revised Bloom's Taxonomy A quasi-experimental study using transcript analysis in higher education

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In online higher education, the central issue is no longer merely access to technology or the delivery of content, but rather the cognitive quality of teaching and its capacity to activate deep learning. Despite the expansion of learning analytics, most studies have continued to focus on behavioral indicators or superficial forms of interaction, and relatively few empirical investigations have analyzed instructional discourse as an indicator of the cognitive quality of teaching. Present study combined the revised Bloom's taxonomy, Transcript-Based Lesson Analysis (TBLA), and learning management system (LMS) data to examine whether cognitively redesigned online teaching could improve the cognitive level of instructional discourse and students' multidimensional performance.

The study employed a quasi-experimental pretest–posttest design with repeated measures and was conducted with 25 master's students at a fully online university. Classroom transcripts from synchronous sessions were recorded and coded according to Bloom's cognitive levels. At the same time, students' behavioral and performance data—including grades, LMS participation, problem-based activities, time-on-task, and educational interactions—were collected and analyzed as composite indicators. To assess the cognitive quality of teaching, the Cognitive Teaching Index (CTI) and the Higher-Order Ratio (HO Ratio) were calculated.

The findings showed that, following the intervention, instructional discourse shifted significantly from lower-order cognitive levels toward analysis, evaluation, and creation. The mean CTI increased from 2.91 to 3.43, and the proportion of higher-order utterances rose from 42.8% to 52.0%. At the same time, the composite student performance index and the engagement index showed a significant increase with a large effect size ($p < .001$). In addition, test scores, LMS participation, problem-oriented questions, use of interactive tools, and time-on-task all improved.

These findings suggest that the quality of online learning is not determined solely by technological infrastructure, but also by the level of cognitive demand embedded in teaching discourse. By operationalizing the cognitive quality of teaching through transcript analysis, this study offers a data-driven framework for analyzing and redesigning online instruction. It further shows that classroom transcripts can serve not merely as records of interaction, but as a mechanism for monitoring and improving learning quality in higher education.

Keywords: Online Learning; Higher Education; Revised Bloom's Taxonomy; Transcript-based Lesson Analysis; Community of Inquiry; Constructive Alignment; Learning Analytics; Teaching Quality; Student Engagement;

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From Enjoyment to Cognitive Buoyancy: A Conceptual Framework for Foreign Language Learning Resilience in Human-AI Interaction

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Purpose. The integration of generative artificial intelligence into language education has accelerated faster than the field's theoretical and pedagogical capacity to interpret it. Existing scholarship has treated AI either as a cognitive tool — evaluated against learning gains and skill development — or as an affective context — evaluated against engagement and enjoyment — yet the lived experience of the language learner unites these strands. The present study advances a conceptual framework, the AI-mediated Enjoyment-Resilience Pathway (AERP), to articulate the affective-cognitive sequence through which human-AI interaction in language learning environments may build, or fail to build, learner resilience. The study addresses the ICETOL 2026 theme directly by asking how language educators can engineer durable resilience in learners whose daily affective-cognitive ecology is increasingly mediated by artificial agents.

Methodology. This is a conceptual contribution rather than an empirical investigation. The framework integrates five theoretical traditions in second language acquisition and educational psychology — Foreign Language Enjoyment (Dewaele & MacIntyre, 2014), broaden-and-build theory (Fredrickson, 2001), academic buoyancy (Martin & Marsh, 2008), self-determination theory, and control-value theory — and brings them into explicit dialogue with the classical SLA interactionist tradition (Krashen, 1982; Long, 1996; MacIntyre et al., 1998), task-based language teaching (Ellis, 2003), language teacher psychology (Mercer & Kostoulas, 2018), and the emerging literature on cognitive offloading. The framework yields five testable propositions and a prototypical experimental matrix triangulating behavioural, process, and verbal-report measures for future empirical operationalisation.

Key theoretical contributions. The framework articulates a sequential pathway from AI design affordances through Foreign Language Enjoyment, the broaden phase, the build phase, and ultimately L2 academic buoyancy. Its central analytical move is the identification of two related failure modes. The build short-circuit occurs at the broaden-to-build transition: AI-mediated learning produces enjoyment and apparent cognitive expansion but does not consolidate experiences into durable learner resources because the resources accumulate in the AI rather than in the learner. The safety-degeneration risk occurs at the sandbox-to-stage transition: consolidated resources remain locked in the low-stakes AI environment rather than transferring to human L2 interaction. A third risk, cognitive contamination, arises when learners uncritically absorb AI errors or hallucinations in high-enjoyment states. The framework re-theorises social-AI Foreign Language Enjoyment as a low-stakes incubation zone for human interaction rather than a substitute for it, positions the language teacher as a metacognitive orchestrator, and identifies six cross-cutting moderators including digital capital and critical AI literacy.

Implications. For language educators, the framework specifies three orchestration moves — AI-mediated debriefing, sandbox-to-stage transitions with fading scaffolding, and protection of both the teacher-learner bond and learner critical AI literacy — as the principal mechanisms preventing the two pathological pathways. For AI tool designers, it argues for target-task authenticity in the TBLT sense, recovery-aware design, and embedded metacognitive scaffolding. For policymakers, it supports infrastructure-aware and resilience-oriented assessment frameworks. The framework offers educators, designers, and

researchers a diagnostic instrument for asking where, along an identifiable affective-cognitive pathway, an AI-mediated language learning intervention is succeeding or failing in its contribution to durable learner resilience under conditions of uncertainty.

Keywords: Foreign Language Enjoyment; Academic Buoyancy; Broaden-and-build; Cognitive Offloading; Human-AI Interaction; Willingness To Communicate; Language Learning Resilience; Critical AI Literacy

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Natural or Artificial Intelligence? How Generative AI Transforms the Role of Higher Education Faculty

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The rapid proliferation of generative AI systems fundamentally challenges established conceptions of academic teaching (Miao & Holmes, 2023; Urmeneta & Roméro, 2024). Prior research has primarily focused on the effects of AI on student learning outcomes and assessment integrity (Kasneci et al., 2023). So far there has been a lack of empirical work examining how faculty members conceptualize and experience this transformation from their professional point of view (Mah & Groß, 2024). Especially faculty at distance learning institutions remain an underexamined population in the context of AI in education. Digitally mediated teaching, spatial distance, and learner heterogeneity are structural features and influence the perception and navigation of AI-induced role change (Sanders & Mukhari, 2024; Mah & Groß, 2024).

This study investigates how higher education faculty understand the transformation of their professional role under the influence of generative AI. Drawing on research of role identity studies in digitally mediated higher education (Blumentritt et al. 2019, 2020; Markgraf et al. 2024; Schwinger et al. 2022), it aims to examine the role dimensions and perceived changes.

Data were generated through a structured think tank session involving 17 faculty members from diverse disciplinary backgrounds at a German distance learning university of applied sciences. The two-hour session was recorded and complemented by collaborative digital artifacts. Transcripts and materials were analyzed using the Gioia methodology, a qualitative inductive approach that moves from participant-near first-order concepts through second-order themes to aggregate theoretical dimensions (Gioia et al., 2012). This method was chosen for its particular suitability in capturing how practitioners make sense of the occuring changes (Langley & Abdallah, 2011).

During the analysis, 30 first-order concepts, eight second-order themes, and finally four aggregate dimensions were created: (1) the epistemic transformation of teaching practice, (2) relational teaching and social-normative role modeling, (3) the institutional reordering of authority and assessment, and (4) the emergence of new meta-competencies in AI-mediated higher education. Findings reveal that faculty do not primarily perceive AI as a threat to their professional relevance. They rather describe it as a catalyst accelerating a shift from knowledge transmission toward learning facilitation, curation, and the cultivation of independent thinking. At the same time, tensions around eroding epistemic authority are noted which lead to the necessity of redesigning valid assessment formats. AI literacy should be considered as a new core competency.

The study contributes an empirically grounded structural model of faculty role transformation in the age of generative AI. Distance learning institutions, with their established culture of digital facilitation, may serve as instructive forerunners for broader higher education transformation. Institutions are recommended to develop clear AI governance frameworks, invest in faculty development programs addressing both technical and pedagogical AI competencies, and foster an open reflective teaching culture that positions AI as an integral — and critically examined — part of academic practice.

Keywords: Faculty Role Transformation, Generative AI, Higher Education, Gioia Methodology, AI Literacy, Distance Learning, Qualitative Research

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Sociological Metacognition, Artificial Intelligence and Learning in an African Context: Theoretical framework, empirical study and proposals for experimentation

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This paper presents a theoretical framework articulating sociological metacognition, constructivism and artificial intelligence (AI) in African educational contexts, grounded in an original empirical study conducted at ESP/UCAD (Dakar, Senegal). Drawing on Vygotsky, Bourdieu, Bernstein and African NLP research, we show that metacognition is a socially distributed practice, unequally accessible depending on sociolinguistic backgrounds. Analysis of the TranspoBot project data (N=22 groups, ~110 students, L3 GLSi) empirically demonstrates that explicit metacognitive regulation is the strongest predictor of academic performance in an AI-integrated learning environment ($r = 0.973$, $p < 0.001$). Based on these findings, three experimental proposals (EP1–EP3) are formulated to test the effects of AI tutoring in national languages, augmented collective metacognition, and equitable algorithmic adjustment, in Senegalese, Ivorian and Cameroonian institutions.

Keywords: Metacognition; Sociological Constructivism; Artificial Intelligence; Learning; Sub-Saharan Africa; National Languages; Digital Sovereignty; Text-to-SQL; Educational Inequalities

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Human-Centered Agentic AI for Adaptive Language Learning in Secondary Education

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The rapid integration of generative artificial intelligence into education has created new opportunities for personalized learning, adaptive feedback, and learner autonomy. At the same time, it has raised significant concerns regarding pedagogical quality, curriculum alignment, data privacy, cognitive overload, and the replacement of meaningful teacher guidance by purely automated systems. This paper introduces a human-centered framework for teacher-orchestrated agentic AI in secondary language education, developed within the context of the Innovation Education Institute (IEI) and an emerging AI-supported learning platform for European schools.

The study presents the conceptual design and pedagogical architecture of an adaptive AI-assisted language learning ecosystem designed for lower and upper secondary education, with an initial focus on English language learning aligned to the Bavarian Gymnasium curriculum (G9). Unlike many current AI-based educational applications that rely primarily on generalized conversational models, the proposed approach combines curriculum-based instructional design, structured progression models, multimodal microlearning, gamification principles, and teacher-controlled AI orchestration.

The framework integrates adaptive grammar and vocabulary support, contextualized communication tasks, differentiated scaffolding, formative assessment, learner reflection tools, and emotionally aware support mechanisms designed to increase learner engagement and sustainable motivation. Special attention is given to maintaining teacher agency and educational transparency while leveraging AI-supported personalization. The system architecture also incorporates principles of responsible and ethical AI, including GDPR-conscious data minimization, explainability, human oversight mechanisms, and age-appropriate design principles suitable for European educational contexts.

Methodologically, the paper employs a design-based research approach combining educational theory, instructional systems design, curriculum analysis, and iterative AI-supported prototyping. The study explores how agentic AI systems can support individualized learning pathways without undermining curricular coherence or pedagogical consistency. In addition, the paper examines the emerging role of AI as a collaborative educational assistant rather than an autonomous instructional replacement. Particular emphasis is placed on balancing personalization with learner wellbeing and preventing passive dependency on AI-generated outputs through reflective and metacognitive learning strategies.

The proposed framework contributes to current discussions on AI-augmented learning environments by positioning teachers as central orchestrators of adaptive educational ecosystems. The paper argues that future-ready educational AI systems should not merely optimize efficiency or automate instruction, but instead strengthen learner motivation, cognitive engagement, wellbeing, and meaningful human-centered educational relationships. Furthermore, the study discusses how AI-supported educational systems can contribute to resilience, multilingual learning, critical thinking, intercultural competence, and self-regulated learning in uncertain educational contexts. The paper ultimately proposes a scalable European model for responsible educational AI that combines technological innovation with pedagogical rigor, ethical governance, and inclusive learner-centered design principles suitable for formal schooling and lifelong learning contexts.

Keywords: Generative AI in Education; Agentic AI; Human-Centered AI; Adaptive Learning; Language Learning Technologies; AI-Supported Language Learning; Teacher-Orchestrated AI; Personalized Learning; Educational Technology; Secondary Education; Digital Pedagogy; Curriculum-Aligned AI; Ethical AI in Education; GDPR And Educational AI; Gamification; Multimodal Learning; Design-Based Research; AI-Augmented Learning; Learner Wellbeing; Self-Regulated Learning; AI Literacy; Future-Ready Education; Responsible Educational Technology

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Emotionally Aware AI in Secondary Education: Motivation, Wellbeing, and Teacher Agency

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The increasing integration of generative artificial intelligence into educational environments is transforming how learners interact with digital systems, receive feedback, and experience personalization. While AI-driven educational technologies offer considerable potential for adaptive learning and learner support, they also raise important pedagogical and psychosocial concerns regarding learner wellbeing, emotional dependency, reduced self-regulation, cognitive overload, and the erosion of meaningful teacher-student relationships. This paper explores the concept of emotionally aware AI learning environments as a human-centered approach to educational technology design in secondary education.

Developed within the context of the Innovation Education Institute (IEI) and an emerging AI-supported educational ecosystem for European schools, the study investigates how emotionally responsive AI systems can support learner motivation, engagement, and reflective learning without replacing teacher agency or authentic pedagogical relationships. The proposed framework combines adaptive AI support with curriculum-aligned instructional design, multimodal learning strategies, gamification principles, and teacher-orchestrated interventions. Particular emphasis is placed on the role of AI as a supportive educational assistant rather than an autonomous authority or emotionally substitutive system.

The paper discusses how emotionally aware AI environments may identify motivational barriers, support differentiated learning pathways, encourage reflective learning behaviors, and reduce learner frustration through context-sensitive scaffolding and adaptive interaction patterns. At the same time, the study critically examines ethical risks associated with emotionally responsive AI systems, including over-personalization, emotional manipulation, passive dependency, privacy concerns, and the commercialization of learner data.

Methodologically, the paper follows a design-based research approach integrating educational psychology, human-computer interaction, instructional design, and AI-supported prototyping. The framework is particularly situated within European educational contexts emphasizing GDPR-conscious design, ethical AI governance, educational transparency, and human oversight mechanisms. Special consideration is given to balancing technological personalization with learner autonomy, wellbeing, critical thinking, and sustainable motivation.

The study contributes to current discussions on responsible educational AI by proposing a human-centered model for emotionally aware learning systems that strengthens rather than replaces pedagogical relationships. The paper argues that future educational AI systems should be designed not only for efficiency and personalization, but also for emotional sustainability, learner wellbeing, resilience, and meaningful human interaction. The findings are relevant for researchers, educators, policymakers, and educational technology developers seeking ethical and psychologically informed approaches to AI integration in formal education.

Additionally, the paper explores the importance of preserving authentic human interaction and social-emotional development in increasingly AI-mediated learning environments. The study discusses how emotionally aware educational AI can support inclusive and differentiated learning experiences for diverse learner profiles while avoiding the risks of emotional overreliance on digital systems. Particular attention is given to fostering self-efficacy, metacognitive awareness, and healthy digital learning habits among adolescents.

The framework further examines multilingual and intercultural dimensions of emotionally responsive AI systems within European educational contexts and argues for a balanced integration of technological innovation, pedagogical responsibility, and learner wellbeing in future-ready educational ecosystems.

Keywords: Emotionally Aware AI; Human-Centered AI; AI in Education; Educational Technology; Learner Wellbeing; Digital Wellbeing; Secondary Education; Personalized Learning; Adaptive Learning; Teacher Agency; Educational Psychology; AI-Supported Learning; Responsible AI; Ethical AI in Education; Human-Computer Interaction; Motivation in Learning; Gamification; Reflective Learning; Self-Regulated Learning; AI Literacy; Inclusive Learning; European Educational Technology; GDPR And Educational AI; Design-Based Research; Pedagogical

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Interweaving Art, Culture, and Health Promotion: Visual Narratives and Newspaper Editing as a Dialogical Learning Methodology

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Background: Traditional models of health education training often present limitations in engaging and connecting with the realities of school students, requiring methodologies that integrate subjectivity and territory into learning processes. This study analyzes a formative experience based on the production of visual narratives and newspaper editing, developed within the scope of a health education project grounded in dialogical and critical pedagogical perspectives, articulating art, culture, and collective production as a learning methodology.
Methodology: Using a qualitative, exploratory, and descriptive approach, the experience was carried out across four Brazilian states, involving 15 municipalities and 5 administrative regions of the Federal District. The course was structured through video classes, with a total workload of 16 hours organized into three modules, each resulting in original productions that were later systematized into collective artistic catalogues.
Results: The findings demonstrate the development of critical thinking and the active participation of 1,250 school students. The use of art as a pedagogical tool enabled the problematization of complex and cross-cutting issues, such as health promotion, social inequalities, and the exercise of citizenship, translating technical knowledge into situated and sensitive productions. Digital mediation expanded the accessibility and reach of the proposal, establishing a favorable relationship between cost and coverage. Furthermore, the dynamics of knowledge dissemination contributed to broadening the impact of the experience across the territories involved.
Conclusion: Visual narratives act as powerful mediators of learning processes, contributing to innovative, participatory educational practices oriented toward health promotion.

Keywords: Visual Narratives; Art; Health Education; Dialogical Learning; Educational Technology

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Agency of School and University Students from Ukraine and Poland in Interaction with Artificial Intelligence

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The rapid spread of generative artificial intelligence in educational environments raises questions not only about young people's digital competence but also about the preservation of their agentic position in learning. The use of AI tools may enhance students' autonomy, support idea generation, structuring, feedback, and self-directed learning. At the same time, it may create risks of excessive delegation of intellectual activity, reduced critical thinking, loss of authorship, and dependence on algorithmically generated responses. In this context, the study of young people's agency in interaction with artificial intelligence becomes particularly relevant.

The aim of the study is to conduct a comparative analysis of the agency of school and university students in Ukraine and Poland when using artificial intelligence tools in educational activities. The theoretical basis of the study is Albert Bandura's social cognitive theory of human agency, which holds that human agency is manifested through intentionality, forethought, self-reactiveness, and self-reflectiveness. In this study, these components are interpreted as a young person's ability to use artificial intelligence purposefully, to understand the educational, ethical, and personal consequences of its use, to regulate the process of completing learning tasks, and to critically evaluate both AI-generated outputs and one's own contribution to their creation.

To investigate this issue empirically, a questionnaire was developed containing blocks of questions theoretically related to the main dimensions of agency identified by Bandura. The questionnaire is designed to reveal the purposes of AI use, the nature of interaction with AI tools, the level of independence in completing learning tasks, the ability to verify and critically assess AI-generated responses, and respondents' attitudes toward authorship, responsibility, and ethical boundaries in the use of artificial intelligence. The study involves comparing responses from Ukrainian and Polish participants and analyzing possible differences between school and university students.

The study's expected results will enable the identification of typical models of young people's interaction with artificial intelligence, ranging from instrumental, critically controlled use to partial or excessive delegation of learning activities to AI. Particular attention will be paid to differences in self-regulation, reflectiveness, and awareness of responsibility for learning outcomes. The comparative Ukrainian-Polish context will allow us to outline both common trends and specific features in the formation of young people's agency amid the digital transformation of education.

The practical significance of the study lies in the possibility of using its results to develop pedagogical approaches that support responsible, critical, and agentic use of artificial intelligence in education. The findings may be useful to teachers, university lecturers, educational policymakers, and researchers working on digital transformation, academic integrity, the development of critical thinking, and learner agency.

Keywords: Artificial Intelligence in Education; Student Agency; Learner Agency; Generative Artificial Intelligence; Social Cognitive Theory; Self-regulation; Self-reflection; Academic Integrity; Digital Transformation of Education; Ukraine; Poland.

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Teaching Students to Think with AI for Responsible Generative AI use in Programming Education

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Generative artificial intelligence (GenAI) is influencing how students learn, practise, and demonstrate programming knowledge. GenAI tools such as ChatGPT, GitHub Copilot, and other large language model-based systems can generate code, explain programming concepts, debug errors, suggest alternative solutions, and provide immediate feedback during programming tasks. While these tools create important opportunities to support novice programmers, they also raise concerns about overreliance, cognitive offloading, shallow understanding, and uncritical acceptance of AI-generated outputs. In programming education, the central issue is therefore not only whether students should be allowed to use generative AI, but how they can be taught to use it responsibly. This conceptual paper proposes the Think-With-AI model as a pedagogical approach for responsible generative AI use in programming education. The model is designed to guide students away from answer-seeking use of AI and toward reasoning-seeking engagement. It consists of six connected stages: Frame, Ask, Explain, Challenge, Revise, and Reflect. These stages encourage students first to understand the programming problem, ask AI for clarification or support rather than complete answers, request explanations of code logic, question and test AI-generated outputs, revise solutions using their own judgement, and reflect on what they accepted, rejected, changed, and learned. The paper argues that responsible generative AI use can support higher-order thinking when students are explicitly guided to use AI critically, creatively, and reflectively. Problem-solving can be supported when students use AI to clarify requirements, decompose tasks, debug errors, and compare strategies. Critical thinking can be supported when students verify AI outputs, identify limitations, challenge assumptions, and justify programming decisions. Creativity can be supported when students adapt, extend, or improve AI-generated ideas instead of copying them directly. The paper contributes to educational technology and online learning by offering a conceptual model that can inform programming task design, AI literacy instruction, responsible classroom practice, and future empirical research on AI-assisted programming education. It concludes that programming educators should move beyond asking whether AI should be allowed and instead focus on how students can be taught to think with AI.

Keywords: Generative Artificial Intelligence (GenAI), ; Programming Education, ; Responsible AI, ; AI Literacy, ; Higher-order Thinking Skills (HOTS)

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Preparing Future Cybersecurity Professionals Through Human-AI Collaboration: Design of an AI-Augmented SOC Learning Environment

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The growing integration of Artificial Intelligence (AI) into cybersecurity operations is transforming the skills required of future cybersecurity professionals. While AI-powered tools increasingly support threat detection, incident investigation, and security monitoring, educational approaches that prepare learners to collaborate effectively with AI in realistic operational environments remain limited. This challenge calls for new pedagogical models that combine technical cybersecurity competencies with responsible and critical use of AI technologies.

This paper presents SOC Lite, an AI-augmented educational platform designed to simulate the workflows of a modern Security Operations Center (SOC). The platform enables students to engage in authentic cybersecurity tasks, including threat analysis, log investigation, incident response, and decision-making activities supported by Generative AI tools. Rather than positioning AI as a replacement for human expertise, the platform emphasizes human-AI collaboration, encouraging learners to evaluate, validate, and refine AI-generated insights within realistic cybersecurity scenarios.

The paper describes the pedagogical rationale, instructional design principles, and technical architecture of the platform. Drawing upon experiential learning and authentic learning approaches, SOC Lite seeks to bridge the gap between classroom instruction and professional cybersecurity practice. Particular attention is given to the development of cybersecurity competencies, AI literacy, critical thinking, and responsible decision-making in technology-rich environments.

By presenting the design and implementation of an AI-augmented SOC learning environment, this work contributes to ongoing discussions regarding AI-driven innovation in education and the preparation of learners for increasingly complex and uncertain digital futures. Preliminary evaluation activities are currently underway and will inform future investigations of learning outcomes and student experiences in AI-supported cybersecurity education.

Keywords: Cybersecurity Education; Generative AI; Human-AI Collaboration; Security Operations Center; Experiential Learning; Simulation-Based Learning; AI Literacy; Higher Education; STEM Education; Responsible AI

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Are We Moving Toward Autonomous Learning Through Generative AI?

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The rapid advancement of generative artificial intelligence (AI) is profoundly transforming the educational landscape and challenging traditional teaching, learning, and assessment paradigms. Educational institutions worldwide are currently facing significant uncertainty regarding what should be taught, how knowledge should be delivered, and how learners' competencies should be assessed. This situation is largely driven by the widespread adoption of generative AI tools such as ChatGPT, Gemini, Claude, and other large language models by both educators and students. While these technologies offer unprecedented opportunities for personalized learning, content generation, tutoring, and knowledge acquisition, they also raise important questions about academic integrity, pedagogical practices, and the future role of educational institutions.

This paper examines the convergence between e-education and e-learning frameworks and the rapidly evolving capabilities of generative AI systems. It explores how these technologies can be integrated into educational environments to establish a coherent and productive collaboration between human educators and AI-powered learning assistants. Rather than considering AI solely as a disruptive force, this study investigates its potential as a catalyst for the development of innovative educational models that combine human expertise, digital learning environments, and intelligent tutoring systems based on contextualized generative AI.

By analyzing current trends and emerging practices, we propose issues where we explore the possibility of a transition towards autonomous learning models in which learners acquire knowledge independently with the support of generative AI. In parallel, we examine alternative scenarios involving AI-enhanced blended learning approaches, where teaching, assessment, certification, and learner support processes are redesigned to leverage the strengths of both human instructors and artificial intelligence. Particular attention is given to the implications of these transformations for higher education institutions and schools, including potential changes in student enrollment, physical attendance, curriculum design, and educational governance.

The study further investigates whether the increasing accessibility and effectiveness of AI-driven learning systems could reduce learners' dependence on traditional educational structures. Finally, the paper discusses the future evolution of educational institutions in an AI-driven society and proposes a conceptual framework for what may be termed "e-autonomous learning," a new paradigm in which generative AI becomes an integral component of knowledge acquisition, skills development, assessment, and lifelong learning. The findings contribute to the ongoing debate on the future of education and provide insights into how academic institutions can adapt to the opportunities and challenges created by generative AI technologies.

Keywords: Generative AI, AI in Education, Autonomous Learning, E-learning, Digital Education Transformation, Educational Innovation

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What Drives Academic Success in Open and Distance Learning? Examining the Roles of Motivation, Interaction, and Student Satisfaction

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The rapid expansion of online learning, particularly within open and distance learning (ODL) systems, has increased the need to better understand the determinants of students' academic success in digital learning environments. Although online learning offers flexibility and broader educational access, concerns remain regarding its effectiveness in supporting students' academic performance. This study aims to examine the effects of motivation and interaction on academic performance, with student satisfaction serving as a mediating variable. A quantitative explanatory research design was employed, involving 877 students from an open and distance higher education institution in Indonesia. Data were collected through a structured questionnaire using a five-point Likert scale and analyzed using Structural Equation Modeling (SEM). The findings reveal that motivation and interaction significantly and positively influence student satisfaction. Furthermore, motivation, interaction, and student satisfaction all have significant positive effects on academic performance. Mediation analysis also confirms that student satisfaction significantly mediates the relationships between motivation and academic performance, as well as between interaction and academic performance. Notably, interaction emerged as the most dominant predictor of both student satisfaction and academic performance. These findings highlight the critical role of creating interactive and satisfying online learning experiences to improve student academic outcomes in ODL contexts. The study contributes to the literature by integrating Self-Determination Theory and Expectation-Confirmation Theory to explain academic performance in online learning environments and offers practical implications for higher education institutions seeking to enhance the quality of digital learning.

Keywords: Performance; Interaction; Motivation; Student Satisfaction; Open And Distance Learning

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A Systematic Review of Inclusive Education Strategies for Identified Needs in Higher Education Institutions: Current Challenges and Future Directions

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Through this systematic review, we critically examine inclusive education practices being used for students with diagnosed needs within Higher Education Institutions (HEIs) with a focus on Azerbaijan's educational environment. Using the PRISMA framework and a thematic analysis, this research compiled data from forty-one (41) peer-reviewed articles to identify current best practices, continuing challenges and significant gaps in the existing literature (e.g., curriculum, technology integration, faculty development, institutional support). While there is an increasing commitment worldwide to develop inclusive policies for higher education, the findings show that HEIs still have a lot of challenges in implementing these strategies effectively, and these challenges are especially severe in the Azerbaijani context. instructors do not get specialized training; there are inconsistent institutional procedures; and the barriers to digital and physical accessibility still exist. Assistive technology provides excellent results in terms of student success, but these technologies continue to be underused because there is very little technological infrastructure to support using this equipment and providing enough training for faculty and students to use it. To correct the shortcomings, the paper provides colleges & universities evidence-based recommendations to create inclusive environments by developing faculty professional development, improving institutional policies & implementing assistive technology on a comprehensive level. In addition, the preliminary analysis provided several recommendations that would directly impact the policy makers in Azerbaijan, including the creation of a clearly defined national framework for students with identified needs. The findings of the study demonstrate the need for future research to go beyond preliminary needs assessments & towards longitudinal studies that will measure how these inclusive practices impact the academic & social life of the student for an extended period.

Keywords: Inclusive Education; Student Identification; Higher Education in Azerbaijan; Assessment Tools; Systems Review

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Exploring the Deployment of AI/Ml Architecture for Granular Computation of Learning Outcomes in a Foundational Online MBA Course

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Higher education institutions worldwide face increasing pressure from societal stakeholders to demonstrate meaningful and measurable graduate outcomes. Outcome-Based Education (OBE) is a pedagogical framework promoted to address these expectations. However, computing course outcome (CO) attainment, with granularity for large cohorts, is manual and taxing.

This paper explores the measurement of outcomes with Bloom's taxonomy levels for 927 questions used in formative and summative evaluation of seventy students in a foundational online MBA course. The evaluation used multiple assessment types: case-driven MCQs, concept MCQs, case-led short descriptive questions, case-led long descriptive questions and a project. The faculty spelt out course outcomes.

A tiered AI/ML architecture was deployed — from GPT-5.0/5.4 for multiple-choice questions to a course-configured Custom GPT for long-form descriptive questions to a 22-call agentic pipeline for the project. The automation outputs were iterated with the faculty.

The six Bloom's taxonomy levels and COs were mapped for each question into a matrix. The Faculty validated the CO × Bloom matrix. Each rubric element, for each question, was evaluated for the matrix using the architecture. Outcomes were computed for every student, question, question type, evaluation type and for the overall course.

Attainment of the five course outcomes for overall performance, ranged between 56% and 63% for the batch; and between 43% and 62% for the six Bloom's taxonomy verb levels. AI based outcome computation for the project was 32% lower than faculty based scores, reflecting greater realism exhibited by AI evaluation in open-ended project-based learning. Bloom's taxonomy analysis indicated lower attainment for 'evaluating' and 'creating' levels.

This architecture enables visibility into individual student and question performance, feedback on pedagogy and assessment effectiveness for students and faculty. It can inform personalized learning and enables automation for all courses. It has potential to save significant faculty and support services staff time. It can serve OBE reporting for accreditation with granular transparency and process authenticity. It provides feedback to the institution on the redesign of curricular aspects by surfacing gaps between intended and achieved outcomes.

The authors recommend the adoption of this architecture as a replicable institutional standard for AI-assisted OBE reporting across courses and programmes.

Keywords: Outcome Based Education, Course Outcomes, Program Outcomes, NBA, Agentic AI, AI/ML Architecture, Granular Computation of Learning Outcomes, Bloom's Taxonomy, Learning Outcomes

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An Intent-Aware Hybrid RAG Architecture for Academic Advising Systems

Asil Abuassabalouseini

Large language models have started using retrieval-augmented generation (RAG) techniques to keep their responses grounded in institutional knowledge, and higher education is no exception. This type of grounding will help mitigate one of the weaknesses of these models: confident statements followed by inaccurate information [1, 5]. However, a RAG pipeline can only reason over texts it can retrieve, while academic advising does not adhere to such constraints. A student's ability to graduate on time is based on his/her completion of coursework, accumulation of credits, GPA, and pending requirements, all of which can be found in a database, but never in any policy text.

In this paper, we formulate and answer one narrow question: can we obtain improved academic advising outputs through adding a layer for intent-based orchestration to a RAG pipeline? Our approach involves analyzing queries and routing them into one of three branches – retrieval of relevant policy texts, querying of structured student records using SQL, or model reasoning on the topic. Routing is accomplished by using a language model to identify intent instead of predefined keyword-based rules.

To conduct this research while avoiding any contact with personal student data, we synthesized a virtual university data set comprising student profiles, enrollments, GPAs, a course catalog, and requirements for undergraduate, graduate, and doctoral programs. The RAG-only model demonstrated acceptable performance on policy lookups but failed to provide relevant answers to personalized questions; hybrid models generated relevant responses to student-specific and hybrid questions by anchoring them in database information.

Keywords: retrieval-augmented generation; educational AI; academic advising systems; intent classification; tool-augmented LLMs; hybrid reasoning.

Keywords: Retrieval-Augmented Generation (RAG); Academic Advising Systems; Large Language Models (LLMs); Intent Classification; Tool-Augmented AI; Hybrid Reasoning.

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Behavioural Profiles of Productivity Impairment: A Latent Class and Network Analysis

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Existing literature has treated digital productivity loss among young adults as if they were all of one type, neglecting differences that could inform specific interventions for different subgroups. The purpose of this study was to apply Latent Class Analysis to a 16-item behavioural scale (categorical) assessing students' online behaviours (N=878, 68.5% students) and identify the four latent classes: Drifting Students (40.4%) – characterised by an afternoon/evening social media drift; Consumed Users (26.3%) – defines their entire day of distraction with the lowest level of satisfaction; Regulated Professionals (26.8%) – exhibits the highest levels of satisfaction while experiencing stress-triggered distractions at set times and will therefore be most likely to benefit from interventions designed around those time frames; and Disengaged Gamers (6.5%) – characterised by late-night gaming with the least amount of self-reported desire to make changes. A mixed graphical model found that users who checked phones during work/study were the most central node to focus on when developing intervention plans. In addition, proportional odds logistic regression revealed statistically significant differences in satisfaction across profiles, beyond individual predictor variables. Gradient boosting with SHAP attribution identified three primary factors associated with satisfaction: the number of wasted hours per day, the frequency of phone use, and the timing of wasted hours.

Keywords: Latent Class Analysis; Digital Distraction; Productivity; Mixed Graphical Model; SHAP; Behavioural Typology

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Artificial Intelligence Integration in Chemistry Education: A Discipline-Specific Pedagogical Perspective from Secondary Chemistry Teachers

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Generative applications of artificial intelligence (AI) is reshaping educational practices worldwide, yet its significance for chemistry teaching remains distinct: the discipline's persistent challenge of coordinating macroscopic, submicroscopic, and symbolic representations, together with the central role of laboratory-based learning, means that AI's educational value cannot be assumed to transfer uniformly from other subjects. Although AI has attracted growing attention in educational research, secondary chemistry teachers' disciplinary perceptions, instructional engagement patterns, and professional learning needs regarding AI remain insufficiently examined. This study addressed that gap by exploring how secondary chemistry teachers perceive AI, how they pedagogically engage with it within the distinctive demands of chemistry teaching, and what barriers and professional learning needs they identify in relation to its meaningful classroom integration.

The study employed a qualitative descriptive research design. Semi-structured individual interviews were conducted with 40 secondary chemistry teachers working across different school types in Türkiye, selected through purposive sampling to maximise variation in professional background and school context. Data were analysed using inductive qualitative content analysis, yielding seven overarching themes and 49 verified codes.

The findings revealed a substantial perception–practice gap as the study's central empirical finding: while participants broadly recognised AI's instructional potential, only three teachers reported active in-class AI use. Cross-case analysis identified nine distinct teacher-AI engagement profiles — including active in-class users, pre-class preparation users, delegated classroom users, and principled non-users — demonstrating that AI adoption in chemistry is not binary but heterogeneous and pedagogically structured. Teachers consistently framed AI's primary educational value through a disciplinary lens: visualisation of three-dimensional molecular structures, compensation for laboratory infrastructure deficiencies, and pre-class content preparation emerged as the dominant perceived affordances, reflecting the representational architecture of chemistry itself. A structurally significant asymmetry emerged: most participants rejected AI as a substitute for teachers while accepting its potential to replace printed materials — a distinction grounded in their understanding of teaching as a relational practice irreducible to information delivery. Every participant lacked formal chemistry-specific AI training, and most were unaware of the Ministry of National Education's published guidance; this universal gap suggests the problem lies not in individual teachers' readiness but in the absence of disciplinary infrastructure for professional learning.

These findings contribute to the emerging literature on AI in chemistry education by offering an empirically grounded, discipline-specific account of teachers' pedagogical engagement with AI. The study's nine-type engagement typology extends binary adoption/resistance frameworks and identifies previously undocumented forms of engagement, including delegated classroom use and dialogic quality-control use. Taken together, the findings suggest that meaningful AI integration in chemistry depends less on technological proficiency than on discipline-specific pedagogical judgement — and that closing the perception–practice gap requires professional learning that is chemistry-specific, practice-oriented, and structurally embedded, rather than generic AI literacy training.

Acknowledgements: This study was supported by the Scientific Research Projects Coordination Unit of Balıkesir University under Project No. 2025/053.

Keywords: Generative AI; Chemistry Education; Chemistry Teachers; Pedagogical Engagement; Technology Integration; Professional Learning

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From Posted Feedback to Productive Action: Tech-Mediated Communication Competence in Online and Hybrid Learning

Randy Kelley

Purpose: In online and hybrid learning environments, posting instructor feedback does not ensure that students can use it. Learners must locate feedback across digital platforms, interpret meaning without immediate clarification, regulate emotional responses to critique, and convert guidance into concrete action. This paper introduces Tech-Mediated Communication Competence (TMCC), a learner-centered framework that explains why digital feedback uptake can break down even when feedback has been delivered. Positioned within the broader Digital Feedback Literacy Theory ecosystem, TMCC focuses specifically on the competencies learners need to transform digital feedback into improvement.

Methodology: TMCC was developed through a structured conceptual synthesis of scholarship on student feedback literacy, dialogic feedback, agentic engagement, self-regulated learning, cognitive load, achievement emotions, and social presence in digitally mediated learning. The synthesis identifies four interdependent domains: digital literacy, cognitive processing, emotional regulation, and social presence. These domains were translated into a practice-oriented diagnostic framework that organizes visible feedback-use difficulties and links them to targeted educational supports.

Findings: TMCC proposes that digital feedback failure is often multidimensional. A student may miss feedback because platform pathways are unclear; read feedback without knowing how to revise; understand the message but disengage because critique triggers anxiety or defensiveness; or avoid clarification because asynchronous learning weakens perceived instructor presence. These breakdowns require different responses. Digital-literacy gaps call for LMS orientation and feedback-navigation supports. Cognitive-processing gaps call for guided revision plans and reflection prompts. Emotional-regulation gaps call for growth-oriented framing and strategies that normalize critique as part of learning. Social-presence gaps call for dialogic routines that invite questions, clarification, and continued exchange. TMCC therefore reframes feedback uptake as a teachable and diagnosable competence rather than an assumed learner capacity.

Implications: TMCC offers educators, instructional designers, and institutional leaders a practical framework for moving beyond the delivery of feedback toward the deliberate cultivation of feedback competence. The model can inform student orientation, faculty development, LMS workflow design, and future instrument development. It also establishes a research agenda for empirically examining how learner competence, LMS usability, and relational conditions shape digital feedback engagement. By identifying where the feedback process breaks down, TMCC supports more resilient, equitable, and action-oriented online and hybrid learning environments.

Keywords: Tech-mediated Communication Competence, Digital Feedback Literacy, Online Learning, Hybrid Learning, LMS Usability, Feedback Uptake, Emotional Regulation, Social Presence

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Career Perceptions and Occupational Concerns of Information Technology Students in the Context of Developments in AI Technologies: A Qualitative Case Study

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Rapid developments in artificial intelligence (AI) technologies are transforming career trajectories, professional competence expectations, and the transition from higher education to the labor market, particularly in the field of information technology. This study aims to examine students' career perceptions and occupational concerns in information technology-related programs in the context of recent developments in AI. More specifically, it focuses on how students evaluate AI as a career opportunity or risk and how they make sense of its possible effects on their future professional lives. The study was designed as a qualitative case study. The participants consisted of 67 students enrolled in information technology-related undergraduate programs at a public university. Participants were selected through criterion-based purposive sampling. Data were collected using a printed semi-structured open-ended questionnaire developed by the researchers and reviewed by field experts. The collected written responses were transferred to a digital environment without changing their content and analyzed through inductive content analysis. The findings indicate that students perceive AI technologies both as career opportunities and as potential sources of occupational concern. While some students associate AI with new career opportunities, productivity, and professional development, others express concerns about job competition, automation, and the changing nature of entry-level positions. Overall, the study suggests that students view AI not as a force that eliminates information technology professions, but rather as a transformative force that requires continuous adaptation and skill development.

Keywords: Artificial Intelligence, Information Technology Students, Career Perceptions, Occupational Concerns, Qualitative Case Study, Content Analysis

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Beyond Technology: Strategic Priorities for Improving Online Learning Experiences and Academic Performance in Open and Distance Learning

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Open and Distance Learning (ODL) has expanded access to higher education, but challenges related to student retention and academic success remain. This study seeks to address these challenges by identifying key factors contributing to student academic performance and by providing strategic recommendations for improving the quality of online learning. Specifically, the study examines the role of motivation, e-learning readiness, and learning perceptions in shaping academic performance, while also identifying priority areas for improvement from a student perspective. Through this approach, the study aims to offer theoretical and practical insights for enhancing student success in ODL environments. A quantitative approach was used in two stages. The first stage involved 862 students from a leading ODL university in Indonesia and used Structural Equation Modeling (SEM) to test the proposed relationships. The second stage involved 280 students and applied Importance–Performance Analysis (IPA) to evaluate the importance and performance of online learning attributes. The results indicate that motivation and e-learning readiness positively influence learning perceptions and academic performance. Learning perceptions also positively influence academic performance and partially mediate the effects of motivation and e-learning readiness. The IPA findings indicate that the institution generally meets student expectations, although improvements are needed in learning accessibility, timely feedback, digital competency, and students' ability to innovate in learning. These findings highlight the importance of strengthening student learning experiences to support academic success in an Open Distance Learning (ODL) environment.

Keywords: Open And Distance Learning; Motivation; E-learning Readiness; Perceived Learning; Academic Performance ; Importance–Performance Analysis

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Reduce Friction, Not Thinking: A Human-Centered Architecture for AI-Supported Digital Feedback Literacy

Randy Kelley

Purpose: Generative artificial intelligence is increasingly capable of providing learners with immediate explanations, suggestions, and revisions. However, improved speed and output quality do not necessarily ensure that learners understand feedback, evaluate its relevance, regulate emotional responses, or apply guidance independently. When AI removes the productive cognitive work required for learning, convenience may coexist with passive reliance, reduced learner agency, and limited transfer. This conceptual paper proposes a human-centered architecture for AI-supported digital feedback literacy in online and hybrid learning environments.

Methodology: The architecture was developed through a theory-informed synthesis of feedback-literacy scholarship, dialogic feedback processes, cognitive-affective processing, technology-mediated communication competence, learner agency, and system-usability principles. Feedback is positioned not as information delivered to learners, but as a developmental process through which learners make sense of information from multiple sources and use it to improve their work or learning strategies. The synthesis was used to derive a human-centered design architecture consisting of learner-facing processes, diagnostic domains, intervention rules, developmental outcomes, and ethical safeguards for AI-supported feedback environments.

Key Findings: The proposed architecture centers on a recurring learner-facing process: Elicit → Process → Enact. Learners locate, request, or notice relevant feedback; interpret, evaluate, and prioritize that information; and take purposeful action. Before providing support, an AI-enabled environment should identify the primary barrier preventing meaningful engagement. Barriers may involve difficulty navigating digital feedback pathways, cognitive overload or uncertainty, emotional responses that interfere with engagement, difficulty interpreting tone or seeking clarification in digitally mediated environments, or interactions among these factors. The system should then provide the smallest useful intervention, return productive reasoning to the learner, and preserve a clear pathway to human support when instructor judgment, clarification of expectations, or reassurance is needed. Repeated engagement should support transfer across contexts, self-generated feedback, evaluative judgment, and progressively greater independence from external scaffolding.

Implications: Educational AI should not be evaluated solely by the immediacy or quality of its outputs. Its deeper value lies in whether it helps learners become more capable of understanding, questioning, applying, and eventually generating meaningful feedback independently. Future research should examine the usability, ethical acceptability, and developmental effects of AI-supported feedback environments across diverse learners and learning contexts.

Keywords: Digital Feedback Literacy, Generative AI, Learner Agency, Dialogic Feedback, System Usability, Human-centered AI

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To AI or Not to AI That is the Question: The Assessment of Efficiency of Corrective Writing Feedback Provided by Teachers vs. AI: a Case of Omani Students

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This article explores the effects of integrating Artificial Intelligence (AI), particularly ChatGPT, into English as a Foreign Language (EFL) writing instruction for foundation students at Sultan Qaboos University (SQU) in Oman. The study employs a pre-post-test design with a ten-week intervention, focusing on task achievement, coherence and cohesion, lexical resources, and grammatical range and accuracy. Participants were intermediate-level EFL students (aged 17-19). One group (12 students) utilized ChatGPT as a writing assistant to receive feedback on their assignments—covering grammar, syntax, coherence, cohesion, vocabulary, and structure—for ten weeks. The other group (13 students) received corrective feedback exclusively from their teacher. The Shapiro–Wilk test was performed for both groups, yielding a p-value of 0.053904, which suggests that the data do not significantly deviate from a normal distribution. This study uses a quantitative approach to compare writing development across both groups. Data collected through writing assessments were analyzed using paired-sample t-tests and ANOVA. Results indicate that while ChatGPT integration significantly improved students' task achievement (mean 3.0 to 4.2), coherence and cohesion (3.2 to 4.1), and lexical resources (3.0 to 3.8), the teacher-feedback group showed more substantial progress. Specifically, the teacher-feedback group's task achievement improved from 3.1 to 5.2, coherence and cohesion from 3.1 to 4.8, grammatical range and accuracy from 3.0 to 4.1, and lexical resources from 3.1 to 4.4. Overall, the teacher-feedback group demonstrated a more significant increase in writing skills (12.3 to 18.5) compared to the AI-feedback group (12.2 to 15.2). Despite these gains, both groups showed minimal improvement in grammatical range and accuracy, suggesting a need for further investigation and refined instructional strategies. The study concludes that while AI integration can support EFL writing development, it does not currently match the efficacy of teacher-led feedback. It highlights the necessity of a balanced approach that combines AI tools with traditional teaching methods to achieve optimal learning outcomes. Although students appreciated the detailed and specific nature of ChatGPT's feedback, some reported that it could be excessively lengthy, occasionally irrelevant, and sometimes confusing.

Keywords: Artificial Intelligence (AI), Writing Feedback, Learner Autonomy, Active Learning

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Enabling Social Coding Spaces in Fostering Computational Thinking and Student Engagement

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The 21st century has seen significant technological progress, especially in Information and Communications Technology (ICT), with Artificial Intelligence (AI) being one of the most impactful innovations. Higher Education Institutions (HEIs) are quickly integrating AI into their curricula. A key milestone was the November 2022 release of ChatGPT 3.5 by OpenAI, based on the Generative Pretrained Transformer (GPT) model, which uses deep learning to produce human-like responses to various prompts. While AI presents many opportunities to improve learning and research, its misuse in academic settings raises concerns about integrity. A major challenge is students using AI tools in computer programming courses to complete coding assignments without truly engaging in problem-solving. Nonetheless, when used responsibly, AI can be a valuable educational resource. Educators can utilize platforms like GitHub to foster collaboration, transparency, and accountability by observing emerging trends and best practices. Features such as version control, peer review, and open-source contributions encourage active participation and enhance learning. This study examines how Social Coding Spaces (SCSs), like GitHub Classroom, can boost student engagement and build computational thinking skills. The results highlight the advantages for educators in adopting innovative teaching strategies that incorporate social coding tools while safeguarding academic integrity.
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Keywords: Student Engagement, Computational Thinking, Connectivism

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Strengthening Academic Staff Capacity to Facilitate Blended Learning in Ukrainian Teacher Education Institutions During Wartime

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The full-scale war in Ukraine has placed teacher education institutions in a context of uncertainty, requiring them to maintain continuity and reorganise teaching through flexible blended formats. In this context, blended learning can be defined as a combination of face-to-face and online instruction, as well as an institutional response that depends on academic staff capacity to organise interaction, adapt learning materials, select digital tools and ensure coherence between synchronous and asynchronous activities.

The present study examines the manner in which the capacity of academic staff to facilitate blended learning in Ukrainian teacher education institutions can be strengthened on the basis of an empirical needs assessment. The research was conducted within the scope of the grant project (2022.01/0098) entitled "Maximizing the Effectiveness of Blended Learning Resources in Higher Pedagogical Education Institutions During the War and the Post-War Recovery of Ukraine", which is supported by the National Research Foundation of Ukraine. The objective of the study was to identify the barriers, needs and resource areas that influence the capacity of academic staff to design, deliver and support blended learning during wartime. The findings were to be used as a basis for professional development.

A quantitative online survey was conducted in September and October 2023, utilising a Google Forms questionnaire comprising both closed and open-ended questions. The sample comprised 544 academic staff members from 20 Ukrainian higher teacher education institutions across 13 regions. The quantitative data was analysed using descriptive statistics, while the open-ended responses contributed to the clarification of the contextual challenges and needs.

The findings demonstrate that academic staff recognise blended learning as a mechanism for ensuring flexibility, access to learning materials, continuity of communication and adaptation of educational trajectories in wartime conditions. Concurrently, their capacity to facilitate blended learning is constrained by several factors. These include insufficient methodological guidance, uneven digital competence, limited experience in designing blended courses, difficulties in coordinating online and offline components, unstable internet access, power interruptions, increased workload and limited technical support. The respondents indicated a need for methodological recommendations, examples of blended learning models, criteria for selecting digital platforms, and support in adapting course content to different learning formats.

As an applied outcome, the study substantiated and informed the development of a professional development training programme for academic staff in Ukrainian Teacher Education Institutions, within which the role of a "blended learning supervisors of the pedagogical HEIs" was conceptualised as a specialist capable of supporting the practical facilitation of blended learning at the institutional level. The study concludes that the enhancement of academic staff capacity to facilitate blended learning is a pivotal condition for institutional adaptability in uncertain educational contexts.

Keywords: Blended Learning; Academic Staff Capacity; Wartime Teacher Education; Blended Learning Supervisors; Professional Development Programme; Ukraine

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Human-in-the-Loop LLM-Based Assessment in LMS Environments: Developing an LTI-Compatible Tool for Rubric-Guided Evaluation

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Open-ended questions are widely used to assess higher-order thinking, reasoning, interpretation, and written expression. However, evaluating student responses with detailed rubrics can be time-consuming for instructors, particularly in large, blended, or online courses. Recent developments in large language models create new possibilities for rubric-guided feedback and assessment, but their use in educational contexts requires careful attention to transparency, instructor control, and responsible implementation. This study describes the planned design and development of a Learning Tools Interoperability (LTI)-compatible LLM-based assessment tool for learning management systems (LMS).

The study will follow a design-based research approach, proceeding through requirements analysis, architectural design, and prototype development. The tool will be developed as an external assessment application that integrates with LMS environments via LTI: it sends student responses and instructor-defined rubrics to an LLM, which generates a score and feedback, and the instructor reviews this output before it is released to the student.

This human-in-the-loop design places the rubric at the center of the evaluation workflow, combining the efficiency of LLM-based scoring with instructor oversight at the point where it matters most: before feedback reaches the student. The study will present the system architecture and the LTI-based integration logic, and will discuss workflow feasibility, rubric alignment, feedback generation, and responsible AI use in educational assessment. The architecture is organized into three components: a rubric and task-creation interface for instructors, an LLM-based scoring service, and an instructor review interface through which scores and feedback are approved or revised before release to students. This separation is intended to support adaptation to other LTI-compatible LMS platforms, although such adaptation is not evaluated within the scope of this study. The expected contribution is a design model for integrating LLM-based assessment into LMS environments through LTI that keeps the final scoring decision with the instructor, which may inform future work on formative feedback in large, blended, or online courses.

Keywords: LLM-based Assessment, Learning Tools Interoperability, Rubric-guided Feedback, Human-in-the-loop Assessment, Learning Management Systems

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Beyond Enrollment Equity: Institutional Factors and Gendered Training Outcomes in Philippine TVET

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Despite efforts by the Technical Education and Skills Development Authority (TESDA) to promote gender parity in Technical and Vocational Education and Training (TVET) enrollment, women's participation remains concentrated in traditionally female-dominated sectors such as beauty services, caregiving, and hospitality. In contrast, high-demand fields including information and communications technology (ICT), electronics, and advanced manufacturing remain largely male-dominated. This persistent occupational segregation suggests a gap between access to TVET programs and actual sectoral mobility, highlighting the institutional factors shaping gendered training pathways and outcomes in the Philippines.

This study examines these institutional factors using TESDA enrollment and completion data from 2015–2025, categorized by sex and qualification sector, alongside policy document analysis and a review of gender-responsive TVET literature. It focuses on how career guidance systems, training pathways, and industry partnerships contribute to the reproduction of gendered clustering across sectors.

Findings point to three recurring patterns: limited exposure of women to non-traditional technical tracks during early career guidance; comparable completion rates in selected high-skill qualifications that do not translate into broader sectoral entry; and weak employer signaling in ICT, electronics, and manufacturing in actively recruiting women into technical roles. Together, these suggest that access to TVET alone is insufficient to shift sectoral outcomes.

The study contributes to debates on gender equality and skills development by highlighting the gap between formal access and substantive labor market inclusion, arguing that gender-responsive reforms must extend beyond enrollment targets to support women's transition into high-demand technical occupations.

Keywords: TVET, Gender Inclusivity, Employment Outcomes

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From Awareness to Advocacy: Exploring the Mechanisms of Responsible Digital Citizenship through Environmental Awareness and Online Word of Mouth

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As digital environments increasingly mediate consumer decision-making, the ability to critically evaluate environmental information online has emerged as a critical dimension of responsible digital citizenship. In the era of artificial intelligence, digital citizenship education has transitioned from basic technical skills to fostering ethical awareness and responsible participation within digital ecosystems. This study investigates how awareness of environmental consequences and green online trust benevolence jointly shape consumers' green purchase intention, with word of mouth as a mediating mechanism and self-image congruity as the outcome variable. This study addresses this gap by examining a structural model based on Awareness of Environmental Consequences, Green Online Trust Benevolence, Word of Mouth (Advocacy), and Self-Image Congruity. A quantitative survey was conducted with 123 consumers in Taiwan (48.0% male, 51.2% female). Data were analyzed using Partial Least Squares Structural Equation Modeling (PLS-SEM). Measurement model results confirmed acceptable reliability (Cronbach's alpha ranging from 0.781 to 0.818) and convergent validity (AVE > 0.60 for all constructs). Discriminant validity was established via the Fornell-Larcker criterion. Structural path analysis revealed that both awareness of environmental consequences ($\beta = 0.346$, $p < 0.001$) and green online benevolence ($\beta = 0.555$, $p < 0.001$) significantly predicted word of mouth, which in turn strongly predicted self-image congruity ($\beta = 0.708$, $p < 0.001$). Indirect effects further confirmed that green online benevolence exerts a stronger mediated influence on self-image congruity through WOM (indirect effect = 0.393) than environmental awareness alone (indirect effect = 0.245). These findings highlight that trust in green online information is a more potent driver of eco-conscious self-identification than cognitive awareness alone. The results carry significant implications for digital and AI literacy education in online learning ecosystems. As AI-curated content and algorithmic recommendation systems increasingly shape how consumers encounter green product information, learners must develop the critical competencies to assess source credibility, detect greenwashing, and make responsible consumption decisions in digitally mediated spaces. Educational institutions and platform designers are encouraged to embed green digital citizenship frameworks that cultivate both environmental awareness and discerning online trust as interdependent pillars of responsible digital behavior. Online learning environments should not only provide information but also cultivate the ethical trust and critical literacy necessary for students to advocate for sustainable development, thereby aligning their digital behavior with their self-concept as global citizens. The findings imply that educational systems should prioritize normative competencies—the ability to apply ethical principles in complex AI-mediated contexts. Education is no longer just about information consumption; it is about cultivating ethical digital behavior and accountability.

Keywords: Green Online Trust Benevolence, Awareness of Environmental Consequence, Self-image Congruity, Word of Mouth

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Does the Course Progress Percentage Reflect Reality in Online Learning? An Investigation of the Relationships Between Learner-Content Interaction and Academic Achievement

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In the field of distance education, evaluating student engagement and predicting academic performance through digital footprints has become a cornerstone of learning analytics. Among various system metrics, the "course progress percentage" is frequently utilized as a critical indicator of student completion; however, the extent to which this automated metric reflects meaningful interaction and actual academic success remains a subject of discussion. The primary purpose of this study is to comprehensively examine the relationships among students' specific interaction behaviors (documents, assignments, and virtual classrooms) within a learning management system (LMS), their system-calculated course progress percentages, and their academic achievement in online courses.

Employing a correlational research design, which is a quantitative research methodology, the study's population consists of 3730 university students who were enrolled in the distance education delivery of the Turkish Language II course at a state university during the spring semester of the 2025–2026 academic year and who exhibited active system interaction. The research data comprise comprehensive, activity-specific LMS log data (such as completion status, views, downloads, uploads, and duration metrics), system-calculated course progress percentages, and end-of-term academic grade point averages obtained directly from the Student Information System (SIS).

For the data analysis phase, a multi-stage statistical approach will be implemented. First, students' activity interaction levels, progress percentages, and academic achievements will be compared across different faculties using the ANOVA test to reveal discipline-specific learning cultures and digital behavior patterns. Subsequently, a Pearson correlation analysis will be performed to examine the direct, linear relationship between students' course progress percentages and their end-of-term academic grade point averages. In the final stage, the extent and direction to which specific interaction behaviors (viewing, downloading, submission, duration, etc.) toward document, assignment, and virtual classroom activities within the LMS predict final academic achievement will be tested separately through correlation and regression analyses. The study is expected to provide valuable institutional insights and practical strategies for distance education system designers and instructors regarding the update of data-driven evaluation criteria, the restructuring of student tracking mechanisms, and the optimization of course completion algorithms.

Keywords: Online Learning, Learner-Content Interaction, Course Progress Percentage, Academic Achievement, Correlational Research

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An Examination of Epistemic Curiosity, Presence, and Situational Interest in a 360-Degree Video-Based Immersive Learning Experience

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This study aims to examine students' levels of epistemic curiosity, presence, and situational interest following a 360-degree video-based immersive learning experience; to reveal the relationships among these constructs; and to explain, in light of students' experiences, the elements that trigger their epistemic curiosity. In recent years, 360-degree video and virtual reality-based applications have enabled students to experience learning content in more experiential ways; this has made it increasingly important to address the cognitive and affective dimensions of learning environments together. In this context, examining epistemic curiosity, situational interest, and presence together may contribute to understanding how immersive learning experiences are perceived by students. Considering these three constructs together may help reveal not only whether immersive experiences are attention-grabbing, but also how they relate to learners' desire to know and understand.

The study was conducted with a group of 34 students aged 12-13 enrolled in the 6th and 7th grades. Within the scope of the study, students experienced a publicly available 360-degree video on carbon footprint and climate change through immersive virtual reality (IVR) headsets; following the experience, they completed scales related to epistemic curiosity, presence, and situational interest. The implementation was carried out as a single-session process in which students experienced the 360-degree video in an immersive way. In addition, supportive qualitative data were collected in order to reveal the same students' views on their experiences and to better understand the elements that triggered their epistemic curiosity. Each implementation session, including the video experience and the brief interview, lasted approximately 10 minutes.

Rather than testing a specific causal model, this study aims to analytically examine students' cognitive and affective experiences within a single immersive learning context. Quantitative data were used to examine students' post-experience levels of epistemic curiosity, presence, and situational interest, as well as the relationships among these constructs; qualitative data were used to understand which elements students associated with epistemic curiosity. Data collection has been completed, and data analysis is currently in progress. This abstract presents the initial framework of an ongoing study. The study is expected to generate preliminary findings on how 360-degree video-based immersive learning experiences relate to students' cognitive and affective responses and to contribute to the development of design implications for technology-enhanced science education.

Keywords: Epistemic Curiosity, Presence, Situational Interest, 360-degree Video, Immersive Learning

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GenAI-Augmented Mindfulness Training and Sustainable Behavior Transformation among University Students: A Two-Study Investigation Combining Qualitative Reflective-Trajectory Analysis and PLS-SEM

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Sustainability education in business schools faces a persistent gap between students' environmental knowledge and their actual behavior. This study tests whether Generative AI (GenAI) can strengthen mindfulness training as a scaffold for sustainable behavior change, grounded in two theories: the Mindfulness-to-Meaning Theory (MMT; Garland et al., 2015), which describes a sequential pathway from Decentering to Positive Reappraisal, Savoring, and Eudaimonic Meaning, and the Monitor and Acceptance Theory (MAT; Lindsay & Creswell, 2017), which holds that Attention Monitoring and Acceptance must work together to produce stable positive regulation.

Two studies were conducted. Study One used a quasi-experimental design with 120 business school volunteers, comparing a GenAI-augmented mindfulness group (ChatGPT-guided practice plus GenAI-generated sustainability scenarios) with a mindfulness-only group. Fifty-word reflective prompts were collected before and after training and analyzed qualitatively. Post-training prompts covered a wider range of SDGs, with new attention to industrial innovation (SDG9), marine ecosystems (SDG14), and economic prosperity (SDG8, SDG11), and partnership-related reflections (SDG17) moved from general statements to specific issue analysis. Reflection-oriented prompts rose from 9% to 23%, a larger gain than knowledge-oriented (19% to 25%) or behavior-oriented prompts (25% to 28%). Prompt length increased from 46 to 67 words on average, with more multi-dimensional reasoning and references to AI and digital technology, consistent with Valcea et al. (2024) on GenAI's role in business education.

Study Two used valid survey data and PLS-SEM (SmartPLS) to test the MMT and MAT pathways together. Reliability and validity were adequate: Cronbach's alpha ranged from .707 to .872, composite reliability exceeded .83, and AVE exceeded .50 for all constructs. The structural model supported the MMT sequence: Decentering predicted Positive Reappraisal ($\beta = .717$, $p < .001$), which predicted Meaning Savoring ($\beta = .684$, $p < .001$); Meaning Savoring predicted Engagement Behavior ($\beta = .356$, $p = .001$), which predicted Coping Behavior ($\beta = .682$, $p < .001$). Positive Reappraisal had no direct effect on Coping Behavior ($\beta = -.010$, $p = .913$), but its indirect effect through Savoring and Engagement was significant (total indirect effect = .351, $p < .001$), matching Garland et al.'s (2015, 2017) broaden-and-build model rather than a direct-effect model. For MAT, Acceptance Orientation predicted Coping Behavior directly ($\beta = .222$, $p = .005$), and its interaction with Positive Reappraisal predicted Meaning Savoring ($\beta = .101$, $p = .047$), supporting the idea that monitoring and acceptance work together. R^2 values were .621 for Coping Behavior, .532 for Meaning Savoring, .514 for Positive Reappraisal, and .339 for Engagement Behavior. SRMR was .093, slightly above the .08 benchmark, indicating room to refine the measurement items.

This research integrates GenAI scaffolding into mindfulness training and tests the MMT mediation pathway and MAT moderation mechanism using both qualitative and quantitative evidence. The findings speak to the gap between sustainability knowledge and behavior in business education, support technology-enhanced mindfulness training, and inform the

design of AI-integrated programs for sustainable behavior. Future studies could track these effects over time.

Keywords: Generative AI, Mindfulness Training, Mindfulness-to-Meaning Theory, Monitor And Acceptance Theory, Sustainable Behavior,

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From Correcting the Effect to Understanding the Cause: eCRONY for Movement Education

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This paper presents eCRONY, a digital platform for movement education designed to support the teaching and learning of movement through a cause-and-effect approach. Its main objective is to propose a formative device capable of shifting didactic correction from the visible outcome of a movement to the motor and biomechanical causes that produce it. In movement education, corrective interventions often focus on externally observable elements, such as foot placement, posture, step length, or segment position. Although these indications may describe what should change, they do not always help learners understand how to generate that change. eCRONY therefore aims to guide users in observing movement, interpreting its functional organisation, and translating biomechanical knowledge into clear and meaningful didactic communication.

The paper adopts a theoretical-applied and design-based framework and presents the methodological architecture of a formative device already available online. The platform was developed through the integration of didactic analysis of movement education practices, biomechanical principles, progressive instructional design, and Universal Design for Learning criteria. Walking was selected as the motor action under study because it involves fundamental components of human movement, including support, weight transfer, dynamic balance, propulsion, interaction with the ground, and segmental coordination. The learning pathway is organised into progressive levels that combine movement observation, proprioceptive experience, biomechanical analysis, identification of the relationship between observable effect and motor cause, and reformulation of technical correction into didactic instruction. A central feature of the platform is the transformation of instructions focused on external form into instructions oriented towards perception, intention, and motor cause. For example, the corrective instruction “lengthen your step” may be reformulated as “push the floor further backwards”, directing attention towards the action that produces the observable effect. In line with Universal Design for Learning, the platform integrates videos, images, written texts, concept maps, podcasts, practical activities, and guiding questions. It also includes proprioceptive awareness exercises intended to connect bodily experience with biomechanical interpretation and corrective communication.

The main result of the work is the formalisation of eCRONY’s didactic architecture as a prototype digital environment for movement education. The platform connects observation, bodily awareness, causal interpretation, and communication, offering a structured pathway for the training of teachers, movement educators, coaches, and sport and exercise science students. Its distinctive contribution lies in treating corrective communication not as the transmission of an ideal external form, but as the translation of functional and biomechanical principles into instructions that learners can perceive and apply.

eCRONY represents a formative device for developing skills in movement observation, causal reasoning, and corrective communication. The present paper defines its theoretical and didactic structure and provides the basis for subsequent research phases. Future evaluation will investigate user experience, clarity, usability, perceived usefulness, educational transfer, and the empirical effectiveness of the platform in teacher and movement-education training.

Keywords: Movement Education; Motor Learning; Didactic Communication; Biomechanics; Universal Design for Learning.

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Making Computational Judgment Visible: Teaching and Assessing Responsible GenAI Use in Introductory Programming

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Generative artificial intelligence (GenAI) is increasingly shaping how students approach introductory programming tasks. Tools such as ChatGPT and GitHub Copilot can generate, explain, debug, and modify code, creating new opportunities for learning while also raising concerns about overreliance, shallow understanding, and uncritical acceptance of AI-generated outputs. This paper argues that the key challenge for programming education is not only whether students should use GenAI, but how educators can make students' computational judgment visible when they do. We propose a pedagogical and assessment-oriented framing for responsible GenAI use in introductory programming. The framing is organised around five instructional principles: think before prompting, explain before accepting, test before trusting, compare before choosing, and reflect before submitting. These principles are intended to shift learning evidence beyond final code correctness toward students' ability to formulate problems, explain generated solutions, verify outputs, adapt code, and account for their use of AI. The paper illustrates how ordinary CS1 tasks can be redesigned to include pre-AI planning, code annotation, test-case design, solution comparison, and AI-use reflection. In doing so, it offers a practical way to preserve the educational value of programming in the GenAI era by requiring students not merely to obtain code, but to demonstrate understanding, evaluation, and responsibility for AI-assisted computational work.

Keywords: Generative Artificial Intelligence, Introductory Programming, AI-Assisted Programming, Computational Judgment, Programming Assessment, Responsible GenAI Use

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What Does the Grade Prove? Rethinking Programming Assessment Evidence in the Age of GenAI

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Generative artificial intelligence is changing what programming grades can legitimately claim about student learning. In many programming courses, submitted code has traditionally served as the main evidence that a student can understand a problem, design a solution, implement code, test behaviour, and debug errors. However, when AI tools can generate, explain, transform, and repair code externally, a correct or polished submission may no longer be sufficient evidence of the student's actual capability. This discussion paper argues that the central challenge for programming assessment in the age of Generative AI is not only cheating, plagiarism, or detection, but assessment validity: what does the grade actually prove? The paper introduces the idea of assessment evidence debt to describe the growing gap between the claims programming assessments make about student competence and the evidence that final artefacts alone can support. It then proposes a claim-evidence approach for rethinking programming assessment around five evidence channels: constrained performance, process provenance, executable verification, interpretive defence, and transfer probes. These channels help educators distinguish between code that runs, code that students understand, code they can verify, and code they can adapt under changed conditions. The paper contributes a discussion framework for designing programming assessments in which grades are grounded in defensible evidence of learning rather than in final code alone.

Keywords: Generative AI; Programming Assessment; Computing Education; Assessment Validity; Evidence of Learning; Academic Integrity; Transfer Assessment; Evidence Architecture;

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Designing a Large Language Model–Supported Biostatistics Course to Ensure Statistical Literacy and Reduce Statistical Anxiety

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Biostatistics education plays a critical role in developing physicians' abilities to accurately analyze, interpret, and apply data in clinical decision-making processes. However, it is often perceived by students as anxiety-provoking. Following rapid technological advances and digital transformation, updating the content and instructional approaches of traditional biostatistics courses has become increasingly important to reduce statistical anxiety and ensure statistical literacy. This study aimed to evaluate outcomes and satisfaction of an innovative biostatistics course supported by large language models (LLMs) targeted to enhance medical students' statistical literacy and reduce statistics-related anxiety. A thematic analysis was conducted to explore students' prior experiences with biostatistics education, perceived challenges, and expectations regarding an LLM-supported course model. The effectiveness of the Moodle-based, eight-module LLM–supported biostatistics course was evaluated in 33 students using pre-post measures of statistical literacy, self-efficacy, and statistics anxiety. Pearson's chi-square and Fisher's exact tests were used to compare categorical variables in groups. Independent-samples t-test and Mann–Whitney U test were applied for between-group comparisons, and Spearman's rank correlation coefficient was used to examine relationships between continuous variables. Changes in scale score differences between pre-posttests among participants with-without LLM experience were analyzed using Brunner–Langer approach. Most participants (85.4%) reported having previously used LLM tools for learning purposes. Statistics anxiety decreased, while statistical literacy self-efficacy increased significantly ($p=0.040$ and $p<0.001$, respectively). A non-significant increase in statistical literacy scores was observed ($p=0.247$). Students with prior experience using LLMs in education demonstrated a significantly greater increase in belief scores related to statistical reasoning compared with those without such experience ($p=0.024$). Confidence in statistical processes and belief in statistical reasoning were positively correlated with post-course self-efficacy scores ($r_s=0.446$, $p=0.009$; $r_s=0.504$, $p=0.003$). Overall course satisfaction was high; all students evaluated the use of LLMs as beneficial and indicated their intention to continue using them in future learning processes. An LLM–supported biostatistics course was found to be feasible and acceptable for medical students and was associated with reductions in statistics anxiety and notable gains in self-efficacy, particularly in reasoning and application-based interpretation domains. Based on these findings, LLM-supported biostatistics education should be integrated into medical curricula through structured, application-oriented, and interactive learning activities. LLM-based tools may serve as complementary educational aids that enhance conceptual learning, statistical literacy, and learner confidence through feedback-rich learning environments. Further multicenter and longitudinal studies with larger samples are needed to confirm the effectiveness and sustainability of this approach. Future research should compare different AI tools and instructional models to identify the most effective strategies for integrating AI-supported statistics education into medical training.

Keywords: Large Language Models, Biostatistics Education, Statistical Literacy, Statistical Anxiety

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Redesigning Assessment in a Power Systems Course under the Influence of AI: A Rubric-Based Methodology Using OpenDSS

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The increasing availability of generative artificial intelligence (AI) tools, such as ChatGPT or Copilot, is transforming how engineering students approach modelling and simulation tasks. In the master-level course “Power Systems and Smart Grids” of the Industrial Engineering Master’s programme at Universitat Politècnica de València, students can now request complete OpenDSS scripts or detailed explanations of network behaviour from AI, which challenges traditional assessment practices based on take-home assignments. This paper presents a rubric-based assessment methodology for this course, in which a key laboratory activity involves modelling distribution networks using OpenDSS. The aim is to distinguish genuine conceptual understanding from mere reliance on AI-generated solutions, while still allowing students to use AI as a legitimate learning support.

The methodology combines three complementary assessment layers. First, a pre-lab diagnostic quiz without AI access evaluates prior knowledge of fundamental concepts (per-unit system, network topology, load-flow variables). Second, a laboratory project in which students are explicitly allowed to use AI in the design and debugging of OpenDSS models, but are required to document prompts, AI outputs and their own modifications. Third, an individual in-class oral exam, based on the previously developed models, focuses on the interpretation of results, justification of modelling decisions and identification of potential errors in AI-generated code. A detailed rubric integrates four criteria: technical correctness of the electrical model, depth of conceptual explanation, quality of critical judgement regarding AI suggestions, and degree of autonomy demonstrated in problem solving.

The methodology is proposed for implementation with students enrolled in “Power Systems and Smart Grids” in the Industrial Engineering Master’s programme. It is expected that the three-layer, rubric-based design will help to detect superficial use of AI, promote explicit reflection on its limitations and provide more robust evidence of individual learning. The paper will present the full rubric, sample assessment tasks and anticipated practical recommendations for instructors who need to redesign assessment in technical master-level courses where AI-assisted coding and simulation are becoming common place.

Keywords: Power Systems Education; Assessment Rubric; OpenDSS; Generative AI; Electrical Engineering

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Challenge-Based and Gamified Learning in Energy Market Courses: Designing Engaging Experiences for Engineering Students

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Motivating engineering students to engage deeply with abstract and mathematically intensive topics such as energy market design and electricity pricing is a persistent challenge. This contribution presents the design of a challenge-based and gamified learning approach applied to the course Energy Markets in the Bachelor's Degree in Energy Engineering at Universitat Politècnica de València. The main objective is to increase student engagement and promote higher-order skills such as critical thinking, creativity, and collaborative problem solving, while preserving the rigor of the technical content. In the course, students participate in a sequence of market-based challenges in which they analyse and simulate different electricity market configurations and regulatory scenarios. These include, for example, high penetration of renewable generation, scarcity pricing situations, and the introduction of new flexibility mechanisms. Students adopt the roles of generators, retailers, regulators, and consumers in a simplified electricity market and are asked to design bidding strategies, interpret price outcomes, and justify their decisions from technical, economic, and social perspectives. Game mechanics such as leaderboards, badges, bonus tasks, and time-limited missions are incorporated to encourage participation and reflection on the consequences of strategic behaviour.

The proposed approach is intended to be implemented in Energy Markets as a way to improve motivation and make theoretical concepts more meaningful for students. Evidence to be collected will include course analytics such as participation rates and timely submission of tasks, student surveys on motivation and perceived learning, and analysis of student artefacts such as simulation files, reports, and reflection logs. It is expected that the challenge-based structure will increase active participation, strengthen collaboration within teams, and lead to richer justifications in written work. The paper will discuss the pedagogical design, examples of challenges and game mechanics, and practical recommendations for introducing gamified learning into highly technical engineering courses related to energy markets.

Keywords: Gamification; Challenge-based Learning; Energy Markets; Engineering Education; Student Motivation

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Designing Micro-Credentials in Power and Energy Engineering: Short Learning Programs for Lifelong and Industry-Relevant Learning

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The energy sector is undergoing rapid transformation due to decarbonisation, digitalisation, and decentralisation, creating new demands for up-to-date skills among both students and professionals. Traditional semester-long university courses are often too rigid to respond quickly to emerging topics such as microgrids, flexibility markets, or advanced power system operation. This paper explores the design of micro-credentials and short learning programs in the domain of power and energy engineering, aimed at supporting lifelong learning and improving employability. The proposed model is based on modular units of 2–3 ECTS each, which can be stacked into broader specialisations. Example micro-credentials include: “Introduction to Distribution Network Modelling”, “Energy Markets Fundamentals for Engineers”, and “Integration of Renewable Energy in Distribution Grids”. Each unit combines online materials, short intensive workshops, and authentic assessment tasks linked to real-world problems or data sets. The design process involves collaboration with industry partners to identify critical skills, define learning outcomes, and co-create case studies that reflect current challenges in energy companies and system operators.

The paper draws on the experience of implementing initial pilot micro-credentials within an engineering faculty, involving both undergraduate students and practising engineers. Evidence includes enrolment patterns, completion rates, feedback from participants, and qualitative input from industry stakeholders. Early findings suggest that micro-credentials offer a flexible way to address niche or emerging topics without overloading standard curricula and can be recognised by companies as meaningful indicators of specific competences. The contribution concludes with recommendations on how universities can structure micro-credential ecosystems in power and energy engineering to complement degree programmes, foster institutional resilience, and support lifelong learning.

Keywords: Micro-credentials; Lifelong Learning; Power And Energy Engineering; Employability; Short Learning Programs

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Computational Thinking and Algorithmic Literacy as Core Competencies of the Artificial Intelligence Era

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The article examines computational thinking and algorithmic literacy as fundamental competencies in the context of the widespread adoption of generative artificial intelligence. The author analyzes the structural components of computational thinking - decomposition, pattern recognition, abstraction, and algorithmic reasoning - and argues for their relevance beyond programming and engineering disciplines. Particular attention is given to algorithmic literacy as a practical understanding of how digital systems operate, which underpins the cognitive autonomy of the user. Drawing on empirical data from a range of international studies, the article explores the relationship between these skills and specialists' economic competitiveness, resistance to digital misinformation, and integrity in academic work. The article also investigates the normative divergence between students and faculty regarding the ethical acceptability of generative AI in educational settings. It is demonstrated that a deficit of algorithmic literacy reproduces and deepens existing social inequalities, while the cultivation of these skills constitutes a precondition for equitable access to the opportunities of the digital economy. The institutional steps taken in Kyrgyzstan toward addressing these challenges are reviewed alongside the key structural constraints that remain. The article concludes that the systematic integration of computational thinking and algorithmic literacy into educational programs at all levels and across all fields of study has become an educational and social priority.

Keywords: Computational Thinking, Algorithmic Literacy, Generative Artificial Intelligence, Digital Literacy, Academic Integrity, Digital Inequality, Higher Education.

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The Invisible Barrier of Gamification in Education: From Hand-Holding to Cognitive Mastery

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This study critically examines the increasingly prevalent phenomenon of hand-holding (over-guidance) in modern digital learning environments and discusses, within a theoretical framework, its adverse effects on students' cognitive development. Gaming the system, defined as students' use of educational software in ways that diverge from its intended purpose, is analyzed with reference to the work of Ryan S. Baker and colleagues; it is argued that this behavior originates in overly structured help mechanisms. Adopting a Design-Based Research approach, the study subjects the help mechanisms of existing digital tools to critical analysis and proposes a model developed through comparison with retro game mechanics. Scaffolding fading, derived from Vygotsky's (1978) Zone of Proximal Development (ZPD) theory, Bjork's (1994) theory of desirable difficulties, and Csikszentmihalyi's (1990) Flow theory together form the theoretical underpinnings of challenging gamification mechanics. The theoretical synthesis posits that a well-designed balance of difficulty fosters cognitive resilience and self-regulated learning capacity in students. The study concludes with practical design principles for instructional designers and researchers.

Keywords: Gamification, Hand-holding (over-guidance), Flow Theory, Scaffolding And Fading, Cognitive Mastery

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A Comparative Conceptual Analysis of AI Literacy Frameworks and Their Synthesis in the Context of Teacher Education

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This study aims to conduct a comparative conceptual analysis of three influential frameworks in the field of artificial intelligence (AI) literacy, namely the UNESCO AI Competency Framework for Teachers (2024), the European Commission's DigComp 2.2 (Vuorikari et al., 2022), and the conceptual model of Long and Magerko (2020), and to synthesize the findings in the context of teacher education. Designed as a descriptive-analytical document analysis, the study examines the points of convergence and divergence among the frameworks in terms of technical competence, ethics, pedagogical integration, and critical thinking, and discusses the limitations of the existing frameworks with respect to technological pedagogical content knowledge (TPACK) and cultural/local adaptation processes. As a result of the analysis, a three-layered, interdisciplinary integration model is proposed for faculties of education and in-service teacher training programs.

Keywords: Artificial Intelligence Literacy, Teacher Education, Competency Frameworks, TPACK, Digital Competence

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The Challenges Students Face in the Transition from Simulation to Physical Application in Robotics Coding Education

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The main purpose of this study is to examine the pedagogical and technical challenges that middle school students encounter during the transition from simulation-based environments such as Tinkercad to Arduino-based physical computing applications within information technologies education. The study adopts a descriptive review method; works directly related to the topic were examined within the framework of the keywords Robotics Coding, Physical Computing, Arduino, Tinkercad, and Simulation-Based Learning. Drawing on the reviewed literature, the study offers a critique through the SAMR model, one of the technology integration models. It is observed that current applications generally remain at the model's first stage, "Substitution." Using simulation tools merely as a direct digital copy of physical components, without producing any functional change, is thought to limit the potential to transform the learning experience. The reviewed studies indicate that, when moving from the flawless digital models of the simulation to real hardware, students face technical difficulties at points such as recognizing pin connections, building circuits that require fine motor skills, and handling sensitive electronic components. This gap between the idealized environment of the simulation and the uncertainties of the physical world strains students' debugging skills and negatively affects their self-efficacy perceptions. Consequently, the transition from simulation to physical application is regarded not merely as a change of tools but as a distinct learning phase that requires different problem-solving skills. Accordingly, it is recommended that guiding materials and scaffolding strategies which increase hardware awareness and reduce technical anxiety be implemented, particularly through a design in which support is gradually withdrawn as the student becomes more competent.

Keywords: Robotics Coding, Arduino, Tinkercad, Simulation-Based Learning, SAMR Model

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Hybrid Learning through the Recognition of the Ancient Sundanese Handwriting System Using Deep Learning

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Indonesia is a country rich in ethnic and cultural diversity, one example being the Sundanese people of West Java. The Sundanese have been familiar with writing since the 5th century AD, as evidenced by the discovery of inscriptions, charters and ancient manuscripts from that period. To this day, the Sundanese people have their own alphabet, the form of which has continued to evolve over time. However, what of the ancient Sundanese script? Does it still exist, and is it being introduced to the Sundanese people? Through this research, a system will be designed to support the sustainability of the ancient Sundanese script, ensuring its continued existence alongside the progression of time. It is hoped that this system will become a key component in the teaching of the Sundanese language in primary schools, particularly in West Java. The system utilises the ancient Sundanese script, comprising consonants, independent vowels, diacritics and numerals. The intended users of this application are teachers, students and philologists.

Teachers act as instructors, teaching students how to write and recognise each character of the ancient Sundanese script, whether online or offline, and guiding them based on feedback provided by philologists. Other users include students, who can access the learning resources both online and offline. Students are provided with a page on which to write samples of ancient Sundanese script; these are then identified by the system using deep learning modelling to analyse and determine the similarity of the students' handwriting to ancient Sundanese script, after which they are evaluated and given feedback by the philologist. The philologist will also act as the arbiter in selecting students' handwriting samples, which will then be processed into features in accordance with the repository's requirements. Every user can view the progress of students' handwriting, presented in the form of a graph showing their handwriting achievement.

Keywords: Hybrid Learning, Ancient Sundanese Script, Deep Learning, Handwriting

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Prompt Literacy in the Age of Generative Artificial Intelligence

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The rapid spread of generative artificial intelligence technologies in the field of education has led to the emergence of new skill areas in learning processes. Large language models such as ChatGPT, Gemini, and Claude now play an active role not only in accessing information but also in content generation, problem solving, and supporting learning processes. This transformation has brought about a new area of competence that enables users to communicate effectively with artificial intelligence systems. This area of competence is called prompt literacy. Prompt literacy is defined as individuals' ability to provide appropriate instructions to generative artificial intelligence systems, critically evaluate the outputs obtained, and continuously improve the interaction in order to achieve the desired result. The aim of this study is to examine the concept of prompt literacy in the field of education and to reveal approaches and challenges related to effective prompt design. When studies conducted in recent years are examined, it is seen that the quality of outputs obtained from generative artificial intelligence tools largely depends on the quality of the prompts prepared by users. Therefore, prompt literacy is considered not only a technical process but also a new pedagogical field in which learning design, critical thinking, and digital literacy skills converge. Various strategies for effective prompt design are suggested in the literature. For example, instead of a simple prompt such as "Explain photosynthesis," role-based prompts such as "Act as a science teacher and explain photosynthesis to 6th-grade students using examples from daily life" are reported to produce higher-quality outputs that are more appropriate for students' levels. Similarly, instead of the prompt "Solve this mathematics problem," chain-of-thought prompts such as "Solve the problem step by step and explain the strategies you use" are reported to support students' higher-order cognitive skills. In educational environments, prompts are used in many areas, such as preparing lesson plans, developing measurement and assessment tools, generating content, creating individualized learning experiences, and supporting academic writing processes. For example, while a teacher can quickly develop assessment tools by using a prompt such as "Create 10 analysis-level questions based on Bloom's taxonomy," a student can support the writing process with a prompt such as "Revise this text using academic language and indicate the types of sources that are missing." The prompt "Simplify this text for a student diagnosed with dyslexia, use short sentences, and add suggestions for visual support" contributes to inclusive education practices. Similarly, prompts such as "Identify the student's missing learning outcomes based on the questions answered incorrectly and create a revision study plan" support individual learning. However, the literature draws attention to various risks and ethical issues associated with prompt use. The generation of incorrect information by artificial intelligence systems, the creation of content without citing sources, and the production of biased results are among the primary risks. Recent studies conducted in higher education show that the majority of students use generative artificial intelligence tools, but a significant proportion of them have not received any training on this subject. This situation reveals that, rather than merely teaching the use of artificial intelligence, it is necessary to teach how artificial intelligence can be used effectively, consciously, and ethically. In conclusion, prompt literacy is regarded as one of the prerequisites for effective interaction with generative artificial intelligence systems and holds an important place among contemporary digital competencies.

Keywords: Prompt Literacy, Generative Artificial Intelligence, Artificial Intelligence Literacy.

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Approaches to Learning and Collaboration Patterns in Flipped Classrooms: Examining Differences in the Quality of Collaboration

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This study examined how students' approaches to learning influence the formation of collaboration patterns and how these patterns, in turn, relate to the quality of collaboration and academic performance in flipped classroom settings. Drawing on a combination of self-reported survey data and digital trace data from 432 first-year undergraduate students, a latent profile analysis identified two distinct approaches-to-learning profiles: a Deep-Active profile, characterised by intrinsic motivation, active engagement, and strategic learning behaviours, and a Surface-Disengaged profile, characterised by minimal effort, fragmented engagement, and a focus on task completion rather than understanding.

By considering both students' approaches-to-learning profiles and their self-selected collaboration partners, three collaboration patterns emerged: homogeneous Deep-Active patterns, homogeneous Surface-Disengaged patterns, and heterogeneous Mixed patterns comprising students from both profiles. One-way analyses of variance revealed significant differences among these patterns in several social network indicators, including indegree, outdegree, and inward harmonic closeness centralities. Students in the Deep-Active and Mixed patterns demonstrated more reciprocal, sustained, and extensive interaction patterns, occupying network positions that made them more visible and accessible to their peers. In contrast, students in the Surface-Disengaged pattern tended to be more peripheral, maintaining fewer collaborative ties and experiencing lower levels of peer connectivity.

Hierarchical regression analyses further showed that a surface approach to learning and outward harmonic closeness were significant negative predictors of academic achievement, suggesting that students who adopted less meaningful learning strategies and occupied outwardly dispersed network positions tended to perform less well academically. Conversely, behavioural engagement indicators derived from digital traces—specifically, the frequency of participation in preparatory and consolidating learning activities—as well as outdegree centrality, positively predicted learning outcomes. These findings underscore the importance of both meaningful engagement and active network participation in supporting student success in flipped classrooms.

Overall, the study highlights the intertwined relationships among students' approaches to learning, their collaborative network positions, and academic achievement. The findings suggest that fostering deep approaches to learning and creating opportunities for productive peer interactions may help students establish more beneficial collaboration patterns and improve the quality of collaboration, thereby enhancing their learning outcomes in technology-enhanced and flipped learning environments.

Keywords: Quality of Collaboration; Approaches To Learning; Social Network Analysis;

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What Influences Early Childhood Teachers' Adoption of Artificial Intelligence in Teaching? Insights from UTAUT2

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Artificial intelligence (AI) has been increasingly integrated into early childhood education (ECE), and a growing number of EC teachers are adopting AI technologies and tools to support teaching, assessment, and administrative tasks. However, EC teachers have exhibited both positive and negative attitudes towards using AI in teaching, recognising its potential to enhance teaching effectiveness while also expressing concerns about its complexity, reliability, and implementation challenges. Despite the growing use of AI in ECE, limited research has examined the factors that influence EC teachers' intentions to adopt AI and their actual use of AI in educational practice. Understanding these factors is essential for supporting the effective and sustainable integration of AI technologies in ECE settings.

This study aimed to investigate the relationships between the seven key determinants of the Unified Theory of Acceptance and Use of Technology 2 (UTAUT2) and Chinese EC teachers' behavioural intention (BI) and use behaviour (UB) regarding AI in teaching. By applying the UTAUT2 model to the relatively underexplored context of early childhood education, the study sought to identify the key drivers and barriers associated with teachers' AI adoption.

A quantitative research design was employed. Data were collected from Chinese EC teachers working in a range of early childhood settings and analysed using PLS-SEM to examine the direct relationships among the UTAUT2 constructs, behavioural intention, and actual use behaviour.

The findings revealed that Habit was the strongest predictor of teachers' behavioural intention to use AI, followed by Personal Innovativeness, Performance Expectancy, and Hedonic Motivation, all of which had significant positive effects on BI. In contrast, Effort Expectancy negatively predicted BI, suggesting that teachers may be less inclined to adopt AI when they perceive its use as difficult or requiring substantial effort. Regarding actual AI use, only Behavioural Intention and Facilitating Conditions significantly and positively influenced Use Behaviour. The findings suggest that internal factors, particularly Habit, play a critical role in shaping teachers' intentions to adopt AI, whereas external contextual factors, such as the availability of technological infrastructure, resources, and support, are more influential in determining teachers' actual use of AI in teaching.

This study contributes to the growing literature on teachers' AI adoption by providing empirical evidence from the relatively underexplored context of early childhood education. Specifically, it demonstrates that Habit is the most influential determinant of Chinese EC teachers' behavioural intention to use AI, while Facilitating Conditions are crucial for translating intention into actual use behaviour. The findings highlight the importance of developing teachers' habitual use of AI, fostering personal innovativeness, and establishing supportive technological environments to promote AI integration in teaching. Practical strategies, including providing systematic AI training, encouraging teachers to experiment with diverse AI tools, and strengthening technical and infrastructural support, may facilitate EC teachers' effective and sustained use of AI in educational practice. For Chinese EC teachers to actively integrate AI into their teaching, kindergartens and ECE centres should invest in professional development programmes, provide adequate technological resources, and establish strong support systems that enable teachers to use AI confidently and effectively.

Keywords: Early Childhood Teachers, Artificial Intelligence Use, UTAUT2

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The Role of Teacher Feedback and LLM-Generated Feedback in Chinese Students' English Essay Revision: Evidence from a Mixed-Methods Study

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The emergence of large language models (LLMs) has created new opportunities for providing writing feedback in foreign language (FL) education. However, limited research has compared the effectiveness of LLM-generated feedback and teacher feedback in supporting students' writing revision and examined learners' perceptions of these two feedback sources. Adopting a mixed-methods design, this study compared teacher feedback and LLM-generated feedback on Chinese students' English essay revision, their perceptions of the usefulness and ease of use of the two types of feedback, and their perceived benefits and drawbacks.

Thirty-five Chinese students completed two English essay-writing tasks and received feedback from their English teacher and a large language model, respectively. Students revised one essay based on teacher feedback and the other based on LLM-generated feedback. Following the revision activities, they completed a 5-point Likert-scale questionnaire measuring the Perceived Usefulness and Perceived Ease of Use of the two types of feedback. In addition, qualitative data were collected to explore students' experiences and perceptions of teacher feedback and LLM-generated feedback.

The quantitative results showed that students achieved significantly higher scores on essays revised using LLM-generated feedback than on those revised using teacher feedback, suggesting that AI-generated feedback was effective in facilitating immediate text revision. However, despite the superior revision outcomes associated with LLM-generated feedback, students perceived teacher feedback as significantly more useful and easier to use during the revision process. The qualitative findings further revealed four overarching themes regarding the benefits and drawbacks of the two types of feedback. Students appreciated LLM-generated feedback for its immediacy, detailed suggestions, and accessibility, but also expressed concerns about its accuracy, contextual appropriateness, and occasional lack of personalised guidance. In contrast, teacher feedback was valued for its credibility, contextual understanding, and tailored support, although students noted limitations related to feedback timeliness and the amount of feedback provided.

Overall, the findings indicate that teacher feedback and LLM-generated feedback possess complementary strengths and weaknesses in supporting English essay revision. While LLM-generated feedback appears particularly effective for improving immediate revision performance, teacher feedback remains highly valued for its pedagogical guidance and trustworthiness. The study highlights the potential of integrating AI-generated feedback with teacher feedback to enhance students' writing development and provides important implications for the effective use of generative AI technologies in foreign language writing instruction.

Keywords: Teacher Feedback; LLM-generated Feedback; Foreign Language Writing; Perceived Usefulness; Perceived Ease of Use

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Investigation of Student Acceptance in the Process of Virtual Reality-Supported Material Development

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In recent years, the widespread use of virtual reality technologies in education has made it crucial to investigate students' acceptance levels toward these technologies. Although studies on virtual reality acceptance exist in the literature, such research predominantly focuses on processes where students experience ready-made virtual reality content. However, there is a limited number of studies examining how activities where students utilize digital tools to create their own virtual reality videos reflect on their virtual reality acceptance levels. Within this scope, the purpose of this research is to investigate students' virtual reality acceptance levels regarding the processes of developing and experiencing virtual reality-supported instructional materials. The study group of the research consists of 25 university students enrolled in the Geography Education Program at a state university and taking the Instructional Technologies course. Within the scope of the research, students were primarily trained on the use of Google Earth Studio, ThingLink, and virtual reality headsets. Following this training, students produced 360-degree videos based on three-dimensional locations they selected using Google Earth Studio; they then transferred these videos into the ThingLink environment to transform them into interactive instructional materials enriched with multimedia elements. Finally, the created materials were shared via ThingLink, and students experienced these shared materials using virtual reality headsets. Following the application, data were collected through the Educational UTAUT-Based Virtual Reality Acceptance Scale. The research findings demonstrated that students' overall acceptance levels toward virtual reality were high. When the sub-dimensions of the scale were examined, it was determined that students possessed a high level of virtual reality acceptance in the dimensions of performance expectancy, effort expectancy, and facilitating conditions, while maintaining a moderate level in the social influence dimension. Additionally, it was determined that students reached their highest acceptance level in the facilitating conditions dimension. The obtained results indicate that students have positive perceptions toward using virtual reality technologies for educational purposes.

Keywords: Virtual Reality, Virtual Reality Acceptance, UTAUT, Google Earth Studio, ThingLink

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The Impact of School Principals' Technology Leadership Skills on their Competency-Based Job Performance

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The contemporary world is characterised by accelerated technological advancement. As with many sectors, the impact of this change on countries' education systems has been significant. In this particular context, it can be posited that the most significant impact has been observed within the domain of education. In the context of the political framework, governments are cognisant of the necessity to adapt their education systems to this change. In order to ensure the successful integration of the aforementioned elements, it is essential to provide support for the transformation of schools, which represent the smallest unit of the education system. In this context, the technological skills of school principals and their technology leadership, along with competency-based job performance, are becoming increasingly important. The efficacy of this integration or transformation can be evaluated by the extent to which the school principal, as a pivotal member of the school's faculty, possesses leadership skills in the domain of technology. In the context the central research question pertains to the influence of school technology leadership skills on competency-based job performance, which is pivotal to understanding educational quality and success.

The purpose of this study is to examine the effect of school principals' leadership skills in the field of school technology on their competency-based job performance. The study adopted a correlational research model, utilising quantitative research methods. The study group was determined using simple random sampling and included primary school teachers and principals working in Istanbul. The School Technology Leadership and School Principals' Competency-Based Job Performance Perception scales, in both principal and teacher versions, were utilised in the study. The research findings indicate that school principals' perceptions of their school technology leadership and competency-based job performance exceed those of teachers, and the discrepancy between the two groups is statistically significant. Cohen's d effect size analysis indicated that the task variable exerted a negligible influence on school technology leadership and competency-based job performance. The present study set out to determine whether there is a positive and meaningful relationship between school technology leadership and competency-based job performance. The results of the study support the hypothesis, with the study finding a high level of correlation between the two variables. However, while a moderately significant positive relationship was determined between school principals' perceptions of school technology leadership and all sub-dimensions of competency-based job performance, only a moderately significant positive relationship was determined between teachers' perceptions of school technology leadership and the sub-dimensions of 'Provision and Management of Financial Resources' and 'Communication and Values'. The present study set out to investigate the impact of school technology leadership on competency-based job performance. The results of the study indicated a positive and significant effect. It is the opinion of school principals and teachers that school technology leadership is an important predictor of competency-based job performance and its sub-dimensions.

Keywords: Technology, Competency, School Technology Leadership, Competency Based Job Performance, School Principal

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Using GeoGebra to Visualize the Bisection and Newton Methods in the Teaching of Nonlinear Equations

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Nonlinear equations arise in numerous mathematical models and applications, making numerical methods essential for obtaining approximate solutions. However, students often encounter difficulties in developing an intuitive understanding of iterative procedures and the convergence process when numerical methods are presented solely through formulas and numerical computations. Dynamic mathematics software can help overcome these difficulties by providing visual representations and connecting analytical procedures with their geometric interpretation. In this context, visualization can play an important role in supporting conceptual understanding and promoting meaningful learning.

This paper presents the use of GeoGebra for the visualization and teaching of two classical numerical methods for solving nonlinear equations: the Bisection Method and Newton's Method. The theoretical background of both methods is briefly reviewed, including the conditions required for their application, stopping criteria, and convergence properties. Particular attention is devoted to the graphical representation of the iterative process and to illustrating the geometric ideas underlying each method. Interactive GeoGebra visualizations were developed to provide students with a dynamic representation of successive approximations and to enable them to observe the convergence process in real time.

The developed visualizations were incorporated into the teaching process as a supplement to traditional instruction. By combining analytical procedures with graphical representations, students are able to relate symbolic calculations to their geometric meaning more effectively and to explore numerical methods through active interaction. Such an approach encourages active learning and supports the development of a deeper conceptual understanding of convergence and approximation processes. Furthermore, dynamic visualizations make abstract mathematical concepts more accessible and facilitate the interpretation of iterative procedures, which are often difficult to understand through numerical calculations alone.

This results suggests that the integration of GeoGebra into higher mathematics courses can serve as a valuable complement to traditional teaching. The use of interactive visualizations contributes to increased student engagement and creates a more stimulating learning environment, encouraging students to investigate mathematical concepts independently and to connect symbolic calculations with their geometric meaning. By supporting active learning and facilitating the interpretation of abstract concepts, GeoGebra has considerable potential as an educational tool for enhancing the teaching and learning of numerical methods and promoting meaningful mathematical understanding. Moreover, the proposed approach may be extended to other areas of mathematics, where dynamic visualizations can facilitate conceptual understanding, promote active learning, and contribute to more interactive and meaningful learning experiences.

Keywords: Numerical Methods, GeoGebra, Mathematics Education.

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Bridging the Gap: A Hybrid AI Approach to Multi-Parameter Anomaly Detection and Decision Support in Clinical Laboratories

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Clinical laboratories now process enormous sample volumes every day, but the final review step hasn't changed all that much. Technicians and pathologists still lean heavily on static, single-parameter reference ranges to flag what's abnormal. For medical residents and trainees, learning to identify complex, multi-parameter anomalies presents a steep cognitive hurdle, as real pathology rarely announces itself through one biomarker crossing a line. More often, it shows up as a coordinated drift across several values at once, none individually alarming, but together suggestive of an underlying condition.

AI-LabMed is our attempt at closing both gaps at once, the operational one and the pedagogical one. The framework runs as a two-stage pipeline layered on top of existing lab workflows: an Isolation Forest first screens incoming panels for multi-parameter outliers without needing labeled training data, and candidates flagged at this stage are passed to an XGBoost classifier, which looks for non-linear relationships and longitudinal shifts by comparing each new result against a patient's own historical records.

On top of this sits a SHAP-based explainability layer, added partly for clinical transparency and just as much because future clinicians need practice questioning automated systems rather than trusting them blindly. Each flagged case comes with a ranked breakdown of which biomarkers drove the anomaly score. In an educational context, this turns the framework from a simple screening tool into something closer to an interactive instructional scaffold: trainees can trace the model's reasoning biomarker by biomarker, which sharpens both their data literacy and their independent clinical reasoning.

We tested the pipeline on three years of longitudinal data from 10,000 patients across cardiology, hematology, oncology, and family medicine, covering 42 distinct biomarkers. Results show that the system substantially cuts routine manual workloads while doubling as a transparent decision-support tool. For learners specifically, that transparency is the real point: instead of facing a wall of unexplained alerts, trainees get a structured, case-by-case window into how the model reasons, which is what makes explainable AI genuinely useful in laboratory medicine training, not just in day-to-day clinical practice.

Keywords: Artificial Intelligence, Laboratory Medicine, Anomaly Detection, Explainable AI, Medical Education, Decision-Making Literacy

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Adaptation of the Human–Computer Trust Scale into Turkish in the Context of Generative Artificial Intelligence

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Trust has become a critical construct in human–artificial intelligence interaction as generative artificial intelligence increasingly produces, recommends, and mediates content in educational and everyday contexts. Unlike conventional artificial intelligence systems, generative AI requires users to evaluate the reliability, accuracy, transparency, usefulness, and ethical acceptability of system-generated outputs. Although recent studies in the Turkish context have mostly focused on artificial intelligence literacy, attitudes, awareness, and anxiety, there is still a clear need for valid and reliable instruments that specifically measure trust in artificial intelligence and generative AI. Therefore, this study aimed to adapt the revised Human–Computer Trust Scale into Turkish in the context of generative artificial intelligence and to examine its psychometric properties. This study was designed as a scale adaptation study. The original scale, developed by Gulati et al. and later extended and cross-culturally validated by Beltrão et al. (2025), consists of 14 items rated on a five-point Likert scale. The translation process included forward translation, back-translation, and expert review. The Turkish form was evaluated by two Turkish language experts and eight instructional technology experts for linguistic clarity, content validity, conceptual equivalence, and contextual appropriateness. Prior to final administration, face-to-face interviews with ten undergraduate students were conducted to assess item comprehensibility and dimensional alignment. Based on expert and pilot feedback, necessary revisions were made. The final form was administered online to [N = 696] participants during the 2025–2026 academic year. Confirmatory factor analysis, convergent validity, discriminant validity, composite reliability, and Cronbach's alpha analyses were conducted. The confirmatory factor analysis indicated that item m3 was removed due to a low factor loading, while items m12 and m7 were removed because of modification indices. The final model consisted of 11 items and five factors: perceived risk, benevolence, competence, structural assurance, and trust. The model showed acceptable to good fit values [$\chi^2/df = 3.429$; GFI = .969; AGFI = .940; NFI = .946; CFI = .961; TLI = .936; IFI = .961; RMSEA = .059; RMR = .040; SRMR = .045]. Factor loadings ranged from .545 to .853. AVE values ranged between .43 and .61, composite reliability coefficients ranged between .60 and .76, and Cronbach's alpha coefficients ranged between .60 and .75. The overall internal consistency coefficient was α = .66. HTMT values were below the commonly accepted threshold, supporting discriminant validity. The findings indicate that the Turkish form of the scale provides acceptable validity and preliminary evidence of reliability for measuring trust in generative AI systems. The adapted scale may contribute to future research on human–AI interaction, generative AI adoption, educational technology use, and trust-related variables in Turkish educational contexts. Future studies are recommended to test the scale with larger and more diverse samples and to examine its relationships with variables such as AI literacy, technology acceptance, perceived usefulness, and ethical AI use.

Keywords: Generative Artificial Intelligence; Trust in Artificial Intelligence; Human–computer Trust; Scale Adaptation; Validity And Reliability.

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Future-Proofing the Educational Ecosystem: A Synergistic Framework of Transformative Learning, Resilience, and Artificial Intelligence

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Contemporary educational systems are undergoing a fundamental paradigm shift in an era researchers describe as a polycrisis—the simultaneous convergence of armed conflicts, climate emergencies, public health disasters, and rapid technological acceleration. In this context, traditional knowledge-transmission models are proving inadequate in addressing the epistemological and ontological disruptions brought about by the artificial intelligence (AI) revolution, while the gap between current educational structures and the demands of a volatile, uncertain world continues to deepen. This study seeks to answer how transformative learning, psychological resilience, and AI can be conceptualized within a holistic framework capable of sustaining the educational ecosystem of the future by developing a triple synergy (tripod) model comprising these three dimensions and translating it into concrete, actionable strategic policy recommendations. The study employs an integrative literature review and conceptual model-building approach, drawing on Web of Science, Scopus, and Google Scholar platforms and supplemented by strategic reports from UNESCO, the World Bank, and the African Union. The literature was thematically analyzed under three main categories—cognitive and perspective-focused change, systemic and socio-ecological resilience, and technological catalysis—and synthesized into the proposed model. The findings reveal three interconnected dynamics. The first dimension, grounded in transformative learning theory, demonstrates how disorienting dilemmas, critical reflection, and rational discourse enable individuals to reconstruct their meaning structures, aligning with UNSDG 4.7 targets. The second dimension reframes psychological resilience beyond bouncing back through the concepts of transformative resilience and transilience, integrating stress and allostasis—the active process by which the organism re-establishes internal equilibrium in response to changing conditions or stressors—across individual, relational, and institutional levels to cultivate meta-competencies such as agency, adaptability, creativity, and self-awareness. The third dimension positions AI as a bidirectional catalyst: AI for Resilience ensures educational continuity during crises, while AI for Transformation supports critical thinking through models such as CEDE, HASRL, and the emerging Intelligent-TPACK teacher competency framework. However, caution is advised that when deployed without adequate critical thinking support, AI risks generating new inequalities—most notably the AI Divide and techno-solutionism. Empirical illustrations from Ghana, Namibia, and Botswana substantiate these dynamics in practice. The study concludes that a future-ready educational ecosystem must integrate AI's efficiency with human empathy and systemic durability. Such a system is defined not merely by academic outcomes, but by an ongoing process of becoming in which AI scales human potential, resilience ensures sustainability, and transformative learning confers depth of meaning—always anchored in the human-in-the-loop principle. Building on these conclusions, the study presents a draft strategy and policy framework aligned with the UNESCO 2030 Agenda, the World Bank's ERA approach, and the African Union Digital Education Strategy, recommending the integration of Intelligent-TPACK competencies into teacher education programs, the adoption of CEDE and HASRL instructional design models, and the reorientation of curricula toward ethical reasoning and metacognitive skill development. Future research is encouraged to empirically examine the effects of digital

transformation and global crises on this synergy, and to develop standardized tools for measuring meta-competencies and institutional resilience.

Keywords: Artificial Intelligence, Future of Education, Instructional Design, Intelligent-TPACK, Resilience, Transformative Education, Transilience

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AI-Supported Learning in Girls' Madrasah Education: AI Literacy, Perceptions and Cultural Acceptance in Bangladesh

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Artificial Intelligence (AI) is increasingly transforming education through personalized learning, instant feedback, and accessible knowledge resources. However, little is known about AI literacy, perceptions, and cultural acceptance of AI-supported learning in girls' Madrasah education in Bangladesh. This study investigates students' AI literacy levels and explores the perceptions, trust, and sociocultural acceptance of AI among students, guardians, and teachers in a girls' Madrasah context. A convergent parallel mixed-method design was employed. Quantitative data were collected from 200 female students in Grades 8, 9, and 11 using the AI Literacy Scale developed by Wang et al. (2022) and adapted by Çelebi et al. (2023), comprising 12 items across four dimensions: awareness, usage, evaluation, and ethics. Qualitative data were collected through semi-structured interviews with 20 students, a focus group discussion with 20 guardians, and key informant interviews with 8 teachers using researcher-developed instruments that were piloted and reviewed by education experts. The quantitative findings revealed moderate to high AI literacy among participants. Overall AI literacy declined across grade levels, with Grade 8 students achieving the highest total scores, followed by Grades 9 and 11. Grade 8 students demonstrated the highest AI usage, Grade 9 students showed the strongest AI awareness, and Grade 11 students exhibited the highest ethical awareness, indicating greater sensitivity to privacy, security, and responsible AI use. Evaluation skills remained relatively consistent across all grades. Qualitative findings showed that Grade 8 students were more accustomed to using the free version of ChatGPT than higher-grade students. Although most participants did not own personal devices, they accessed AI through parents' or siblings' smartphones for approximately 10–15 minutes, two to three times per week. ChatGPT was primarily used for self-study, homework support, concept clarification, and assignment preparation, particularly for English, mathematics, science, and ICT subjects. Some students also used AI for personal inquiries and occasional image generation. Participants regarded ChatGPT as a useful and easy-to-use academic assistant but did not blindly trust its outputs, preferring to verify information with textbooks, teachers, and peers. The findings further indicate that cultural acceptance of AI is strongly influenced by family and school environments. While many guardians had limited knowledge of AI, they generally permitted its use for educational purposes. Teachers recognized AI's potential to enhance learning but expressed concerns regarding overreliance, academic dishonesty, misinformation, privacy, and inappropriate internet use. Conversely, technologically informed teachers viewed AI literacy as an essential competency for preparing girls for a technology-driven society and advocated responsible rather than restrictive AI use. Overall, AI-supported learning is gradually gaining acceptance in girls' Madrasah education, although its adoption remains shaped by ethical considerations, trust, parental supervision, and institutional attitudes. The study highlights the need for structured AI literacy initiatives, ethical AI education, and context-sensitive implementation strategies to promote responsible AI integration in culturally conservative educational settings.

Keywords: AI Literacy, Artificial Intelligence in Education, Girls' Education, Madrasah Education, Cultural Acceptance, Responsible AI.

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Investigation of Pre-Service Teachers' AI-Assisted Self-Regulation Skills

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With the widespread use of Generative Artificial Intelligence technologies in higher education, students' use of these tools for different purposes, particularly learning, has increased. At this point, students' self-regulation skills have come to the forefront in order for them to obtain the highest benefit from these tools. Self-regulation, which is a multilayered process through which individuals exercise cognitive, motivational, behavioral, and affective control over their own learning processes, has gained greater importance due to the structure of generative artificial intelligence that supports autonomous learning. Against this background, this study aimed to determine the self-regulation skills of education faculty students in AI-assisted learning processes. Since the research aimed to describe an existing situation as it is, it was designed using the survey model in accordance with quantitative research methods. A total of 113 students studying in different fields, predominantly foreign language-related fields, at the faculty of education participated in the study. Data were collected using the "Self-Regulation in AI-Assisted Learning Scale" (SRAILS) developed by Yurt (2025). The scale consists of four main dimensions and nine subdimensions. In terms of its main dimensions and subdimensions, the scale has a structure consisting of motivational components (intrinsic motivation, extrinsic motivation, self-efficacy), cognitive and metacognitive strategies (cognitive strategies, metacognitive self-regulation), time and study management (time management, task management), and environmental self-regulation (resource management, technological adaptation and flexibility). As a result of the analyses conducted on the current sample, the overall scale and its subdimensions were found to be highly reliable. Although all main dimensions were above the average, among the main dimensions, the highest mean was found for environmental self-regulation, while the lowest mean was found for time and study management. At the subdimension level, self-efficacy had the highest mean and metacognitive self-regulation had the lowest mean. Overall, all findings indicate that education faculty students strongly adapt to artificial intelligence tools in terms of technological adaptation and resource management among their self-regulation skills. In addition, students consider themselves competent in terms of self-efficacy and cognitive strategies. In contrast, although their self-regulation skills in terms of time planning and metacognitive self-regulation are generally above average, they are lower compared to the other subdimensions. This indicates that pre-service teachers still need support in this area. According to the results of the study, the inclusion of supportive practices that can be implemented in faculties of education to improve pre-service teachers' time management, task management, and metacognitive awareness skills in AI-assisted learning environments will enable them to further develop their self-regulation skills.

Keywords: Generative Artificial Intelligence, Pre-Service Teachers, Faculty of Education, Self-Regulation

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Uncovering Pre-service ELT Teachers' Conceptions of AI through Metaphor Analysis

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Artificial intelligence (AI) has advanced rapidly and existed almost in every part of people's lives. In language education, teachers and other stakeholders have been utilizing it for several purposes while having diverse opinions and attitudes. However, it is much more important for teacher candidates to be aware of what AI is, how it functions, and how it affects education to promote effective teaching practices in the future. Also, their conceptions of AI will likely influence their present and future AI uses such that whether they will take advantage of or avoid it, and whether they will use it competently or uncritically. Therefore, understanding how they describe and interpret AI can be helpful to uncover their cognitive illustrations of and approaches towards AI in order to shape their understandings and beliefs in teacher training and to make them ready for the future. Then, this study aims to explore pre-service teachers' ideas about AI through metaphor analysis to find out their AI conceptions with their reasons so that their mental representations of AI will be revealed. Designed as a qualitative study, the current study investigated what kind of metaphors were ascribed to AI and under which categories they were distributed. 103 pre-service ELT teachers responded to an online form in which they wrote AI metaphors with their rationales. Out of 103 responses, 98 of them were eligible to be analyzed within the frame of a metaphor. As a result of the content analysis, the metaphors were categorized into five groups: A supportive friend/tool (e.g., maid), an evolving entity (e.g., life), a source of knowledge/information (e.g., library), an ambivalent power (e.g., nuclear bomb), and a threat (e.g., virus). The findings showed that most of them held positive views of AI stressing its functions such as doing tasks easily and automatically. Similarly, they emphasized it is a huge repository like knowing everything. Also, some labeled AI as something that grows gradually and is adaptable by underlining its present and future potential. However, some were uncertain about its power by reporting its dual nature that AI can be useful and hazardous at the same time. Lastly, few of them had totally negative conceptions in that they considered AI as a risk by stating the concerns such as misinformation and displacing teaching profession. Accordingly, it can be concluded that pre-service teachers had diverse conceptions, many thought AI was beneficial and versatile and were aware of its unpredictable growth and some dangers. However, using AI efficiently in teaching as a partner, approaching its outputs critically, and avoiding overreliance on the automation of teacher tasks were not highlighted much in their conceptions. Hence, in teacher training, AI literacy education including critical thinking, challenges and limitations, guidelines for more pedagogical and practical uses in relation to the subject matter should be addressed to cultivate teacher identity and confidence in understanding AI concept early in learning.

Keywords: Artificial Intelligence, Conception, Metaphor, Pre-service Teacher, Teacher Training

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AI Readiness in Open and Distance Education Institutions: A Phenomenological Inquiry into Organizational, Technological, Environmental, and Ethical Factors

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AI technologies are changing open and distance education in real terms: personalized learning, adaptive assessment, intelligent decision support. Institutions have taken notice. However, it is unclear whether they are actually prepared to adopt these tools at the organizational level and what that preparation requires. Existing research has mainly focused on the technical aspects of AI systems or their pedagogical applications. The readiness conditions that must come before successful adoption, particularly within the ODE context, have received far less attention.

This study addresses this gap by examining the AI readiness factors of open and distance education institutions. The theoretical framework combines the Technology-Organization-Environment (TOE) Framework (Tornatzky & Fleischer, 1990) and the Diffusion of Innovation Theory (Rogers, 2003), which together allow for a more complete view of how institutions encounter and respond to technological changes. A phenomenological design was adopted because AI readiness is best understood through lived expert experience rather than through aggregated scores or outcomes.

Data were collected through semi-structured in-depth interviews with 15 international domain experts selected through criterion-based purposive sampling. Both conditions had to be met: recognized expertise in AI and active professional engagement in an ODE institution. Over 100 invitations were extended before the sample was complete, which reflects how rare that combination actually is. Data were analyzed using descriptive and thematic coding in NVivo 14, and data collection continued until thematic saturation was reached.

Five themes emerged from the analysis: organizational readiness, technological readiness, environmental readiness, ethical readiness for AI, and identified gaps and recommendations. Key factors across these themes included resource adequacy, top management support and AI experience, complexity reduction strategies, the relative advantage of AI, regulatory and competitive pressures, learner-centered integration, algorithmic bias, data privacy, and the need for multidisciplinary governance. Together they form an AI readiness framework grounded in the specific structural and pedagogical conditions of ODE institutions.

The study concludes that AI readiness is not a binary state. It is a layered institutional capacity shaped by the interaction of organizational, technological, social and ethical forces. As a practical output, an AI Readiness Institutional Self-Assessment Checklist was developed to guide administrators before adoption decisions are made. In an era defined by rapid technological change and educational uncertainty, knowing where your institution stands is the necessary first step.

Keywords: Artificial Intelligence Readiness; Open And Distance Education; Technology Adoption; TOE Framework; Phenomenology

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What Do Graduates Say? A Five-Year Satisfaction Trend in Applied Education within Higher Education

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The uncertainty produced by globalisation, rapid technological change and successive crises is shifting the outcomes expected of higher education beyond the transmission of theoretical knowledge, increasingly prioritising the continuity of learning, adaptability and ethical responsibility. Within this framework, monitoring graduate outcomes constitutes a key indicator for institutional quality assurance and strategic planning. This study aims to examine, through secondary analysis, the publicly shared graduate satisfaction survey results (2021–2025) of Sakarya University of Applied Sciences, in order to reveal how the learning, adaptation/resilience and responsibility gains targeted by the "+1 Applied Education Model"—which devotes the final semester to workplace-based applied training—are reflected in satisfaction indicators. The study addresses the following questions: (1) what trend do graduate satisfaction perceptions show between 2021 and 2025; (2) how do satisfaction indicators differ across years and academic units; (3) what changes are observed across years in areas such as foreign-language proficiency and employment opportunities? A repeated cross-sectional (trend) survey design within a quantitative approach was adopted; because data obtained from different graduate groups in different years using the same instrument are compared, change is examined at the cohort rather than the individual level. The data source is the annual results of a 22-item, 5-point Likert-type survey developed by a team of the university's academic staff. Descriptive statistics and—to the extent permitted by the granularity of the data—comparative analyses across years and units are employed, with attention to the cross-year comparability and reliability of the indicators. Because the data consist of voluntary, publicly available responses, limitations regarding representativeness and response rate are explicitly addressed. The study's original contribution lies in combining a five-year trend dimension with a transparent, reproducible secondary-analysis approach to present a situation and needs analysis of sustainable learning and institutional responsibility in applied higher education.

Keywords: Applied Higher Education, Graduate Satisfaction, Repeated Cross-sectional (trend) Analysis, Secondary Analysis, Quality Assurance

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The Impact of Generative Artificial Intelligence Tools on Learning and Decision-Making Strategies: A Bloom's Taxonomy Perspective

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Generative AI (GenAI) tools such as ChatGPT and Google Gemini are rapidly becoming widespread in higher education settings, offering students support in rapid information access, summarization, idea development, and problem-solving processes. However, the literature suggests that unconscious and excessive use of these tools may lead to a decline in critical thinking skills, dependence on artificial intelligence, and a weakening of independent decision-making capacity. Despite this, the effects of GenAI tools on different cognitive levels of Bloom's Taxonomy and their reflections on students' decision-making styles have not been sufficiently examined, particularly within the context of higher education in Türkiye.This study aims to investigate the relationships between university students' frequency of GenAI tool use and their self-assessment scores across the six cognitive levels of Bloom's Taxonomy (remembering, understanding, applying, analyzing, evaluating, creating), their levels of AI dependency, and their general decision-making styles (rational, intuitive, dependent, avoidant). Additionally, the study examines whether AI literacy plays a moderating role in these relationships.An explanatory sequential mixed-methods design has been adopted in the research. In the quantitative phase, at least 384 undergraduate students enrolled at İzmir Democracy University will be administered the following instruments: the ChatGPT Usage Scale (Taktak & Bafralı, 2025), the Artificial Intelligence Dependency Scale (Savaş, 2024), the AI Literacy Scale (Laupichler et al., 2023; Turkish adaptation: Yılmaz, 2024), a Bloom's Taxonomy Self-Assessment Questionnaire developed by the researcher, and the General Decision-Making Style Inventory (Scott & Bruce, 1995; Turkish adaptation: Taşdelen, 2002). Data will be analyzed using correlation analysis, independent samples t-test, multiple regression, and the PROCESS macro. In the qualitative phase, semi-structured interviews will be conducted with 10–15 participants selected based on the quantitative findings.Drawing on the existing literature, it is anticipated that an increase in GenAI usage frequency will be positively associated with lower-order cognitive skills (remembering, understanding) and negatively associated with higher-order skills (analyzing, evaluating, creating). Regarding decision-making, it is expected that frequency of GenAI use may increase the dependent decision-making style while weakening the rational decision-making style. It is further hypothesized that these adverse relationships will be comparatively weaker among students with higher AI literacy.The findings of the study are expected to draw attention to the need for GenAI tools to be considered as factors capable of shaping students' cognitive processes and decision-making behaviors, and to provide educators and curriculum designers with concrete recommendations for the conscious, critical, and pedagogically grounded use of these tools in the classroom.

Keywords: Generative Artificial Intelligence, Bloom's Taxonomy, Decision-making Styles, AI Literacy, AI Dependency

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An Examination of Teachers' 21st-Century Media Literacy Skills in Terms of Various Variables

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Literacy has been defined in various ways in the literature depending on the target population and the content domain under consideration, and these definitions differ according to the skills and competencies through which individuals are conceptualized. While literacy traditionally refers to individuals' possession of basic reading and writing skills, media literacy encompasses the ability to access written, visual, and digital media content, critically analyze and evaluate such content, and consciously produce media messages when necessary. Individuals with media literacy skills are able to question the accuracy of the information and messages to which they are exposed, distinguish misinformation and manipulation, recognize the individual and societal impacts of media content, and demonstrate responsible, ethical, and informed behavior in digital environments.

This study was conducted to determine the knowledge, attitudes, and perceptions of teachers working in public and private secondary education institutions affiliated with the Ministry of National Education in Erzurum regarding their 21st-century media literacy skills, and to identify the areas in which teachers need further training within the context of media literacy. The study employed a general survey model, one of the quantitative research designs, and the study group consisted of approximately 850 teachers working throughout Erzurum province. As a data collection instrument, the "21st Century Media Literacy Skills Scale," consisting of 16 items in addition to a demographic information section, was utilized. Prior to data analysis, the normality of the scale scores was examined using the Kolmogorov–Smirnov normality test. The results indicated that the data were normally distributed; therefore, an independent samples t-test, Chi-square test, and one-way analysis of variance (ANOVA) were conducted. Following the variance analyses, Post Hoc tests were employed to determine the sources of significant differences among groups.

The findings revealed that teachers generally possessed high levels of media literacy skills. According to the gender variable, male teachers demonstrated higher levels of media literacy skills than female teachers, whereas no statistically significant differences were identified among certain groups with respect to professional seniority and educational attainment.

Keywords: Media Literacy, 21st-century Skills, Teacher Competencies, Digital Literacy

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ChatGPT as an AI-Powered Feedback Partner: Implications for Peer Review and Academic Writing Development among First-Year Students

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The rapid growth of generative Artificial Intelligence (AI) technologies has created new opportunities and challenges for teaching and learning in higher education. Among these technologies, ChatGPT has gained significant attention for its ability to generate text, provide feedback, and support students during the writing process. While concerns about academic integrity and overreliance on AI remain prevalent, emerging research suggests that ChatGPT can function as a valuable educational tool when used ethically and responsibly. In particular, its potential role as an AI-powered feedback partner offers new possibilities for enhancing peer review practices and supporting academic writing development among first-year students.

This study explores the use of ChatGPT as an AI-powered feedback partner in first-year academic writing. The research focuses on how first-year education students engage with ChatGPT during the drafting, reviewing, and editing of argumentative essays and examines the implications of AI-generated feedback for writing development. The study is guided by two research questions: (1) In what ways does ChatGPT function as an AI-powered feedback partner in supporting peer review practices among first-year students? and (2) How does the use of ChatGPT as an AI-powered feedback partner influence the development of academic writing competencies among first-year students?

The study adopts a qualitative exploratory research design within an interpretivist paradigm to gain an in-depth understanding of students' experiences and perceptions. Purposive sampling will be used to select first-year education students who have utilised ChatGPT in academic writing tasks. Data will be collected through open-ended questionnaires and reflective responses and analysed thematically to identify key patterns related to students' engagement with AI-generated feedback.

The study is informed by contemporary scholarship in Artificial Intelligence in Education (AIED) and feedback literacy. Recent literature highlights the potential of generative AI tools to support self-regulated learning, provide formative feedback, and enhance student engagement. ChatGPT may assist students in improving grammar, coherence, argument structure, and clarity of expression while encouraging reflection and revision. However, concerns regarding the accuracy, ethical use, and potential overreliance on AI-generated feedback underscore the need for critical engagement with such technologies.

The findings of this study are expected to contribute to the growing body of knowledge on AI-assisted learning by providing insights into the opportunities and challenges of integrating ChatGPT into academic writing instruction. The study may inform lecturers, academic literacy practitioners, and higher education institutions seeking to leverage generative AI tools to enhance feedback practices and support student writing development in ethical and pedagogically meaningful ways.

Keywords: ChatGPT, Artificial Intelligence in Education, Generative AI, Academic Writing, Peer Review, Feedback Literacy, Academic Literacy, First-Year Students, Higher Education, Writing Development.

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Generative AI in Visual Design Education: Insights from Students' Lived Experiences

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Generative artificial intelligence has advanced rapidly, leading to widespread use of AI-assisted tools in visual design. These tools accelerate design, offer alternatives, and prompt discussion about creativity and ownership. This research explores students' views on the impact of AI-assisted tools in the design process.

The research was conducted within the scope of a phenomenological design, a qualitative research method. The study group consists of 23 students in the graphic design department of a higher education institution enrolled in visual design courses. Data were collected through a semi-structured interview form comprising 7 open-ended questions, developed in line with the relevant literature. The data obtained were analyzed using content analysis. Based on the analysis, the participants' opinions were grouped into 7 themes. These themes were named: the purposes of using artificial intelligence, effects on the learning process, changes in design thinking, effects on creativity and originality, contributions to the design process, perceptions of inspiration and ready-made solutions, and design ownership. The findings show that the vast majority of students use artificial intelligence for idea generation, inspiration, visual editing, and the development of alternative designs. Participants stated that artificial intelligence supports the learning process, provides new perspectives, and accelerates design processes. They particularly emphasized the time savings in drafting, visual editing, and technical operations. However, some participants expressed that excessive use of artificial intelligence could reduce originality and negatively impact creativity. Regarding design ownership, participants had differing opinions. While one group of students considered artificial intelligence merely a tool and argued that the resulting product belonged to them, another group stated that works produced by artificial intelligence could not be fully owned. In conclusion, the research findings show that AI-assisted visual design tools make significant contributions to students' learning and design processes but raise new questions about originality and ethical ownership. Accordingly, it is recommended that the pedagogical and ethical dimensions of artificial intelligence tools be considered in visual design education.

Keywords: Generative Artificial Intelligence, Visual Design, Graphic Design Education, Phenomenology

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Examining the Artificial Intelligence Technological Pedagogical Content Knowledge (AI-TPACK) Levels of High School Mathematics Teachers: A Case Study of İzmir

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The primary purpose of this study is to determine the levels of Artificial Intelligence Technological Pedagogical Content Knowledge (AI-TPACK) of mathematics teachers working at the secondary education level and to examine whether these levels differ significantly according to demographic variables such as gender, age, professional seniority, and educational background, as well as variables including receiving AI-oriented training, utilizing artificial intelligence technologies in teaching practices, daily duration of digital tool/internet usage, and familiarity with common artificial intelligence technologies.

This study adopts a correlational survey model, one of the quantitative research methods. The study group consists of high school mathematics teachers working in secondary education institutions in İzmir, Türkiye. Data were collected using the "Artificial Intelligence Technological Pedagogical Content Knowledge (AI-TPACK) Scale," developed by Ning et al. (2024) and adapted into Turkish by Canbazoğlu Bilici et al. (2024), with the aim of determining teachers' knowledge levels and self-assessments regarding the integration of artificial intelligence technologies into instructional processes.

Today, as the role and transformative impact of artificial intelligence technologies in educational processes continue to increase, it has become critically important for teachers to integrate these technologies effectively into their disciplinary fields in accordance with pedagogical principles. The AI-TPACK framework theoretically grounds teachers' capacities not only in terms of technological literacy but also in integrating the dynamic opportunities offered by artificial intelligence with pedagogical strategies and content knowledge at an advanced level.

A review of the literature indicates that studies focusing specifically on artificial intelligence technological pedagogical content knowledge within the context of mathematics education, particularly among high school teachers, remain quite limited. Accordingly, this study analyzes and examines the AI-TPACK levels of high school mathematics teachers across various independent variables.

The findings obtained from this study are expected to contribute to the structuring of curricula and teacher competencies in ways that support the integration of artificial intelligence. Additionally, the study aims to provide recommendations for in-service training activities and curriculum development efforts designed to equip mathematics teachers with the professional knowledge domains required in the age of artificial intelligence.

In conclusion, this research is expected to contribute to the development of artificial intelligence applications in education and the related literature by describing high school mathematics teachers' levels of knowledge and self-assessments regarding artificial intelligence integration.

Keywords: Artificial Intelligence, TPAB, AI-TPAB, Math Teachers, Educational Technologies

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Investigating Students' Inquiry Behaviors and Time Use in a Simulation-Supported Inquiry Learning Environment

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This study aimed to examine students' inquiry behaviors during the implementation of a "Human Pressure" activity developed within a simulation-supported guided inquiry learning environment. Specifically, the study examined: students' performance at each inquiry stage, the time spent at each stage, the relationship between time and performance, and the relationship among performances across inquiry stages. The research was conducted as a case study. The participants consisted of 24 ninth-grade students. Data were obtained from log records of the learning process carried out by the students in a simulation-supported learning environment. Students' inquiry performances were evaluated using an analytic rubric developed for each inquiry stage: Understanding the Task, Formulating a Hypothesis, Designing an Experiment, Data Collection (Use of Simulation), Data Analysis, and Drawing Conclusions. The rubric consisted of stage-specific criteria and yielded scores ranging from 0 to 4, with higher scores indicating better performance. The analyses were conducted using SPSS 29.0 and Microsoft Excel. Descriptive statistics were used to determine the distribution of performance and time variables, and Spearman's correlation coefficient was used to determine the relationship between time and performance within each stage and the relationship between performance across stages.

The analysis results showed that students performed best in the Formulating a Hypothesis (M=3.83, SD=.565) and Understanding the Task (M=3.75, SD=.897) stages, followed by Drawing Conclusions (M=3.25, SD=.897), Data Analysis (M=3.00, SD=.522), and Designing an Experiment (M=2.94, SD=1.31), while their lowest performance was in the Data Collection (M=2.63, SD= .465) stage. It was determined that students spent the most time in the Designing an Experiment stage (M=224.33, SD=118.83). This was followed by the Drawing Conclusions (M=203.42, SD=70.14) and Formulating a Hypothesis (M=202.08, SD=100.88) stages. Students spent the least amount of time on the Data Collection stage (M=78.04, SD=17.38). It was found that there was no relationship between the time students spent on the Understanding the Task, Formulating a Hypothesis, Designing an Experiment, Data Collection, and Drawing Conclusions stages and their performance in those stages. However, in the Data Analysis stage, a significant, negative relationship was found between the time spent and performance (rho = −0.439, p = .032). The results of the Spearman correlation analysis revealed no statistically significant relationship among performance scores in the inquiry stages ($p > 0.05$).

The findings indicate that students demonstrated relatively high levels of inquiry performance overall; however, additional support may be needed in data collection, experimental design, and mathematical representation of relationships among variables. These findings suggest that spending more time on a particular inquiry stage does not necessarily result in higher performance. Individual differences in strategy use and cognitive processing may explain variations in time spent across stages.

In this study, data were analyzed based on a single activity related to one topic. Future studies could analyze data from multiple inquiry activities conducted across different science topics to obtain a more comprehensive understanding of students' inquiry behaviors over time.

Keywords: Inquiry Behaviors, Simulation-supported Learning, Inquiry-based Learning

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Predicting sustainability-oriented consumption intentions: Integrating AI thinking and AI knowledge into the theory of planned behavior

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Sustainable consumption has become an increasingly important issue in consumer behavior, reflecting consumers' growing sense of environmental responsibility. The rapid development of artificial intelligence technology has made its applications across various fields a key focus of both academia and practice. However, its dual impact on sustainability and innovativeness remains insufficiently examined from a theoretical perspective. Artificial intelligence applications have been shown to improve waste management and promote the implementation of circular economy practices. Nevertheless, few studies have examined the important role of artificial intelligence competency–related factors in shaping sustainability-oriented consumption intentions. Therefore, this study proposes and validates a research framework that extends the theory of planned behavior by incorporating external variables—namely, artificial intelligence thinking and artificial intelligence knowledge—to explore the key factors influencing consumers' sustainability-oriented consumption intentions.

This study adopted a questionnaire survey method and used convenience sampling to collect data from 293 consumers in central Taiwan. The data were analyzed using descriptive statistics, correlation analysis, and partial least squares structural equation modeling (PLS-SEM). Regarding the validation of the research model, the results indicated that perceived behavioral control and subjective norms toward sustainability-oriented consumption were important predictors of consumption intentions. Specifically, consumers with higher levels of perceived behavioral control tended to exhibit stronger sustainability-oriented consumption intentions. Furthermore, artificial intelligence thinking and artificial intelligence knowledge were found to be important external variables influencing attitudes, subjective norms, and perceived behavioral control toward sustainability-oriented consumption. These findings suggest that consumers with higher levels of artificial intelligence thinking and artificial intelligence knowledge are more likely to strengthen their positive attitudes, perceptions of social norms, and behavioral control beliefs regarding sustainability-oriented consumption, thereby enhancing their sustainability-oriented consumption intentions.

The contribution of this study lies in its attempt to integrate artificial intelligence–related concepts into a well-established psychological theoretical framework. In doing so, this study deepens the understanding of the formation mechanism of sustainability-oriented consumption intentions and extends the explanatory scope of the theory of planned behavior in the contexts of sustainable consumption and artificial intelligence applications. For practitioners, the findings indicate that enhancing consumers' artificial intelligence thinking and artificial intelligence knowledge can strengthen their attitudes, subjective norms, and perceived behavioral control toward sustainability-oriented consumption, thereby increasing their intentions to engage in sustainability-oriented consumption.

Keywords: Artificial Intelligence Thinking, Artificial Intelligence Knowledge, Sustainability-oriented Consumption Intentions, Theory of Planned Behavior

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A Comparative Analysis of Course Design Quality in Massive Open Online Course Platforms

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This study examines the online course designs of Massive Open Online Course (MOOC) platforms with different structural characteristics to contribute to quality assurance in higher education and lifelong learning. The research was conducted using a document analysis approach within the qualitative research paradigm. A total of 32 courses (eight from each platform), selected through purposive sampling methods (maximum variation and typical case), were systematically evaluated across four platforms representing distinct structural ecosystems: a public service-oriented local model (BTK Akademi), a university-partnered institutional model (Coursera), an open-content model (Khan Academy), and an instructor-driven marketplace model (Udemy). The evaluation was based on the 50 standards included in the six dimensions of the OSCQR 4.0 rubric developed by SUNY Online. The evaluation process was further supported through peer-review activities and focus group discussions involving 30 preservice teachers who had received training in open and distance learning pedagogy.

The findings suggest that institutional characteristics may influence pedagogical quality patterns. Coursera, characterized by university partnerships and standardized institutional templates, achieved the highest overall compliance rate (73.9%). In contrast, BTK Akademi (52.1%), Khan Academy (52.3%), and Udemy (52.8%) demonstrated relatively similar levels of performance. Udemy exhibited the greatest variation in quality across courses, whereas Khan Academy showed weaknesses in institutional standards such as course syllabi, learner support services, grading and certification procedures, and institutional policies. Although BTK Akademi demonstrated strengths in managing cognitive load, deficiencies were identified in assessment criteria, course syllabi, and interaction-related components.

Dimension-level analyses revealed that the overall quality of MOOC ecosystems tends to be concentrated in specific areas while exhibiting structural shortcomings in several fundamental pedagogical components. “Design and Layout” emerged as the strongest dimension across all platforms. Most platforms successfully met standards related to visual hierarchy, course organization, content structuring, and the segmentation of large information blocks into manageable units. General course information, including clearly stated learning outcomes and explicit descriptions of course structure, was also consistently provided. In contrast, “Interaction” was identified as the weakest dimension across all platforms. Similarly, limited transparency in assessment criteria, the absence of course syllabi, insufficient institutional and privacy policy information, and weaknesses in accessibility features such as captions and transcripts were identified as major areas requiring pedagogical improvement.

In conclusion, this study compared different MOOC ecosystems using OSCQR quality standards and identified critical areas for improvement in online course design from a quality assurance perspective. Results indicate that platform governance models may be a more influential determinant of course quality than content delivery models, as platforms characterized by stronger institutional structures demonstrated more consistent alignment with quality standards. While the findings suggest considerable similarities across platforms in terms of design and content organization, common deficiencies persist in pedagogical dimensions such as interaction, assessment transparency, accessibility, and learner guidance.

These results provide a practical evaluation framework for quality enhancement initiatives in MOOC environments. Accordingly, the wider adoption of course syllabi, improvements in accessibility standards, the integration of mechanisms that support learner interaction, and the development of more transparent and systematic assessment processes are recommended.

Keywords: MOOC, Online Learning, Online Course Quality, Course Design, OSCQR, Quality Assurance.

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Perceptions, Uses, and Challenges of Artificial Intelligence in Initial Teacher Education: A Qualitative Study with University Education Students

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The emergence of artificial intelligence (AI) has significantly transformed the ways in which information is accessed, produced, and managed, creating new opportunities and challenges within educational contexts. In this framework, the present study analyzes the perceptions, knowledge, uses, and evaluations that university students in the field of Education hold regarding AI, with particular attention to generative tools such as ChatGPT. A qualitative methodology based on focus groups was employed to explore in depth students' experiences, opinions, and expectations concerning the impact of these technologies on their academic training and future professional practice.

The findings reveal that participants perceive AI as a useful tool due to its ability to provide immediate information, organize content, synthesize information, and facilitate the completion of academic tasks. Among the main advantages identified are time and effort optimization, the creation of educational resources, and increased productivity. However, students also highlighted significant risks associated with AI use, including the dissemination of inaccurate information, the spread of fake news, content manipulation, the erosion of critical thinking, and the potential negative impact on certain professions. Furthermore, participants acknowledged that their knowledge of AI remains limited and that additional training is necessary to develop the competencies required for the critical and responsible use of these technologies.

Regarding faculty members, students perceived notable differences according to factors such as age, academic discipline, and familiarity with AI technologies. They also considered that the widespread adoption of AI is reshaping the ways individuals learn, work, and interact socially, thereby demanding new educational strategies focused on the development of critical thinking, digital literacy, and rigorous information evaluation skills. In conclusion, the study highlights the need to promote specific AI-related training within higher education in order to maximize the benefits of these technologies while minimizing the risks associated with their growing integration into educational and social processes.

Keywords: Inteligencia Artificial, ChatGPT, Educación Superior, Alfabetización Digital, Pensamiento Crítico, Estudiantado Universitario

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The Datafication of Learning: A MATLAB-Based GUI for Transforming Raw Moodle Logs into Structured Machine Learning Datasets

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The rapid expansion of digital learning environments has made Learning Management Systems (LMS), such as Moodle, primary sources for extracting student behavioral data. However, the inherent complexity, noise, and unstructured nature of raw LMS event logs remain major bottlenecks, preventing educators and researchers from directly applying predictive algorithms. This study introduces a robust, MATLAB-based Graphical User Interface (GUI) engineered specifically for the datafication of educational logs, seamlessly transforming chaotic log records into structured, machine learning-ready datasets. The developed software architecture provides an end-to-end data pipeline without requiring advanced programming skills from the end-user. Moving beyond standard preprocessing, the tool focuses on dataset generation functionalities: automated chronological parsing of compound timestamp variables, dynamic frequency-based noise reduction to isolate critical learning interactions, and a localized character-mapping algorithm (e.g., for Turkish characters) to ensure data integrity during categorical matrix transformations. Furthermore, the GUI features an integrated state-memory (undo/redo stack) and original index preservation, allowing researchers to manipulate vast datasets iteratively while maintaining chronological consistency. By democratizing the dataset generation process, this tool bridges the gap between raw educational footprints and advanced AI architectures, supporting the rapid development of scalable analytical models for uncertain educational futures.

Keywords: Learning Analytics, Educational Datafication, Moodle LMS, Dataset Generation, Graphical User Interface, Feature Transformation

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Preparing Future Information Professionals for AI-Enabled Library Services: An Assessment of Turkish LIS Curricula

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In Türkiye, Library and Information Science programs have traditionally emphasized information organization, information retrieval, cataloging, classification, digital libraries, and information technologies. While these areas provide an important foundation for understanding contemporary information systems, it remains unclear to what extent current curricula support the competencies required for AI-enabled library services. Lo (2025) argues that AI literacy extends beyond technical skills and includes ethical and critical competencies. Understanding this level of preparedness is essential for identifying strengths, gaps, and future directions for curriculum development. The study aims to answer the following questions: To what extent do Turkish Library and Information Science (LIS) curricula incorporate the competencies required for AI-enabled library services? Which dimensions of AI preparedness are most strongly and least strongly represented within Turkish LIS curricula? The study employs a qualitative curriculum analysis approach from several LIS departments in Türkiye. An initial dataset of 30 Web of Science (WoS) articles was extracted and reviewed. Following a relevance assessment, 10 records that were outside the scope of Library and Information Science (e.g., clinical and health-related applications of AI) were excluded. The remaining 20 LIS-focused studies were analyzed using keywords, abstracts, and conceptual framework analysis to identify competencies associated with AI literacy and AI-enabled library services. The analysis resulted in a five-dimensional AI preparedness framework consisting of: (1) Foundational AI Knowledge, (2) Information and Data Competencies, (3) Ethical and Critical AI Competencies, (4) AI-enabled Service and Management Competencies, and (5) Professional and Societal Dimensions. The framework subsequently served as the basis for evaluating Turkish LIS curricula. Preliminary findings indicate that Turkish LIS curricula provide strong foundations in traditional professional areas, including information organization, information retrieval, database management, digital libraries, and information services. These areas contribute indirectly to the development of competencies relevant to AI-supported environments. However, the lack of courses covering competencies in artificial intelligence, machine learning, generative AI, algorithmic literacy, AI governance, and the ethical challenges associated with AI appears limited. The findings suggest that while existing curricula provide important technological and informational foundations, the integration of competencies specific to AI-enabled library services remains inconsistent across programs.

Implications The study stresses the importance of evaluating AI preparedness through a competency-based perspective rather than solely through the presence of AI-related courses. The findings support curriculum development efforts to prepare future information professionals for increasingly AI-enhanced library environments. Furthermore, the study contributes to ongoing discussions concerning AI literacy, professional competencies, and the future of Library and Information Science education in Türkiye.

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Keywords: AI-Enabled Library Services, Library And Information Science (LIS), Curriculum Preparedness, AI Competencies, Higher Education, Türkiye

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Bridging Theory and Practice in Robotics: A Pilot Study of a Shared Hardware Loan System

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The integration of advanced automation and robotics into industrial practices necessitates a corresponding shift in vocational education and training (VET) curricula. However, VET institutions frequently encounter substantial resource constraints when attempting to provide hands-on experience with contemporary hardware. To address this challenge within the Moravian-Silesian Region of the Czech Republic, the Moravian-Silesian Technological Academy (MTA) developed a framework of teaching materials that prioritizes industry-standard equipment to ensure graduates' labour market relevance. Recognizing the prohibitive costs of such hardware relative to basic educational alternatives, the MTA paired its "EduBoxes"—open-access digital learning modules—with a shared physical loan system.

This pilot study evaluates the deployment of mobile and service robotics using the Festo Robotino platform. Preliminary curriculum analysis indicates that this domain remains underrepresented in current VET programs compared to traditional industrial robotics. Evaluating the initiative's initial rollout, this pilot study involved 7 of the 44 eligible secondary vocational schools in the region, operating with an anticipated expansion of three additional schools annually. Data was collected via a mixed-methods survey from technical teachers (N = 11) who utilized the robots during a trial loan period. The survey measured parameters including lesson preparation efficiency, perceived material utility, and student engagement.

Results demonstrate that the introduction of physical, industry-grade robots into the classroom environment positively influenced student motivation and active participation. Concurrently, the standardized EduBox materials streamlined lesson preparation tasks, particularly for experienced instructors. However, the study identified specific areas for systemic refinement. Educators with lower baseline experience in mobile robotics reported requiring extended, hands-on training to effectively operate the equipment. Furthermore, logistical feedback indicated that initial trial loan periods were occasionally insufficient, with several teachers requesting extensions of up to three months to facilitate optimal curricular integration. Moving forward, the project will systematically track longitudinal impact metrics, such as student placements in technical competitions, to formally assess the framework's ongoing educational efficacy and the broader viability of shared-hardware models paired with standardized teaching materials in VET environments.

Keywords: Robotics Education, Resource Sharing, Service Robotics

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An Examination of Problem-Solving Activities Designed in the Context of Real-Life Situations in Dynamic Mathematics Software According to the RBC+C Model

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This study, which aimed to investigate how pupils' problem-solving behaviours changed in accordance with the abstraction actions outlined in the RBC+C abstraction model within the context of the 'Geometric Shapes' topic in the Year 8 primary school mathematics curriculum, adopted the case study design from qualitative research methods. The study group consisted of three Year 8 pupils attending a state primary school in a province in western Turkey during the 2025–2026 academic year. The research participants were selected using criterion sampling. Observation and semi-structured interviews were used as data collection methods. Students were set five problems based on real-life scenarios, supported by dynamic maths software, relating to 'Geometric Shapes', Unit 6 of the Year 8 maths curriculum. The students were first asked to solve the problems without using any dynamic software; they were then told that they could use dynamic maths software to help with any points they found difficult or to check the accuracy of their results after finding a solution. Throughout this process, the students were observed by the researchers. Once the problem-solving tasks were completed, semi-structured interviews were conducted to examine in depth the students' ability to understand and express mathematical knowledge during the process, and to analyse their solutions within the context of the RBC+C abstraction model actions. Qualitative data were analysed using descriptive analysis. The codes Ö1, Ö2 and Ö3 were used for the students. The findings of the study are as follows:

1. In the first question, which required students to find the diagonal of a solid, all students were able to solve the problem without the aid of dynamic maths software.

In the second question, which asked about the area of the asphalt to be levelled, the aim was for students to calculate the lateral surface area of the cylinder based on the inferences they drew from the information provided. All three students achieved this objective. Furthermore, the students were able to carry out the epistemic actions of recognition, application and construction.

2. Students were expected to realise in Question 3 that, in the net of the side face of the box, the shortest length must be equal to the length of the hypotenuse. Students Ö1 and Ö2 were unable to reach this conclusion without the aid of dynamic maths software.

In Question 4, where students were expected to establish the relationships in the volume formula for a cylinder, Student 1 reached the solution through the researcher's questions, whilst Student 2 did so with the aid of dynamic maths software. Student 3 did not receive any assistance in solving the problem.

In the final question of the study, where students were expected to reach the conclusion by starting from the net of a cylinder, only Student 3 was able to solve the question without the support of dynamic mathematics software. When the students' responses were analysed according to the RBC+C model, it was observed that Students Ö1 and Ö2 carried out the epistemic actions of recognition, use and construction with support, whilst Student Ö3 did so without any support. Generalisations were reached by modifying the requirements of the question—such as the distance being half a turn or one and a half turns—and seeking the students' views on these scenarios.

In line with the findings of this study, research could be conducted with Year 8 pupils of average mathematical ability; studies could be carried out in which the entire topic of

geometric solids is taught using dynamic mathematics software and the experimental results are investigated; and the impact on success of problem-solving activities prepared using dynamic mathematics software—which also incorporate group work—could be investigated.

Keywords: Abstraction, Dynamic Maths Software, Geometric Shapes, RBC+C Abstraction Model, Real-life Situations.

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Digital Integration in Moroccan Education: Institutional Power, Contextual Realities, and Pedagogical Obstacles

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This study examines the structural complexities of digital integration in Moroccan education, positioning online learning as a contested pedagogical space where global digital infrastructures intersect with localized socio-economic realities. Drawing on an extensive online survey of 982 Moroccan educators administered during and after the COVID-19 pandemic, this research moves beyond purely technical evaluations to investigate online education as a politically and culturally mediated site of institutional power and shifting authority. Through the theoretical lenses of Online Collaborative Learning (OCL) and Technology Acceptance Models (TAM), we analyze educators' experiences with remote interaction, assessment, and digital preparedness to uncover the underlying tensions inherent in national digitization mandates. The findings reveal that while global e-learning frameworks were strategically deployed by the state to signal institutional resilience, modernization, and continuity, their implementation exposed profound contextual realities and structural vulnerabilities. Moroccan educators reported severe pedagogical obstacles, characterized by highly uneven technological preparedness, systemic deficits in institutional support, and persistent fractures in student-teacher interaction and assessment—anxieties heavily exacerbated by regional and socio-economic divides. Consequently, these digital disparities expose the operational limits of adopting globally circulating educational models within Global South contexts that are fundamentally restricted by infrastructural inequalities and centralized governance. Ultimately, this study argues that Moroccan educators assumed critical leadership roles during this transition, acting as vital cultural and pedagogical intermediaries navigating the friction between top-down state policies, global digital platforms, and the actual classroom experiences of Moroccan students. Grounded in critical debates on knowledge production and transnational media studies, this paper re-centers digital integration as an explicitly political arena where institutional power dynamics shape the future narration of Morocco's educational landscape.

Keywords: Digital Integration, Moroccan Education, Institutional Power, Pedagogical Obstacles, Global South, Educational Leadership.

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Instructional Design Based on the Case Method for Developing Entrepreneurial Competencies in Complex Learning Contexts

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Entrepreneurship education has become a strategic priority for higher education institutions seeking to equip students with the knowledge, skills, and attitudes required to navigate increasingly complex, uncertain, and dynamic environments. Traditional teacher-centered approaches often prove insufficient for fostering higher-order competencies that are essential for entrepreneurial practice, including critical thinking, strategic analysis, problem-solving, and decision-making under uncertainty. Consequently, there is a growing demand for instructional designs that promote experiential learning and engage students in authentic, practice-oriented learning experiences.

The aim of this study is to analyze students' perceptions of a case method-based instructional design implemented within an International Entrepreneurship and Innovation Course and to explore its perceived contribution to the development of entrepreneurial competencies in complex learning contexts.

The instructional intervention was designed according to the principles of active learning and learning by doing. The learning sequence combined a training workshop on strategic management tools with the application of those tools to a comprehensive business case specifically developed for the course. Students were required to analyze organizational challenges, interpret contextual information, evaluate strategic alternatives, and make evidence-based decisions under conditions of uncertainty. The instructional design integrated collaborative learning, guided discussion, critical reflection, and authentic problem-solving activities, thereby recreating the decision-making processes commonly faced by entrepreneurs and managers.

To evaluate the educational intervention, a quantitative evaluation study was conducted following a post-intervention assessment design. Data were collected through a structured questionnaire administered at the end of the learning experience to examine students' perceptions of the pedagogical effectiveness of the instructional design. The instrument consisted of 24 Likert-scale items organized around key dimensions of entrepreneurship education, including learning outcomes, competency development, active participation, satisfaction, and perceived professional applicability. The target population comprised 47 international students from Chile participating in the program, from whom 26 valid responses were obtained, representing a response rate of 55.3%.

The findings reveal a highly positive student perception of the instructional design. Approximately 88.5% of respondents reported that the case method enhanced their decision-making skills, facilitated the application of theoretical concepts to real entrepreneurial situations, and strengthened their critical and analytical thinking. Furthermore, 84.6% highlighted the contribution of collaborative case analysis to teamwork and knowledge exchange, while 88.5% recommended maintaining or expanding the use of the methodology in future editions of the course. Overall, students perceived the instructional experience as a valuable opportunity to connect theoretical knowledge with authentic entrepreneurial challenges.

The study concludes that the case method is perceived by students as an effective instructional design strategy for entrepreneurship education, fostering experiential learning and supporting the development of competencies that are critical for professional practice. The findings support the integration of case-based learning into entrepreneurship curricula and suggest that instructional designs grounded in authentic problem-solving can enhance student engagement and perceived competency development in complex learning environments. Future research should explore the long-term effects of such instructional approaches on entrepreneurial behavior, innovation capabilities, and professional performance through longitudinal and mixed-methods designs.

Keywords: Entrepreneurship Education, Case Method, Instructional Design, Active Learning, Experiential Learning.

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The Effect of Gamified Mobile Supported Museum Education Applications on Students' Learning Products

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The purpose of this research is to examine the effects of gamified mobile-supported museum education applications on the academic achievement, historical thinking skills and cultural heritage sensitivity of 5th grade students. This research was conducted using a quasi-experimental design with a pre-test-post-test control group, one of the quantitative research approaches, in order to examine the effects of gamified mobile-supported museum education applications on students' learning outcomes. The study group of the research consists of 60 (EG=30, CG=30) fifth-grade students studying in 2 different branches of a state secondary school. The Academic Achievement Test (AAT) was used as a data collection tool in the study to determine the impact of gamified mobile-supported museum education applications on students' academic achievement; the Historical Thinking Skills Scale (HTSK) was used to determine its impact on historical thinking skills; and the Cultural Heritage Sensitivity Scale (CTS) was used to determine its impact on their sensitivity to cultural heritage. The data obtained were analyzed using the SPSS analysis program. The findings obtained during the research process revealed that gamified mobile-supported museum education applications had a significant impact on students' learning outcomes. Although the academic achievement pre-test scores of the experimental and control groups were similar, there was a significant increase in their post-test scores. Furthermore, although the pre-test scores of the experimental and control groups on the historical thinking and cultural heritage sensitivity scales were similar, a significant increase was observed in their post-test scores on both scales. As a result of the research, it was determined that the student group supported with gamified mobile-supported museum education applications showed improvement in academic achievement, historical thinking and sensitivity to cultural heritage compared to the student group continuing with the current program.

Keywords: Social Studies, Academic Achievement, Gamification, Mobile-supported Applications, Historical Thinking Skills, Sensitivity To Cultural Heritage.

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Metaphorical Perceptions of Artificial Intelligence among Nursing Students: A Qualitative Study

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Background: Understanding nursing students' perspectives on artificial intelligence is important for evaluating their awareness, attitudes, and professional adaptation during the integration of this technology into healthcare. This study aimed to identify nursing students' underlying perceptions and beliefs about artificial intelligence by uncovering the metaphors they used to describe it.

Methods: This qualitative study employed metaphor analysis. This study was conducted with 311 nursing students enrolled in the first, second, third, and fourth years at a university located in the Western Black Sea Region of Türkiye during the fall semester of the 2025–2026 academic year. The inclusion criteria were being 18 years of age or older, being an actively enrolled nursing student at the relevant university, participating voluntarily, completing the data collection form, and providing an appropriate response to the metaphor question. The research data were collected face-to-face using a semi-structured interview form prepared by the researchers. The form consisted of questions designed to evaluate students' perceptions of artificial intelligence through metaphor-based expressions. The first part of the form included questions regarding students' socio-demographic characteristics, while the second part used the statement "Artificial intelligence is like … because …" to elicit the metaphors students developed. The collected data were then named, classified, and categorized.

Results: In this study, 311 valid metaphor responses regarding artificial intelligence were obtained from nursing students. Students expressed their perceptions of artificial intelligence through both positive and negative metaphorical concepts. Positive metaphorical concepts included "encyclopedia," "scientist," "computer," "Swiss Army knife," "navigation," and "superhero," whereas negative metaphorical concepts included "suicide," "disaster," "trap," and "phone addiction."

Conclusions: The findings indicate that nursing students perceive artificial intelligence not only as a useful, guiding, and knowledge-facilitating tool, but also as a concept that may involve risk, threat, harm, and dependency. While positive metaphors highlight the supportive, functional, and knowledge-providing aspects of artificial intelligence, negative metaphors reveal students' concerns and critical perspectives toward it. In nursing education, it is recommended that educational content be included to support students' positive perceptions of artificial intelligence while raising awareness of issues such as risks, ethical concerns, and misuse.

Keywords: Artificial Intelligence; Nursing Students; Nursing Education; Metaphor Analysis; Qualitative Study

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Educational Technology in the Development of Verbal and Social Skills of Students with Hearing Impairments: A Meta-Synthesis Study

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In the traditional educational ecosystem, the linguistic and communicative barriers faced by students with hearing impairments slow down the development of verbal skills and bring with them the risk of social isolation, as indicated in the literature. In the educational world of the future, which is full of uncertainties, ensuring inclusiveness and students' learning resilience is possible through the responsible and human-centered integration of educational technologies. The aim of this study is to bring together and synthesize, from a holistic perspective, the findings of primary qualitative studies examining the use of technology in the development of verbal and social skills of students with hearing impairments. Accordingly, the study was designed using the meta-synthesis method. As a result of the systematic literature review conducted through the Google Scholar, DergiPark, and Scopus databases, qualitative articles and theses meeting the inclusion criteria were analyzed using content analysis and thematic synthesis techniques. Within the scope of the synthesis, 15 qualitative studies meeting the specified criteria were examined in depth. These studies, conducted between 2015 and 2026, emphasize that technology integration increases the motivation of students with hearing impairments toward school, provides a significant increase in their self-confidence, and increases the efficiency obtained from educational processes through improved verbal and social skills. Educational technologies have been shown to successfully transfer the cognitive load from the limited auditory channel entirely to the visual channel for individuals with hearing impairments and to normalize the process. Graphic symbols, visually supported dictation applications such as Hi-Moji, and animations were found to overcome academic difficulties in verbal skills. Smartboards, gamified platforms (Wordwall, Quizizz), and alternative communication software such as Proloquo2Go were found to minimize peer exclusion and strengthen social skills by creating "joint attention" in the classroom. These empirical findings, discussed within the framework of the Social Model of Disability and Technological Pedagogical Content Knowledge (TPACK), provide a strong projection regarding the need to enhance teacher competencies, ensure home-school synchronization, and develop AI-assisted personalized assistive technologies in order to create equal opportunities in the uncertain educational processes of the future.

Keywords: Students with Hearing Impairments, Educational Technologies, Verbal and Social Skills, Meta-Synthesis, Special Education.

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An Examination of Pre-Service Teachers' Purposes and Motivations for Using Artificial Intelligence: A Qualitative Study

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The primary aim of this study is to examine in depth the purposes and motivations underlying pre-service teachers' use of Artificial Intelligence (AI) technologies. As AI applications become increasingly prevalent in educational settings, understanding pre-service teachers' attitudes, experiences, and approaches toward these technologies has become increasingly important. In this context, the study seeks to explore the purposes for which pre-service teachers use AI in educational activities such as lesson planning, instructional material development, student assessment, and supporting learning processes, as well as the motivational factors influencing such use. The study is conducted within the framework of the phenomenological research design, one of the qualitative research approaches. Purposeful sampling methods were employed to determine the study group. Accordingly, the participants consist of 18 volunteer pre-service teachers enrolled in the departments of Computer Education and Instructional Technology, Guidance and Psychological Counseling, Art Education, Science Education, Special Education, Social Studies Education, Turkish Language Education, Preschool Education, and Primary School Education at Ege University Faculty of Education, all of whom have experience using at least one AI tool. The data were collected through a semi-structured interview form developed by the researcher based on a review of the relevant literature. To ensure content validity, expert opinions were obtained from two faculty members in the Department of Computer Education and Instructional Technology and one faculty member in the Department of Turkish Language Education at Ege University. The interview form was finalized in line with their feedback. Individual interviews were conducted with the participants and were either audio-recorded with their consent or documented through detailed note-taking. The collected data were analyzed using content analysis. Following the coding process, the data were organized into categories and themes and interpreted in accordance with the research questions. The findings are expected to provide a comprehensive understanding of pre-service teachers' purposes, experiences, and motivations regarding AI use. Furthermore, the study is anticipated to offer a holistic perspective by addressing both the opportunities and potential limitations of AI integration in education. The results are expected to contribute to the development of teacher education programs, support the informed and effective integration of educational technologies, and provide guidance for future research and practice. In addition, the findings may contribute to shaping future educational policies and supporting pre-service teachers' adaptation to ongoing digital transformation processes.

Keywords: Artificial Intelligence, Pre-service Teachers, Purposes of AI Use, Motivation, Qualitative Research, Phenomenology.

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Thrown into the Deep End: The Consequences of absent AI Policy Guidelines for first-year students in a South African Open Distance e-Learning Institution

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Artificial Intelligence (AI) has rapidly become part of higher education, creating new opportunities for teaching and learning while simultaneously raising questions about academic integrity, assessment and student learning. Although AI has the potential to support learning, UNESCO (2023) argues that its successful integration depends on clear institutional guidance, ethical governance and the development of AI literacy. In many Open Distance e-Learning (ODeL) institutions, first-year students are expected to navigate AI technologies with little or no guidance on how to use them responsibly, ethically or critically. At the same time, they are still adjusting to the expectations of higher education and developing the academic literacy skills required for independent learning (Kasneci et al., 2023).

This conceptual paper draws on my current experiences as an academic in a South African ODeL institution to examine the consequences of the absence of institutional AI policy guidelines for first-year students. I aim to explore how the challenge extends beyond concerns about plagiarism or academic misconduct. Increasingly, students are relying on generative AI to complete assignments and assessment tasks by copying and pasting responses without critically engaging with, questioning or contextualising the information. Rather than supporting learning, AI can unintentionally replace the thinking, reflection and knowledge construction that higher education seeks to develop. In this paper, I argue that the issue is particularly significant in teacher education programmes, where AI-generated responses often reflect international classroom practices and educational contexts that differ from those in South Africa. Students may therefore submit responses that appear academically sophisticated and well written but fail to demonstrate contextual understanding of South African educational practices and realities. This presents a growing challenge for educators, who are expected to assess authentic student learning while recognising that sophisticated language alone is not evidence of understanding and that AI detection tools cannot reliably prove AI use (Cotton, Cotton, & Shipway, 2023).

Therefore, I propose that higher education institutions move beyond viewing AI solely as an academic integrity issue and instead recognise it as a teaching and learning challenge that requires institutional leadership. This paper advocates for the development of clear AI policy guidelines, AI literacy programmes for first-year students, professional development opportunities for educators, and assessment practices that encourage critical thinking, contextual understanding and authentic learning (Tlili et al., 2023; UNESCO, 2023). Preparing students to use AI thoughtfully and ethically, rather than expecting them to navigate these technologies alone, is essential if institutions are to realise the educational benefits of AI while preserving the integrity and purpose of higher education. To extend this conceptual discussion, I will propose three research questions. This proposed paper will adopt a qualitative approach, underpinned by an interpretivist paradigm, and will use open-ended questionnaires and virtual focus group discussions with first-year students. I anticipate that the findings will contribute to the development of contextually relevant AI policy guidelines and inform teaching, learning and assessment practices that support responsible AI use and authentic student learning in South African higher education.

Keywords: Artificial Intelligence; Academic Integrity; AI Literacy; First-year Students; Open Distance E-Learning

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Design and Implementation of the “Artificial Intelligence Applications” Course for Deaf Higher Education Students: A Share of Experience

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Artificial intelligence (AI) technologies have become an integral part of education, professional life, and everyday activities. This transformation highlights the need to equip individuals with disabilities with AI literacy and the skills required to use AI tools effectively. However, there is limited research and instructional design focusing on AI education for deaf learners.

This study presents the development process, course design, and implementation experiences of the newly introduced "Artificial Intelligence Applications" course designed for deaf higher education students. The course was developed by considering students' language proficiency, visual learning preferences, and accessibility requirements. The curriculum includes generative AI tools, text generation, presentation preparation, the use of AI in academic research, ethical considerations, and everyday applications of AI.

The study discusses the instructional strategies employed throughout the course, approaches to developing accessible learning materials, and the challenges encountered by students during the implementation process. Furthermore, reflections based on classroom observations provide insights into how deaf students learn to use AI tools and engage with AI-supported learning activities.

This experience-sharing study aims to provide practical guidance for educators interested in developing similar courses, offer recommendations for accessible AI education, and contribute to the growing body of knowledge on inclusive AI literacy practices in higher education.

Keywords: AI Education, Deaf Students, Accessible Education, Higher Education, AI Literacy

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The impact of learning with mobile devices on biology knowledge

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Biology education has faced critical challenges in recent years, including a declining interest in the subject and difficulties among both students and teachers in identifying common plant and animal species. To address these concerning trends, implementing appropriate student-centered pedagogical approaches and modern technologies is highly recommended. Mobile devices (such as smartphones, tablets, and laptops) represent the most accessible educational technologies due to their availability, portability, and capability to support outdoor education and diverse learning activities. While several meta-analyses have already demonstrated the positive effects of mobile devices on science achievement in general, no study to date has specifically synthesized and quantified their impact solely on biological knowledge acquisition. This meta-analysis aims to estimate the overall effect of using mobile devices in biology education on student knowledge compared to traditional instruction and to identify potential factors influencing this effectiveness. Following the PRISMA guidelines, a systematic literature search was conducted within the Scopus database. Based on predefined inclusion and exclusion criteria, the final dataset comprised 40 articles published between 2005 and 2024. Hedges' g was calculated to determine individual effect sizes, and due to substantial heterogeneity among the included studies ($I2 = 92.6\%$), a random-effects model was adopted. The overall synthesis demonstrated a significant positive impact of implementing mobile devices on students' biology knowledge, yielding a medium to large mean effect size of $g = 0.767$ (95% CI = 0.538 to 0.996, $p < 0.001$), which proves that students taught with mobile devices outperform those taught without them. Subsequent moderator analysis evaluated the potential influence of education level, length of instruction, learning environment, device usage, area of biology, publication year, and country Human Development Index (HDI) values. Although none of these moderators significantly influenced the effect size ($p > 0.05$), valuable sub-group comparisons were identified. The impact can be interpreted as large among primary school students and medium among middle school, high school, and university students, indicating that mobile device implementation has a greater relative effect on younger learners. Furthermore, slightly higher effect sizes were found for short-to-medium-term instructions lasting one to four weeks (suggesting that long-term rigid usage might suppress the novelty effect over time) and for instruction delivered in outdoor environments (which produced a large positive effect compared to the medium effect of indoor settings). Among types of device usage, incorporating gamified elements and gaming apps yielded a large positive effect size, making it a highly effective implementation strategy. Within specific domains of biology, instruction covering botanical topics surprisingly generated larger effect sizes than zoological topics, highlighting mobile learning as a pragmatic stimulus to overcome the low intrinsic popularity of plant biology among students. Finally, continuous meta-regressions revealed slight, non-significant decreases in effect sizes with increasing publication years and higher country HDI values, showing that mobile tools remain remarkably meaningful even in modern, technology-saturated student environments. In conclusion, mobile technologies actively foster biological knowledge development, and maximizing their educational potential relies on practical strategies such as varying instructional activities, integrating game-based learning, and coupling mobile device usage with outdoor biology education.

Keywords: Biology, Education, Information Technologies, Mobile Devices, Smartphone

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Mettbrötchen, Weißwurst, and German Beer: Fostering Intercultural Exchange and Learning between International and Domestic Students through Collaborative Brewing and Culinary Experiences

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International exchange students frequently experience loneliness, limited social integration, and challenges in establishing meaningful relationships within their host universities. For exchange students, this can lead to a period of uncertainty and decreased psychological well-being, which, in extreme cases, can result in them having to cut their exchange short. To address these issues, higher education institutions commonly implement buddy programmes, tandem learning, orientation weeks, and social events. While these initiatives provide valuable opportunities for initial contact, they often rely on short-term interactions that may not foster sustained intercultural relationships. Consequently, there is a need for innovative educational formats that create recurring, authentic opportunities for collaboration between international and domestic students.

This abstract proposes a planned seminar that uses collaborative beer brewing and regional German breakfasts as catalysts for reciprocal intercultural exchange between international and domestic students. The seminar aims to strengthen students' sense of belonging, foster long lasting social relationships, and promote intercultural learning through authentic, hands-on collaboration. Therefore, mixed teams of international and domestic students participate in four collaborative brewing sessions. Each session focuses on brewing a traditional beer recipe from a different German region (e.g., a Pils from Brandenburg, a Bavarian Wheat Bear (ger.: "Weißbier") and a Thuringian Black Bear (ger.: "Schwarzbier")) while introducing participants to the region's culinary culture through a representative breakfast (e.g., a Bavarian White Sausage (ger.: "Weißwurst") breakfast, Northern German fish (ger.: "Rollmops") sandwiches, Berlin-style minced meat sandwich (ger.: "Mettbrötchen")). The breakfast settings (with available vegetarian options) are designed to stimulate conversations about regional traditions, identity, and everyday life in Germany while encouraging participants to compare these experiences with food cultures and customs from their own countries. After the brewing process, the students present their produced beers at a university-wide "Exchange Beer Festival", where they also prepare and serve breakfast specialties from their home countries to festival visitors.

The proposed seminar is situated in the WI-Brewing Cellar at the University of Potsdam, a Creative BA designed to support collaborative as well as experienced- and craft based learning. The Cellar follows the Subject-Oriented Design Learning (SODL) model and combines the physical affordances of a brewing laboratory with flexible social spaces that encourage interaction, cooperation, and reflection. The brewing process requires continuous teamwork, communication, and shared decision-making, creating repeated opportunities for reciprocal intercultural exchange.

Taken together, this abstract argues that embedding authentic collaborative beer brewing within a purposefully designed learning environment, complemented by shared regional culinary experiences, can foster social connectedness and long lasting relationships, strengthen students' sense of belonging, and promote reciprocal intercultural exchange between international and domestic students.

Future work will focus on implementing the proposed seminar and empirically evaluating its educational and social outcomes.

Keywords: Beer Brewing, Intercultural Learning, Intercultural Exchange, Subject-oriented Design Learning, WI-Brewing Cellar, Meaningful Learning Experiences, Psychological Well-being, Collaborative Learning

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EFL Teachers' Perceptions of Participating in a MOOC on Student Engagement: Motivations, Experiences, and Outcomes

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Student engagement is widely recognized as a key contributor to successful language learning. However, empirical evidence regarding EFL teachers' understanding, perceptions, and classroom implementation of student engagement remains limited. As a result, little is known about the effectiveness of professional development initiatives specifically designed to enhance teachers' conceptual understanding of this construct. Addressing this gap, the present study reports the quantitative strand of an explanatory sequential mixed methods evaluation of EngageMore, a conceptually grounded MOOC developed to enhance EFL teachers' understanding of multidimensional student engagement.

The study employed a pretest and posttest survey design within an explanatory sequential mixed methods framework. The MOOC was delivered between February 2025 and March 2026. A total of 652 EFL teachers completed the pretest, 245 completed the posttest, and 237 participants were successfully matched across both administrations. Data were analyzed in R using descriptive statistics and nonparametric inferential analyses to examine participants' self-efficacy, conceptual understanding of student engagement, completion patterns, and evaluations of the course and its integrated artificial intelligence assistant.

The findings indicated significant improvements among course completers. Matched analyses revealed a statistically significant increase in teachers' self reported self-efficacy with a large effect size. Participants also reported positive conceptual change regarding student engagement. Prior MOOC experience and weekly time availability significantly predicted course completion, whereas teaching experience, institution type, and previous participation in English language teaching professional development were not associated with completion. Participants evaluated the AI assistant positively overall, particularly in terms of usability, although its perceived contribution to course specific pedagogical learning was comparatively lower.

The findings suggest that participation in a conceptually grounded MOOC was associated with improved conceptual understanding of student engagement and greater confidence in implementing engagement related practices among EFL teachers. The results also indicate that structural factors, rather than teachers' professional characteristics, play a more prominent role in successful course completion. Although causal conclusions are limited by the absence of a control group and the use of self-report measures, this study contributes empirical evidence on a student engagement focused professional development model for EFL teachers and highlights the potential of theory driven MOOCs as scalable professional development opportunities. Future research will integrate the qualitative strand with the quantitative findings to provide a richer understanding of how teachers translate conceptual learning into classroom practice.

Keywords: Student Engagement, MOOC, EFL Teacher Professional Development, Self-efficacy, Mixed Methods

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Navigating the Techno-Instructional Void: An LMS-Based Asynchronous Training Framework to Enhance Educators' AI-TPACK Competencies

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The rapid proliferation of Generative Artificial Intelligence (GenAI) in higher education has profoundly disrupted traditional learning environments. In design-based and applied disciplines, this sudden technological shift has created a critical "Techno-Instructional Void." Many educators currently lack the specific digital and andragogical competencies (AI-TPACK) required to effectively mentor students in AI-mediated classrooms. Consequently, students face the severe risk of cognitive passivity, often uncritically accepting visually compelling but technically unverified algorithmic outputs—a condition defined as the "Zero Order Thinking State" (ZOTS). To address this urgent pedagogical gap, this study focuses on the instructional design, development, and validation of a comprehensive, asynchronous online training module tailored specifically for higher education faculty. This research employs a qualitative Design and Development Research (DDR Type 2) methodology to construct and validate the architectural blueprint of an LMS-based (Learning Management System) training environment. The proposed instructional design is systematically structured into four sequential learning modules. To enhance learner engagement and combat isolation in an asynchronous setting, the course design incorporates advanced multimedia strategies. This includes the integration of dual virtual pedagogical agents (AI avatars) that simulate dialectical mentoring and intentionally induce "cognitive friction." Furthermore, the framework introduces a novel assessment rubric—the "Merit Report"—designed to guide instructors in evaluating the transparent human-AI interaction process rather than grading the final synthetic output. The pedagogical viability, structural flow, and modular adaptability of this LMS framework were empirically validated through semi-structured, in-depth interviews with senior academics (n=5). The thematic analysis of the expert validation phase yielded strong consensus regarding the model's pedagogical robustness. Evaluators confirmed that the proposed asynchronous training effectively mitigates the risks of ZOTS by equipping instructors with deterministic validation strategies. The expert panel highly endorsed the shift from traditional vertical assessment to process-oriented, horizontal peer-review mechanisms guided by the Merit Report rubric. Ultimately, this study presents a scalable, easily deployable instructional design model. By providing a clear andragogical roadmap, it enables universities to seamlessly integrate AI-TPACK upskilling programs into their existing LMS infrastructures. This framework empowers educators to transition from traditional knowledge transmitters to "Socratic Auditors," ensuring that algorithmic exploration in higher education remains anchored in deterministic academic standards and human cognitive sovereignty.

Keywords: Instructional Design, AI-TPACK, Asynchronous Learning, Generative AI, Learning Management Systems (LMS), Higher Education.

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Analysis of faculty perceptions on the use of artificial intelligence tools in higher education: The case of the Adventist University of Bolivia

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Introduction: Artificial intelligence (AI) is transforming higher education by enabling innovation in teaching and learning. However, its integration presents challenges related to teacher training and pedagogical use. This study analyzes perceptions and use of AI tools in higher education, identifying opportunities and challenges in their implementation. Method: A convergent mixed-methods design was used with 106 faculty members from the Adventist University of Bolivia (Feb–July 2026). Data were collected via a Google Forms survey with 17 closed and 3 open-ended questions for quantitative and qualitative analysis. Results: Faculty reported AI knowledge levels: advanced (12.7%), intermediate (50.0%), basic (31.4%), and none (5.9%). 48% expressed a positive perception. ChatGPT (80%) and Gemini (64%) were most used. Analysis showed low-to-moderate associations between knowledge level and AI use. Qualitative findings highlighted personalization of learning and development of critical and creative thinking as key opportunities, while challenges included limited pedagogical training and experience integrating AI technologies. Conclusion: Findings indicate a generally favorable disposition toward AI, but emphasize the need to strengthen pedagogical competencies for ethical and effective integration in higher education.

Keywords: Artificial Intelligence, Higher Education, University Faculty, Technology Adoption, Adventist University of Bolivia

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Learning Modalities in Spatial Design Education: A Bibliometric Analysis of Online, Hybrid, and Face-to-Face Approaches

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During the COVID-19 pandemic, like all fields of education, the disciplines of architecture, interior architecture, urban design, and landscape architecture—which adopt a studio-based model of instruction—were also confronted with an inevitable process of transformation. The abrupt interruption of face-to-face education and the hybrid practices that followed led to the restructuring of learning processes within the framework of online, hybrid, and face-to-face modalities. Studies that elucidate how studio-based design education can adapt to the online and hybrid learning models projected to become widespread in the future are significant for assessing this transformation. Accordingly, this study aims to provide a holistic evaluation of the academic research conducted over the past decade on different educational modalities within the studio-based spatial design disciplines. To this end, academic publications indexed in the Web of Science Core Collection database between 2016 and 2026 were examined using the bibliometric analysis method. The disciplinary cluster was defined as architecture, interior architecture, spatial design, urban design, and landscape architecture, while the modality cluster—comprising online (distance), hybrid (blended), and face-to-face education—was addressed within a comparative paradigm. The 72 studies retrieved through a Boolean query strategy were assessed in accordance with the PRISMA 2020 protocol, and the 38 studies meeting the established criteria were included in the analysis. The findings reveal that the literature on educational modalities in spatial design education constitutes a young research field that has developed rapidly under the influence of the pandemic and is characterized by intensive academic output. The concentration of publications particularly in 2022–2023, together with the limited number of studies prior to 2020, indicates that the field has been shaped largely by the impact of the COVID-19 pandemic. Nevertheless, the blended learning and network-based studio approaches developed before the pandemic appear to have provided an important conceptual foundation for this transformation. The central debate prominent in the literature centers on how the embodied and spatially grounded experiential nature of studio education and the requirement for peer interaction can be reconciled with the flexibility afforded by digital environments, the opportunities for self-regulated learning, and competencies in the use of digital tools. In conclusion, the study argues that the transition to online education should not be construed as a unidirectional loss or gain; rather, it demonstrates that reconsidering this transition within the framework of hybrid and flexible learning models attentive to the pedagogical requirements specific to studio-based design education represents a more sustainable approach, and it seeks to contribute to the field in this direction.

Keywords: Spatial Design Education, Architecture Education, Online Learning, Hybrid/blended Learning, Design Studio, Bibliometrics.

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Leveraging Chatbots for Green Finance Education: An Empirical Study Based on UTAUT and TPB

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The severe challenges of climate change have prompted countries worldwide to actively promote net-zero carbon emissions and sustainable development. In this context, green finance serves as a core driving force, directing capital flows toward environmentally friendly industries. However, despite the increasing diversity of green financial products—such as green bonds and sustainable funds—public awareness, engagement, and practical application remain generally insufficient. This study aims to explore the use of the LINE messaging app, which boasts a notably high penetration rate in Taiwan, to enhance public understanding of green financial tools through interactive information delivery, thereby influencing purchasing intentions.

Specifically, this project leverages the robust information dissemination and interactive capabilities of LINE Bots to bridge the knowledge gap between green finance and the general public. Beyond mere information delivery, this research incorporates established behavioral models—namely the Unified Theory of Acceptance and Use of Technology (UTAUT) and the Theory of Planned Behavior (TPB)—to validate a suitable framework for understanding the incentives that drive consumers' willingness to purchase green financial products.

Through questionnaire surveys and empirical analysis, this study investigates individual decision-making, the formation of attitudes and intentions, and the underlying mechanisms of LINE Bot interventions as educational measures. By examining the behavioral models governing public awareness and participation in green finance, this research clarifies the core persuasive elements of these digital interventions. Ultimately, it provides strategic recommendations and empirical support for the sustainable development of green finance in Taiwan, anticipating a broader sustainable transition for both society and corporate enterprises.

Keywords: Behavior Model, Line Bot, Green Financial Products, UTAUT

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Implications of AI-Induced Lexical Creativity for Digital Language Tools

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The public release of advanced generative artificial intelligence in November 2022 marked a decisive shift in human-computer linguistic interaction, accelerating the evolution of digital English at an unprecedented pace. Since then, the digital linguistic landscape has been shaped by an exceptional surge of lexical creativity, evident in the rapid emergence of neologisms and continuing semantic change driven by AI technology. At the same time, static digital language tools have proved particularly susceptible to data drift when confronted with these recent developments. Against this backdrop, the present study considers the implications of recent lexical innovations for the functionality and adaptability of contemporary digital language systems. Drawing on a corpus-based methodology, the study identified neologisms that have emerged since 2022 while also examining established lexical items that have undergone substantial semantic change. By tracing these patterns of lexical innovation, it addresses both their theoretical relevance and their practical consequences across a broad range of digital language technologies. Particular attention is paid to automated translation systems, language-learning applications, essay assessment software, and online dictionaries. The study demonstrates that conventional digital language tools can be prone to interpreting post-2022 neologisms and semantic innovations as typographical errors or stylistic deficiencies if they continue to rely on largely static lexical databases. Automated Writing Evaluation systems, for instance, may penalize students for using contextually appropriate contemporary expressions. Translation applications and online lexicographical resources might encounter similar difficulties in semantic parsing, often producing inaccurate, outdated, or excessively literal output when processing current forms of digital discourse. The findings suggest that continuous monitoring of lexical creativity is necessary if digital language tools are to avoid becoming obsolete or unnecessarily punitive. On this basis, the paper argues that educational technology and digital linguistics should move beyond rigid, pre-AI lexicographical frameworks. The integration of dynamic, corpus-driven semantic tracking remains necessary for strengthening the adaptive capacity of these systems, enabling them to represent and respond to the realities of contemporary digital literacy with greater accuracy.

Keywords: Lexical Creativity, Neologisms, Semantic Change, Digital Language Tools, Corpus Linguistics

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Agile Blended Learning: A Review of an Emerging Paradigm

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Driven by rapid digital transformation and the increasing demand for flexible educational models, educational ecosystems require pedagogical approaches that can rapidly adapt to changing learner needs and technological advancements. Agile Blended Learning (ABL) has recently emerged as a novel techno-pedagogical approach that integrates the iterative, collaborative, and flexible principles of Agile software development into blended learning environments by organizing learning activities into dynamic instructional "sprints." Despite growing scholarly interest, research on ABL remains fragmented, making it difficult to identify its defining characteristics, implementation strategies, and educational contributions.

This study aims to examine and synthesize the emerging body of literature on Agile Blended Learning in order to provide an overview of its theoretical foundations, implementation contexts, reported benefits, and current research trends.

A literature review was conducted using 14 studies published between 2023 and 2026 that explicitly addressed Agile Blended Learning. The selected studies were analyzed through thematic synthesis to identify recurring concepts, implementation patterns, educational contexts, and reported outcomes.

The thematic synthesis reveals that the existing literature converges around distinct structural and functional dimensions of ABL. In terms of educational contexts, research primarily spans three domains: (1) higher education institutions, focusing on institutional infrastructure and student retention; (2) metropolitan and remote environments, supporting non-traditional learners; and (3) professional settings, particularly teacher education and AI literacy training. Regarding implementation patterns, ABL environments consistently utilize technology-mediated flexibility, learning analytics, and iterative instructional "sprints." In terms of reported outcomes, the analyzed studies demonstrate that these Agile-inspired practices promote learner autonomy, enhance student engagement, improve overall course effectiveness.

This review study contributes to the growing discourse on adaptive learning design by providing a foundation for future research to evaluate the scalability and long-term effectiveness of ABL across diverse educational settings.

Keywords: Agile Blended Learning; Blended Learning; Instructional Design;

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Academic Use of Generative Artificial Intelligence and its Association with Critical Thinking Disposition Among Mexican University Students

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The rapid integration of generative artificial intelligence (GAI) into higher education has highlighted the need to examine how students interact with these technologies in academic activities. While much of the research has focused on technical skills or ethical risks, there has been less study of the use of GAI in relation to critical thinking disposition among university students; that is, the mental habits, tendencies, and motivation to question, compare sources, and reflect before forming judgments (López-Padilla et al., 2022). Hence, it is necessary to examine this link to generate knowledge that promotes a more reflective interaction between students and these technologies, rather than a potential cognitive dependence. As the literature shows, critical thinking disposition has been linked to character, compassion (Gómez-Vaya et al., 2025), computational thinking (Vigo Ingar et al., 2025), and academic self-efficacy (López-Padilla et al., 2022). The objective of this study was to analyze the academic use of GAI and its association with critical thinking disposition among Mexican university students from various disciplinary areas. The data were collected from 663 students at two universities located in central Mexico, with an average age of 21 years (SD=7.65); 57.2% were women. A cross-sectional study was conducted using an online self-report questionnaire. Results show that, at the time of the survey, the majority of students (43.89%) had been using GAI for academic purposes between one and two years. The most commonly reported tools were ChatGPT, Gemini, Copilot, and DeepSeek. Regarding critical thinking disposition, the majority (78%) exhibited a high level, followed by those who reported a moderate level (19%). A greater number of students with a high level of critical thinking disposition use GAI tools more diversely, both in terms of the types of tools employed and their purposes: searching for information, summarizing readings, receiving writing assistance, organizing activities, translating texts, or exploring out of curiosity, suggesting a greater intentionality in their use depending on the tool. The majority of students with moderate or low proficiency use GAI to search for information, summarize, correct errors, or translate texts. These findings suggest that, while most students possess a disposition toward critical thinking, which involves mental habits and a strong motivation to question and remain open to learning, and are the ones who make the most diverse use of GAI, future research needs to delve deeper into this dynamic to help those who use GAI more limitedly, in the face of the automation offered by these emerging technologies in the academic setting. These results may inform the design of educational approaches that help students harness the potential of GAI without relinquishing their epistemic agency.

Keywords: Disposition Toward Critical Thinking; University Students; Generative Artificial Intelligence

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STEM Education for an Unpredictable Digital World: Competencies and Responsible Innovation

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In a deeply unpredictable digital world, this study examines how STEM education can support the development of skills needed to adapt to accelerated technological transformations. The article investigates how the development of scientific skills, critical thinking, and the integration of emerging technologies can strengthen student autonomy in an educational ecosystem that is constantly changing. The specialized literature emphasizes that scientific and technological literacy can no longer be conceived as a stable set of knowledge, but as a dynamic process oriented towards solving problems and understanding the complexity of the digital world. Bybee (2013) describes STEM as an integrated approach that prepares students for the real challenges of contemporary society, a perspective all the more relevant in a context marked by uncertainty. Many researchers, such as Selwyn (2019) and Holmes (2026), highlight that the digitalization of education is a process fraught with social, ethical and political implications, which requires the formation of a technological awareness, and Floridi (2020) argues that responsibility in the use of emerging technologies becomes a fundamental competence in a world where algorithmic decisions increasingly influence the human experience. In this framework, STEM education takes on a dual function: cultivating the technical and cognitive skills necessary to adapt to change and developing the ethical discernment necessary for responsible innovation. Starting from this, the study formulates three main objectives: (1) identifying STEM competencies relevant for effective functioning in an unpredictable digital world; (2) exploring innovative pedagogical practices that can facilitate the development of these competencies; (3) clarifying how technological responsibility can be explicitly integrated into STEM education. The methodology is qualitatively interpretive, based on literature review, educational case studies, and critical evaluation of emerging pedagogical models. The study formulates three central questions: what STEM competencies are needed to function effectively in an unpredictable digital world; how can innovative pedagogical practices facilitate their development; and how can technological responsibility be integrated into STEM education. The analysis highlights three major results. The first shows that, in the context of technological acceleration, relevant STEM competencies include not only technical skills, but also cognitive and metacognitive dimensions such as critical thinking, cognitive flexibility, and the ability to operate with uncertainty. The second result concerns the role of innovative pedagogical practices: project-based learning, technology-assisted exploration, and interdisciplinary activities facilitate the transfer of skills and the development of student autonomy, although uncritical integration of technology can generate algorithmic dependence and educational inequalities. The third result highlights the importance of the ethical dimension of innovation, with European documents on the ethics of artificial intelligence stressing the need for technological responsibility as an explicit part of STEM education. Overall, the study shows that STEM education can provide a solid framework for preparing students for digital uncertainty, provided that the integration of technology is accompanied by a pedagogy oriented towards autonomy, reflexivity and responsibility. The conclusions highlight the need for a flexible, ethical and discernment-oriented pedagogy, capable of preparing students for a constantly changing digital future.

Keywords: STEM Education, Unpredictable Digital World, Responsible Innovation, Ethics, Digital Pedagogy

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The ecology of AI in education: between technological promise and epistemic responsibility

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Artificial intelligence (AI) is profoundly reshaping contemporary education, generating both significant opportunities for personalizing learning and streamlining teaching activities, as well as ethical, pedagogical, and social risks that require responsible integration. In this context, the study critically examines AI applications in education, evaluating their benefits, emerging risks, and the responsibilities of the actors involved, based on a systematic review of recent literature in educational AI, technology ethics, and educational policy.

Education is undergoing accelerated transformation driven by the introduction of adaptive systems, intelligent tutors, conversational agents, learning analytics, and immersive environments. These technologies are not merely new tools; they produce a paradigm shift that influences how students construct knowledge and how teachers design learning experiences. Adaptive platforms adjust content according to student performance, intelligent tutors provide individualized feedback, while conversational agents and generative models such as ChatGPT support concept explanation and problem solving. Intelligent simulations and immersive environments facilitate experiential learning, strengthening conceptual understanding through multimodal interaction. The specialized literature highlights major opportunities associated with AI: personalized learning, increased inclusion, democratized access to educational resources, and support for the development of 21st century skills such as critical thinking, problem solving, and digital literacy. AI can provide immediate feedback, fostering student self regulation, and can reduce teachers' repetitive tasks, allowing them to focus on activities with high pedagogical value. At the same time, critical literature draws attention to risks: algorithmic bias, cognitive overload, deprofessionalization of the teaching role, excessive dependence on automation, and vulnerabilities related to data privacy and security. These risks underscore the need for an ethical, reflective, and well regulated approach to AI in education. The aim of the study is to critically analyze AI applications in education, relating them simultaneously to pedagogical opportunities, ethical and cognitive risks, and to the responsibilities of the actors involved in designing and implementing educational technologies. The research is theoretical and analytical in nature, grounded in a critical review of recent literature. The study formulates four main objectives: (1) identifying and classifying the main applications of AI in education; (2) analyzing the pedagogical opportunities associated with these applications; (3) examining the ethical, pedagogical, and cognitive risks; and (4) formulating a framework of responsibilities for teachers, institutions, developers, and policy makers. In line with these objectives, four research questions are articulated: (1) what are the main applications of AI in education and how are they evaluated in the specialized literature; (2) how does AI contribute to personalization, inclusion, and the efficiency of teaching activities; (3) what risks are associated with the use of AI and how are they problematized in recent research; and (4) what responsibilities lie with educational actors in the ethical integration of AI. Overall, the study shows that AI represents one of the most promising yet complex transformations of contemporary education. Its opportunities can amplify educational potential only when accompanied by a pedagogy oriented toward autonomy, reflexivity, and epistemic responsibility, in which the student, the teacher, and the learning process remain at the center of the educational ecology.

Keywords: Adaptive Systems, Intelligent Tutors, Conversational Agents, Learning Analytics, Immersive Environments, Simulations

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Adaptive and Metacognitive Epistemic Performance in Teachers' Reasoning About AI in Education

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Artificial intelligence (AI) tools have been increasingly integrated into education, transforming how knowledge is produced, accessed, and evaluated. Although AI-supported systems provide opportunities for teaching, learning, assessment, decision-making, and material development, they also create epistemic challenges as outputs can be inaccurate, biased, incomplete, or fabricated. Therefore, teachers need to make judgments about how to evaluate AI-generated outputs and which limitations or risks to consider. Grounded in the Apt-AIR framework of epistemic performance, this case study examines how prospective and in-service teachers demonstrate adaptive performance and metacognitive regulation when reasoning about the use, evaluation, and pedagogical integration of AI tools. The Apt-AIR framework, developed by Barzilai and Chinn (2018) and elaborated in 2024, is a normative model grounded in reliabilist virtue epistemology that defines fully apt epistemic performance as successful engagement with epistemic aims, ideals, and reliable processes across contexts. Within this framework, adaptive performance refers to a learner's capacity to successfully vary and apply their epistemic aims, standards, and strategies appropriately across different tasks and contexts, while metacognitive regulation involves the planning, monitoring, evaluating, and controlling of one's epistemic performance to manage the deployment of these epistemic components. The case involved developing teachers' AI competencies through the design and implementation of an instructional module within a teacher education program at a major public university in Turkey. Data were collected through semi-structured interviews with three participants, consisting of one prospective and two in-service teachers, who successfully completed the face-to-face Developing AI Competencies for Teaching course. The analysis focused on adapting epistemic performance and metacognitively regulating and understanding it, as these dynamic, interrelated dimensions are critical yet difficult for teachers to sustain without explicit support. Following a hybrid thematic analysis approach, data were analyzed deductively using these dimensions as initial categories and inductively through line-by-line coding and the constant comparative method to contrast responses and allow domain-specific sub-themes to emerge. Findings showed two patterns. First, participants demonstrated adaptive epistemic performance by evaluating AI use conditionally rather than treating it as generally useful or problematic. Their judgments changed according to instructional purpose, assessment context, disciplinary characteristics, student needs, and technological access. AI was considered useful for identifying learning difficulties, supporting lesson planning, designing materials, differentiated learning, and increasing engagement. However, participants emphasized that these uses depend on the subject area, task type, pedagogical purpose, and the availability of technological resources. In mathematics education, participants were cautious about AI-supported assessment because students may demonstrate different solution paths and reasoning processes. Second, participants demonstrated metacognitive regulation by monitoring and controlling trust in AI outputs. They evaluated AI outputs through ideals such as accuracy, source trustworthiness, citation quality, originality, privacy, transparency, ethical use, bias, and reliability. Their regulatory processes included checking sources, revising outputs, limiting personal data sharing, comparing information with their own knowledge, and questioning AI-supported student work. In conclusion, effective AI integration requires

developing teachers' deeper epistemic performances to evaluate, adapt, and regulate AI-mediated knowledge. Teacher education programs should design modules to enhance these adaptive and metacognitive epistemic aspects.

Keywords: Artificial Intelligence in Education; Apt-AIR Framework; Adaptive Epistemic Performance; Metacognitive Regulation; Teacher Education; Case Study

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Together, but Alone: An Autoethnography of Artificial Intelligence-Mediated Academic Life in Seoul

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This autoethnography examines how I, a non-Korean-speaking international student with little prior exposure to Korean culture, turned to artificial intelligence (AI) as my primary survival infrastructure during my master's study at one of the most competitive and prestigious universities in South Korea. It traces how AI mediated my academic and daily life in a country whose language and culture I could not directly access. In my case, AI is not as an emotional companion, but as the infrastructure through which I read announcements, attended lectures, completed administrative tasks, and moved through Seoul. This is an analytical autoethnography drawing on digital fieldnotes and on saved AI-conversation logs across multiple platforms, spanning my arrival in South Korea to my ongoing graduate study as the only non-Korean in a Seoul National University lab. The fieldnotes capture the sensory and psychological texture of each event at the time it occurred; the AI conversation logs preserve what I asked, what AI answered, and what I acted on. Together they form the empirical ground for theoretical analysis. I frame this experience through Don Ihde's postphenomenology, in particular the amplification-reduction structure of technological mediation, and Victor Turner's theory of liminality. The central analytical perspective is to read AI's mediation as amplification and reduction. AI extended my linguistic and functional capacity in a Korean-language environment while, at the same time, reducing social friction (the involuntary contacts with lab mates, classmates, and strangers that would otherwise have pushed me toward communitas and incorporation). I organize the autoethnography into three layers of this same mediation. First, functionality: AI worked, translating lectures, completing administrative tasks, and making Korean institutional life readable to me. Second, relief: AI removed the need to be vulnerable, and that relief quietly opened a hollow in which isolation began to grow unnoticed. Third, cost: AI succeeded just enough to make me stop reaching for the human contact I would otherwise have needed. Inverting Sherry Turkle's Alone Together, my condition was together, but alone. I physically present in the classroom, the lab, the city, yet relationally absent because AI made human contact structurally unnecessary. AI did not produce this condition, but it sustained it. This autoethnography asks South Korean higher education whether AI-enabled functioning of displaced students is best read as successful adaptation, or as a sign that the conditions for institutional welcome have been quietly displaced by technology.

Keywords: Autoethnography; AI As Infrastructure; Amplification-reduction; Postphenomenology; Liminality; Korean Higher Education

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Teacher Readiness and Developmentally Appropriate Practices in Preschool AI Integration: A Preliminary Analysis of a Critical Case

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The growing interest in artificial intelligence (AI) in early childhood education has raised new questions about how preschool teachers understand, evaluate, and set boundaries for AI use in classroom practice. As children increasingly encounter AI-mediated technologies, AI has become an important consideration in preschool education (Su et al., 2023). This issue is sensitive because early learning depends on play, concrete experience, social interaction, and teacher guidance. AI-supported activities may foster creativity and digital literacy when designed in age-appropriate ways (Berson & Berson, 2024; Nikolopoulou et al., 2025; Wang et al., 2025), yet they also raise concerns about appropriateness, misinformation, privacy, security, overreliance, reduced interaction, and limited hands-on learning (Kölemen & Yıldırım, 2025; Schriever et al., 2020; Su, 2024; Wang et al., 2025). Therefore, AI's value and risks depend on how teachers interpret AI, feel ready to use it, and set developmentally appropriate and ethical boundaries (Schriever et al., 2020; Su, 2024).

This critical case study explores how a preschool teacher understands AI use in early childhood education, focusing on teacher readiness, developmental appropriateness, pedagogical boundaries, ethical concerns, and support needs. The study employs a qualitative single-case study design to examine one bounded case within its real-life context (Merriam, 2009; Yin, 2018). The case is a preschool teacher working at a private school in Türkiye. She holds a master's degree in educational technology and has extensive experience in preschool education, robotics, and technology-supported learning. She was chosen as a critical case due to her academic background and extensive classroom experience, which make her well-equipped to evaluate AI from both pedagogical and technological perspectives. Critical cases, such as this one, can provide valuable insights because of their exceptional characteristics (Flyvbjerg, 2006).

Data were collected through semi-structured interviews. The interviews initially explored the participant's perceptions of AI in fostering students' creativity. However, the analysis showed that the discussions shifted toward AI readiness, developmental appropriateness, child-AI interaction, teacher support, and the absence of a preschool-specific AI framework. Additional interviews were conducted to clarify these emerging issues. Data were analyzed through thematic analysis and dramaturgical coding (Braun & Clarke, 2006; Saldaña, 2011). Thematic analysis identified recurring patterns, while dramaturgical coding examined the teacher's goals, concerns, strategies, attitudes, emotions, and implied meanings regarding AI use.

Preliminary findings indicate that the participant did not reject AI but approached it cautiously. She positioned AI mainly as a teacher-support tool rather than a tool directly used by children. She identified benefits for lesson planning, visual production, activity preparation, curiosity, and creative engagement. However, direct child-AI interaction was viewed as developmentally challenging because AI is abstract and complex and may require prerequisite skills. Teacher readiness was shaped by AI knowledge, confidence, uncertainty, ethical concerns, perceived relevance, practical guidance, and the lack of a clear preschool-specific AI framework (Hsu et al., 2025). Overall, this critical case shows that even a highly qualified preschool teacher may adopt a cautious stance toward AI integration. The findings suggest that professional development for preschool AI integration should be treated as a

pedagogical, developmental, ethical, and professional issue that considers teacher judgment, classroom context, and children's needs rather than simply introducing AI tools.

Keywords: Artificial Intelligence; Early Childhood Education; Teacher Perceptions; Teacher Readiness; Developmental Appropriateness; Qualitative Case Study;

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Studies on Updating the Mathematical Thinking Course Content in Higher Education for Students with Hearing Loss

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The “Mathematical Thinking” course, offered in the common preparatory class of four different programs (Computer Operator Training, Architectural Drafting, Ceramics, and Graphic Design) at the School for the Handicapped (EEYO) at Anadolu University, where all students have hearing loss, was designed to provide students with a basic mathematical foundation before they proceed to their departments. However, the integration of current technologies into teaching has remained insufficient in this course. In addition, during the three semesters in which the researcher/instructor taught the course, it was identified that the course content needed to be determined in a way that was more common to students from all four programs and that the intensive learning content needed to be made simpler and more effective. Individuals with hearing loss go through the same learning process as individuals with normal hearing; however, the process may take longer for individuals with hearing loss. In addition, special instructional programs are implemented for these students. Therefore, it was considered necessary to implement a special program within the Mathematical Thinking course. In this study, the fundamental changes in the implementation of the program and the major changes designed will be explained. While designing these changes, collaboration was carried out with the heads of the four departments at the school and the preparatory class coordinatorship. Thus, the intensive course content will be simplified, teaching methods will be diversified, and students will be introduced to the mathematical structures that they will use extensively before proceeding to their departments.

Keywords: Students with Hearing Loss, Mathematics Teaching, Teacher Experience

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Developing AI-Integrated Assessment Competencies: A Case Study of a Preservice Teacher

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The rapid integration of artificial intelligence (AI) into educational environments has fundamentally reshaped teaching and learning practices, necessitating a significant expansion of teacher competency frameworks. Within this evolving landscape, educational assessment has emerged as particularly critical, facing both unprecedented disruptive challenges and transformative opportunities. To address this shift, this study aims to provide insight into how prospective teachers develop AI-integrated assessment competencies, employing a qualitative case study. The case examined is a preservice teacher who participated in a six-week learning module designed to develop AI-integrated assessment competencies in a required educational technology course offered in the fall semester at a major public university in Türkiye. This learning module was developed based on the European Framework for the Digital Competence of Educators (DigCompEdu) and its recent AI Supplement (Redecker, 2017; Bekiaridis & Attwell, 2023). This case was selected using typical sampling, based on the case participant's completion of all assignments, regular class attendance, and voluntary participation in the interview. This sampling enabled an in-depth examination of how a typical prospective teacher developed AI-integrated assessment competencies throughout the module. Data were gathered through semi-structured interviews alongside pre- and post-opinion forms. The data were analyzed using the constant comparative method (Boeije, 2002), which yielded several important themes regarding the case participant's engagement with AI-integrated assessment design. Data were broken into smaller units and assigned labels to capture key ideas, concepts, and patterns. Similar labels were then merged and organized into a codebook. Finally, codes were grouped into themes that represent the broader patterns in the data. The first theme addressed the purposes for using AI in assessment design. The findings indicated that the case participant considered AI a supportive tool rather than a decision-maker in the assessment process. She also shared that she uses AI as a brainstorming tool to generate assessment ideas and to check her work. The second theme addressed decision-making in AI-integrated assessment design. The case participant put human ideas first when designing AI-integrated assessments. When AI tools were used, context, learning objectives, and instructional goals were provided rather than relying on AI to generate assessment tasks independently. She also shared that the choice of when to use AI depended on the type of assessment design. The third theme addressed pedagogical considerations in AI-integrated assessment design. The findings indicated that teaching students to use AI effectively and responsibly was considered an important part of the process. She also shared that making students' thinking processes visible was considered necessary for fair grading. The fourth theme focused on ethical considerations in AI-integrated assessment design. The analysis indicated that environmental responsibility is an important concern, and AI is used only when necessary. Data privacy was also identified as a key concern, influencing the selection of AI tools. The fifth theme addressed the challenges experienced in AI-integrated assessment design. It highlighted challenges such as AI-generated misconceptions that required verification, superficial or traditional outputs, and uncertainty about fair scoring when students use AI. Overall, these findings will contribute to teacher education research by demonstrating how a learning module can meaningfully support the development of AI-integrated assessment competencies.

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Keywords: Teacher Education; AI Competencies; Assessment Competencies; Case Study

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Standardized Pedagogical Prompting for Sustainability-Oriented Chemistry Curriculum Interpretation

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Generative artificial intelligence (GenAI) is increasingly used to generate explanations, classroom activities, and assessment materials directly from curriculum learning outcomes. Yet an important question remains unanswered: is a prompt merely a technical instruction for improving AI-generated responses, or can it function as a pedagogical instrument for curriculum interpretation? From a curriculum perspective, an effective prompt should preserve the intended epistemic demand of a learning outcome—such as experimentation, hypothesis generation, scientific inquiry, critical evaluation, or evidence-based decision making—while shaping how that outcome is represented instructionally. This study investigated how three standardized pedagogical prompt templates influenced the pedagogical representation of sustainability-oriented chemistry curriculum learning outcomes generated by GPT-5.

Three prompt templates were developed a priori, each reflecting a distinct pedagogical purpose: curriculum elaboration (P1), emphasizing scientifically accurate conceptual explanation; systems-thinking interpretation (P2), highlighting relationships among chemical, environmental, technological, economic, and societal dimensions; and instructional translation (P3), transforming learning outcomes into coherent classroom learning experiences. The templates were applied to all ten sustainability-oriented learning outcomes identified across Grades 9–12 of the 2024 Turkish Secondary Chemistry Curriculum. Because the complete set of relevant learning outcomes was analysed, the study was based on full curriculum coverage rather than sampling, producing thirty instructional texts through a standardized single-turn prompting protocol.

The instructional texts were analysed using a theory-informed comparative framework comprising four dimensions: curriculum fidelity, disciplinary enrichment, sustainability enrichment, and pedagogical enrichment. To enhance confirmability, a subset of texts representing one learning outcome from each grade level under all three prompting conditions (n = 12) was independently coded by a second chemistry education researcher using a predefined coding manual, yielding agreement ranging from slight to almost perfect across categories (weighted $\kappa = .65$ for Curriculum Fidelity) after rule-based resolution of initial disagreements.

Across all thirty instructional texts, the intended epistemic demand of each learning outcome was preserved in the great majority of cases. The three prompting conditions, however, generated systematically different pedagogical representations. The curriculum elaboration template strengthened disciplinary reasoning through conceptual sequencing and scientific explanation; the systems-thinking template progressively embedded learning outcomes within increasingly sophisticated sustainability systems; and the instructional translation template transformed curriculum expectations into authentic inquiry-oriented classroom learning sequences.

These findings suggest that standardized pedagogical prompting can function as a reproducible pedagogical specification for curriculum interpretation rather than merely a technical mechanism for optimizing AI-generated outputs. The proposed framework provides teachers with an accessible approach for generating multiple curriculum-faithful instructional representations of the same learning outcome and offers a transferable analytical model for

investigating AI-assisted curriculum interpretation across disciplines and educational contexts.

Keywords: Generative Artificial Intelligence; Pedagogical Prompting; Curriculum Interpretation; Curriculum Fidelity; Sustainability-Oriented Chemistry Education; GPT-5

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Automated Classification of Peer Feedback Across Classroom Conditions: Comparing Machine Learning, BERT, and Large Language Models

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Peer assessment is a powerful learning activity that positions students as active participants who both provide and receive feedback, engaging them more deeply in learning while fostering competencies that learners increasingly need today. However, producing formative feedback is cognitively demanding, and its quality varies widely from learner to learner. Developing feedback literacy depends on support tailored to the individual rather than uniform guidance, helping each student improve the feedback they provide and refine their earlier attempts. As a first step toward such support, this study examined whether peer feedback can be classified automatically using a seven-level feedback coding framework (Lee & Ha, 2026), and how such a classifier might be deployed across different classroom conditions. We applied three approaches—machine learning (ML), the pre-trained language model BERT, and a large language model (LLM)—to 2,080 peer feedback comments from a high-school science classroom and tested how well each generalized across five classroom scenarios. Within the same classroom context, KLUE-BERT reached $\kappa = 0.900$, exceeding the agreement between human raters ($\kappa = 0.804$); the best ML ensemble matched the human raters at $\kappa = 0.804$, and the LLM achieved substantial agreement ($\kappa = 0.644$) without any task-specific training. BERT was especially data-efficient, approaching human-level agreement with as few as two questions and with only half of the students, whereas ML plateaued early. However, in an entirely new context, ML and BERT collapsed, whereas the LLM recovered to $\kappa = 0.639$ once its prompt was updated with information about the new setting. Across all approaches, Level 4 (error-pointing feedback) was the most difficult to classify, largely because it is superficially similar to the adjacent Level 3 (rubric-based feedback). Overall, the results indicate that no single approach is best in all conditions, and that the appropriate tool depends on a classroom's data conditions: a fine-tuned BERT once enough in-context data have accumulated, ML as a lightweight option when computing resources are limited, and the LLM in the early stages or in wholly new settings where no training data yet exist. We see these tools as an aid to teachers rather than a substitute for them: the teacher remains responsible for interpreting each diagnosis, confirming ambiguous cases such as the Level 3–4 boundary, and selecting the appropriate scaffolding.

Keywords: Peer Feedback; Feedback Literacy; Automated Classification

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Mapping Sustainable and Responsible Artificial Intelligence Research in Education: A Bibliometric and BERTopic-Based Analysis

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This study aimed to examine current developments in sustainable and responsible artificial intelligence research in education through bibliometric analysis of Web of Science Core Collection data and a BERTopic-based thematic modeling approach. The widespread adoption of AI-based tools in educational technologies and online learning ecosystems requires a multidimensional evaluation that considers pedagogical effectiveness, efficiency, and innovation alongside ethics, data privacy, academic integrity, accessibility, equity, environmental sustainability, and institutional governance. In this context, the study sought to identify the conceptual and thematic orientations that have shaped the literature on sustainable and responsible artificial intelligence in education. A Topic search was conducted in Web of Science using the terms “sustainable artificial intelligence,” “sustainable AI,” “responsible artificial intelligence,” “responsible AI,” “ethical artificial intelligence,” “ethical AI,” “green artificial intelligence,” “green AI,” “energy-efficient AI,” and “carbon footprint of AI” in combination with “education,” “educational technology,” “online learning,” “e-learning,” “digital learning,” “distance education,” “higher education,” “AI in education,” “generative AI in education,” “learning analytics,” and “adaptive learning.” The search was limited to Article, Review Article, and Proceeding Paper document types. Two BibTeX files were merged, duplicate records were checked, and a total of 887 records were analyzed. Within the bibliometric analysis, publication trends by year, document types, leading countries, institutions, authors, publication sources, research fields, and keyword patterns were examined. The thematic structure of the field was modeled using BERTopic on text bodies created from titles, abstracts, and author keywords. The findings indicate that the literature on sustainable and responsible artificial intelligence in education gained significant momentum after 2024. The number of publications reached 387 in 2025, while 330 records had already been indexed in 2026 before the year was complete. The most frequent keywords were artificial intelligence, generative AI, higher education, responsible AI, ethical AI, ChatGPT, AI literacy, and academic integrity. The BERTopic analysis revealed that the literature was structured around eight thematic clusters: responsible/ethical AI development, educational data privacy, generative AI in education, teachers and AI literacy, AI assessment and equity in education, ethical AI in healthcare, intention to adopt AI in higher education, and AI in medical and nursing education. Overall, the results show that the current discourse on sustainable artificial intelligence in education has developed primarily around ethics, accountability, data privacy, academic integrity, teacher competencies, and institutional governance rather than environmental sustainability. By contrast, the limited representation of energy consumption and digital carbon footprint in the educational technology literature points to a significant research gap. The study emphasizes that AI integration in online learning and educational technology research should be addressed together with sustainability, accountability, and human-centered governance principles.

Keywords: Artificial Intelligence in Education, Sustainable Artificial Intelligence, Responsible Artificial Intelligence, Educational Technologies, BERTopic, Bibliometric Analysis

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Pedagogical Transfer from Semi-Synthetic Dialogues to Real-World Tutoring

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This study examines the extent to which pedagogical patterns learned from semi-synthetic instructional dialogues can be transferred to the task of evaluating teacher/tutor feedback provided in real teacher-student interactions. In this study, a "tutor response" is defined as an explanation, hint, guidance, or feedback provided by a teacher or tutoring system in response to a student's answer, error, or flawed reasoning during the problem-solving process. While examining the contribution of pedagogical transfer from a semi-synthetic to a real tutoring context to the pedagogical quality of existing teacher/tutor feedback in an automated evaluation task, the research aims to test a DeBERTa-v3-base-based fine-tuned classification approach in a comparative evaluation against large language model evaluators such as Gemini 2.5 Flash and GPT-4o. The study used MathDial as the source corpus, the Bridge/Teacher-Student Chatroom Corpus as the target corpus, and the BEA 2025 pedagogical rubric as the common evaluation framework. MathDial consists of semi-synthetic instructional dialogues in the context of mathematics instruction between human teachers and a language model that assumes the role of a student and simulates common error patterns. Bridge, on the other hand, is a dataset composed of real teacher-student interactions that includes authentic teacher feedback on student errors. Tutor responses were evaluated according to four pedagogical criteria within the BEA 2025 framework: whether the student's mistake was identified (Mistake Identification), whether the location of the mistake was pinpointed (Mistake Location), whether appropriate guidance was provided to the student (Providing Guidance), and whether the feedback directed the student toward an actionable next step (Actionability). Each dimension was modeled as a multi-class classification problem with the labels "Yes," "No," and "To some extent." Methodologically, full transfer, low-data, and component removal experiments were conducted using the DeBERTa-v3-base model. The model's performance was evaluated using 5-fold cross-validation; furthermore, the results were compared with those of the Gemini 2.5 Flash and GPT-4o models under zero-shot, few-shot, and chain-of-thought conditions. The findings show that in the DeBERTa main transfer experiments, the Full Transfer condition produced the highest overall average (Macro F1 = 0.407), while in the component removal analysis, the NoContext variant unexpectedly delivered higher performance (Macro F1 = 0.457). Under low-data conditions, MathDial pre-training provided consistent pedagogical prior knowledge, particularly at 25% and 50% target data levels. In the LLM comparison, Gemini 2.5 Flash Zero-Shot achieved the highest overall average (0.568), while the best result in the GPT-4o family was observed under the Few-Shot condition (0.484). Error analysis revealed that GPT-4o struggled particularly in the "error localization" dimension, while the Gemini family showed a tendency toward positive bias in the "guidance" and "action-orientation" dimensions. The results indicate that semi-synthetic instructional dialogs can serve as a functional transfer signal in the evaluation of pedagogical quality. However, it was concluded that a one-way, context-independent superiority relationship cannot be established between small, fine-tuned models and large language models; rather, model selection must be based on a comprehensive evaluation of performance, controllability, cost, and error profiles.

Keywords: Pedagogical Quality Estimation, Semi-synthetic Data, Transfer Learning, Tutoring Dialogue, DeBERTa, Large Language Models

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Forging the future: A systematic review of the literature on AI policy landscape in South African Universities

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The rapid emergence of Artificial Intelligence (AI), and Generative AI (GenAI) in particular, has significantly disrupted higher education (HE) ecosystems worldwide. The release of ChatGPT in November 2022 was a pivotal turning point, compelling universities globally to confront the expanding influence of AI in academic contexts. In South Africa, this disruption is especially acute due to the persistent structural legacy of apartheid, which continues to produce profound digital divides, unequal access to technology and AI infrastructure, language exclusion, risks to data privacy, algorithmic bias, and a tendency to position students and institutions primarily as AI consumers rather than active contributors. Further exacerbating the situation is a stark AI Governance Asymmetry, in which libraries, Human Resources (HR), and student services are largely sidelined from policy formulation yet are nonetheless expected to implement and enforce these policies.

This paper investigates how South African universities formulated their AI policies between November 2022 and April 2026 and evaluates the extent to which these policies engage with the priorities of equity, governance, and national development. Employing a systematic literature review (SLR) approach with inclusion and exclusion criteria currently underway, the study will draw on peer-reviewed scholarship, publicly accessible institutional policy documents, and relevant grey literature. These materials will undergo thematic analysis, using the Covidence platform to support transparency and ensure methodological rigor.

Preliminary reflections on these findings indicate that institutional policies are largely reactive and primarily centred on regulating GenAI, rather than on the transformative incorporation of AI into core activities. Yet, several South African universities have begun designing AI literacy and education initiatives, signalling an emerging transition towards enabling rather than merely policing AI use. Despite this, these efforts remain mostly fragmented and insufficiently anchored in cohesive policy frameworks. Without governance arrangements that are participatory and responsive to equity concerns, South African universities risk being sidelined in the 21st-century digital economy, with negative consequences for graduate employability and the country's overall competitiveness.

Keywords: AI Policy; AI Adoption; AI Policy Landscape; AI Governance Framework; South African HE Institutions

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Setting Limits on Digital Screen Use in Early Childhood: A Qualitative Investigation Based on Parent Interviews

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The increasing visibility of digital technologies in children's daily lives has made parents' experiences of setting limits on screen time, digital content, and device use an important area of research. Preschool and primary school children, in particular, need adult guidance, explanatory communication, and consistent boundaries in their use of digital media due to their developmental characteristics. The aim of this study was to examine parents' experiences of setting limits on digital screen use among children in the preschool and primary school periods.

The study was designed within the framework of a qualitative research approach and conducted using a phenomenological design. The study group consisted of 21 participants who had children in the preschool or primary school period. Participants were selected through criterion sampling, one of the purposeful sampling methods. The interviews were terminated when it was evaluated that data saturation had been reached, as recurring patterns in the data became evident and the emergence of new themes became limited. Data were collected through semi-structured interviews and analyzed using thematic analysis.

As a result of the analysis, parents' experiences of setting limits on digital screen use were found to be structured around six themes. These themes were: reasons for setting limits on digital screen use; time-, routine-, and content-based digital boundaries; children's reactions to digital boundaries; parental consistency and limit-setting strategies; the influence of grandparents and other caregivers on the process of setting digital boundaries; and differences in digital limit-setting experiences according to developmental period.

The findings show that parents perceive digital screen use not merely as an issue of time limitation, but as a multidimensional area of boundary setting associated with sleep patterns, daily routines, attention, concerns about addiction, content selection, family communication, and consistency among caregivers. In the preschool period, parents were found to set more concrete, short, and routine-based limits, with practices such as determining tablet time, limiting television viewing duration, and controlling screen use before bedtime coming to the fore. In the primary school period, however, children were found to engage in more negotiation regarding screen use, question rules more frequently, and create a broader area of family negotiation concerning limits on phone and television use.

The findings also indicate that parental consistency and the strategies used in setting limits are decisive in the implementation of digital boundaries. Parents were found to use strategies such as providing explanations, setting time limits, redirecting attention, offering non-screen alternatives, and making joint decisions. At the same time, in some cases, they were able to allow controlled flexibility depending on the child's age, daily routine, and family circumstances. However, the relaxation of screen limits by grandparents and other caregivers may make it difficult to sustain the rules established by parents.

In conclusion, this study reveals that parents' experiences of setting limits on digital screen use cannot be explained solely by restrictions on screen time. Rather, this process should be evaluated together with family communication, parental consistency, the child's developmental period, content monitoring, and the shared attitudes of caregivers. The study contributes to the fields of digital parenting, healthy media use, and developmentally appropriate technology guidance in early childhood and the primary school period.

Keywords: Digital Parenting, Screen Time, Early Childhood, Limit Setting, Parental Consistency, Educational Technologies.

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Cognitive Risks in Generative AI-Supported Learning: A Literature Mapping

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Generative artificial intelligence (GenAI) tools have spread into learning environments at an extraordinary pace; students' delegation of core cognitive tasks (writing, problem solving, summarizing, and exam preparation) to these tools has raised a set of cognitive risks, most notably cognitive offloading, over-reliance/dependence, and deskilling. Because these concepts are used in a scattered and often disconnected manner across disciplines, the overall conceptual structure of the field remains unclear. Existing reviews are either narrative in nature or address the educational effects of generative AI at a general level; studies that map, in a data-driven and reproducible manner, the specific set of risks arising from delegating cognition to GenAI remain limited. This study aims to map, using computational methods, the scholarly literature on cognitive risks in GenAI-supported learning published between 2023 and 2026. The research was guided by four research questions concerning the volume of publications and the identification of the most influential sources and works, the conceptual structure of the field, the change in latent topics over time, and the comparatively underrepresented contexts. A corpus of 1,412 documents (812 sources) retrieved from Web of Science and Scopus and deduplicated by DOI/title was analyzed through descriptive bibliometrics, keyword co-occurrence (co-word) network analysis, thematic map and thematic evolution analysis, and Latent Dirichlet Allocation (LDA) topic modeling. The co-occurrence analyses were conducted using author keywords, which were far more complete in the combined corpus than the Keywords Plus field; in the LDA, the optimal number of topics was determined as k = 10 using the c_v coherence measure (c_v ≈ 0.374). The findings show that the literature has grown explosively since 2023 (annual growth rate 154.92%; mean document age 0.82 years) and is distributed across education, psychology, and medical-education journals in an interdisciplinary manner. Annual output reached 30 documents in 2023, 182 in 2024, 704 in 2025, and 497 in 2026 (a partial year). Both the co-occurrence network and LDA reveal that the cognitive-risk concepts (cognitive offloading, AI dependency, deskilling, critical thinking, metacognition, self-regulated learning) form a central yet still underdeveloped (basic) thematic cluster, and that they cluster not in isolation but embedded within the broader GenAI–higher education discourse. On the thematic map, among the five clusters the 'generative ai' cluster has the highest centrality (0.746) but relatively low density, constituting a basic theme that contains the study's core concepts. Thematic evolution indicates that concepts such as 'cognitive debt' have recently emerged and become incorporated into the field. The open and distance education context and preventive/intervention-oriented designs are comparatively underrepresented. Studies on K-12 and disadvantaged groups, as well as longitudinal and causal evidence, also remain limited, and theoretical work integrating the family of concepts within a single framework is needed. The study proposes a future research agenda addressing these gaps.

Keywords: Generative Artificial Intelligence, Cognitive Offloading, Cognitive Risks, Literature Mapping, Topic Modeling (LDA)

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Using Multilingual Digital Diagnostic Data to Analyze Learning Support Needs of Multilingual Students

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As digital transformation expands across school education, assessment needs to function not only as a means of producing scores but also as a source of information for identifying the learning support needs of students from diverse linguistic backgrounds. In particular, the results of basic skills diagnostic assessments for multilingual students may reflect a complex combination of subject knowledge, Korean comprehension, home-language comprehension, prior learning experience, and familiarity with school-based assessment practices. This study designed and implemented a multilingual digital basic skills diagnostic assessment for multilingual students in South Korea and analyzed how the resulting data could be used to understand students' linguistic accessibility and learning support needs.

The diagnostic assessment consisted of four domains: science, mathematics, literacy, and English. Google Forms was used to design an assessment environment that considered language accessibility. The web-based digital format enabled items to be presented sequentially, allowing students to focus on each question as they responded. It also made language selection and bilingual parallel presentation possible. Students who needed language support could choose either Chinese or Russian, and each item screen displayed the Korean original alongside the translation in the selected language. This design was intended to allow students to engage with the Korean academic language used in school-based assessment while using a familiar language as a resource for comprehension. The online format also enabled efficient collection and organization of student responses, allowing subject achievement, item-level responses, language comprehension, and prior learning experience to be analyzed together.

The results showed that the response data of multilingual students revealed differences in learning conditions that could not be captured by subject scores alone. Grade-level differences varied across subject domains. Significant grade-level differences were found in mathematics and literacy, while no significant differences were found in science and English. This suggests that grade level and subject-specific performance patterns need to be considered together when designing learning support for multilingual students. In addition, subject scores were significantly associated with Korean comprehension, home-language comprehension, and prior learning experience, and these relationships differed across subject domains. Science achievement was closely related to Korean comprehension, while English achievement was strongly associated with prior learning experience. Meaningful relationships with language comprehension and prior learning experience were also found in mathematics and literacy.

These findings suggest that multilingual digital diagnostic data can be used as supplementary resources for understanding the learning situations of multilingual students in school contexts. The response data collected through Google Forms made it possible to examine subject achievement, item-level responses, language comprehension, and prior learning experience together, which can help teachers identify students' support needs in a more specific way. Through the case of a multilingual diagnostic assessment using an accessible web-based tool, this study discusses the possibility of using digital data to understand the learning conditions of multilingual students and to design inclusive learning support.

Keywords: Multilingual Digital Assessment, Multilingual Students, Diagnostic Assessment, Inclusive Learning Support

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Designing Online CPD Using a Place-Based Education Approach for Multilingualism in STEM Education

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In the wake of the COVID-19 pandemic, the critical role of teachers in fostering 21st-century skills—such as critical thinking, creativity, and collaboration—has been reaffirmed, particularly within K–12 STEM education. However, many educators remain underprepared to teach STEM subjects through the interdisciplinary and applied approaches demanded by modern standards. This study proposes the design of an online Continual Professional Development (CPD) model tailored for K–12 STEM educators, with a focus on inclusivity, accessibility, and pedagogical relevance. The model integrates place-based education (PBE) as sociocultural theoretical framework and emphasizes multilingual engagement to address systemic inequities in STEM access and participation. By leveraging the flexibility and scalability of online platforms, the CPD aims to support a broader and more diverse teaching workforce, foster collaboration with community stakeholders, and enhance student engagement through culturally and geographically relevant instruction. This approach not only addresses the professional development needs of teachers but also contributes to a more equitable and effective STEM education landscape.

Keywords: Teaching STEM, STEM Professional Development, Bi And Multilingualism in STEM, Place-based Education

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The Educational Value of Generative AI Virtual Assistants in Online Economics Education: Evidence from Students' Learning Experience

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Generative Artificial Intelligence (GenAI) is transforming higher education by enabling new forms of personalised, immediate and scalable academic support in online learning environments. Although AI-powered virtual assistants are increasingly being adopted in higher education, empirical evidence regarding their perceived educational value in specific disciplinary contexts remains limited. This study analyses students' perceptions of the educational value of a Generative AI virtual assistant integrated into an undergraduate online Economics course implemented within an institutional educational innovation project.

The study aimed to analyse students' perceptions of the assistant's contribution to conceptual understanding, autonomous learning, skills development, usability and the overall learning experience. A quantitative case study was conducted with 51 undergraduate students enrolled in the course. Data were collected using a previously developed and psychometrically validated questionnaire specifically designed to assess university students' perceptions of AI virtual assistants. The instrument evaluates four complementary dimensions: virtual assistant efficiency, learning impact, skills development, and technical and accessibility aspects. Quantitative data were complemented by qualitative analysis of students' open-ended comments.

The findings reveal a highly positive perception of the educational value of the virtual assistant. More than 90% of participants agreed that the assistant improved their understanding of course concepts, while 88% reported that it was easy to access through the virtual learning environment and that it effectively met their educational needs during the course. In addition, 86% considered that the assistant promoted autonomous learning and facilitated access to relevant academic information. Nearly 80% also perceived that interacting with the assistant encouraged critical thinking about course topics. Qualitative feedback reinforced these results by highlighting the assistant's usefulness for clarifying doubts, supporting independent study and providing timely academic guidance, while suggesting improvements related to response accuracy and additional educational functionalities. Fewer than 8% of respondents would discourage the implementation of similar AI virtual assistants in other university courses.

The findings provide empirical evidence supporting the perceived educational value of Generative AI virtual assistants in online higher education while extending current knowledge through a discipline-specific study in Economics education. The results suggest that AI virtual assistants can effectively complement online teaching by enhancing conceptual understanding, promoting self-regulated learning and improving students' learning experiences. The study contributes to current discussions on AI-driven innovation in higher education and offers practical evidence to support the pedagogically meaningful integration of Generative AI into online university teaching.

Keywords: Generative Artificial Intelligence; AI Virtual Assistants; Online Higher Education; Economics Education; Student Learning Experience.

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Computational Thinking for Adults: Educational Resource Development, Validation and Key Challenges

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Computational thinking (CT) can be defined as a systematic way of analysing and solving diverse problems by applying principles associated with computer science. It is a reasoning process based on logic, problem decomposition, pattern recognition, abstraction, structuring, and sequential thinking, and it can be applied independently of computers or other digital technologies. Nevertheless, its application in adult education, particularly among low-qualified, older, and socially disadvantaged adults, remains insufficiently developed.

This study aims to present the final results of the Erasmus+ project "Enhancing Low-Qualified Adults' Inclusion through Computational Thinking (COMPutational Seniors)". The project seeks to support social participation and labour-market inclusion by providing adult trainers with accessible approaches for developing decomposition, pattern recognition, abstraction, and algorithmic thinking in everyday and professional contexts.

The project adopted an iterative and transnational resource-development and validation approach involving project partners, adult educators, adult learners, and other adult education stakeholders from Spain, Greece, Lithuania, and Poland. Three interconnected educational resources were developed. The Open Educational Resources established the conceptual content and pedagogical approach for teaching computational thinking. The structured e-Guide provided adult trainers with step-by-step instructions for planning, implementing, adapting, and evaluating CT lectures and workshops. The Learning Box of unplugged activities translated abstract CT principles into practical tasks situated in familiar contexts, including household budgeting, travel planning, health-related decision-making, employment, digital public services, sustainable consumption, time management, and disinformation recognition. The quality and practical applicability of the resources were assessed through National Pilot Committees and pilot activities. The evaluation examined methodological coherence, clarity, accessibility, feasibility, adaptability, learner engagement, and the likelihood of future use.

The validation results indicate that CT can be introduced effectively in adult education without presenting it as a narrowly technical, computer-based, or programming-oriented subject. Participants particularly valued the structured guidance, ready-to-use materials, practical examples, and unplugged activities. Connecting CTwith everyday decisions made abstract principles more understandable and relevant, while screen-free activities helped learners develop confidence in their reasoning abilities before engaging with digital technologies.

The development and piloting process revealed several interrelated challenges, including cognitive overload, differences in educational backgrounds, and difficulties in understanding abstract CT concepts. Trainers also reported varying levels of confidence in teaching CT and adapting activities to heterogeneous groups. Additional challenges concerned cultural differences, accessibility requirements, the need for differentiated levels of complexity, and the risk of treating older adults as a homogeneous group. These challenges were addressed through familiar real-life scenarios, simplified and sequential instructions, flexible learning formats, visual and practical materials, unplugged activities, repetition, collaborative learning, and adaptable assessment tools.

The “COMPutational Seniors” framework offers a transferable model for strengthening adult learners’ critical thinking, autonomy, adaptability, problem-solving capacity, and participation in increasingly digital societies.

Keywords: Computational Thinking, Pedagogical Approach, Adult Education, Low-qualified Adults, Social Inclusion

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Opportunities and Challenges for Teaching Female Composers In Virtual Spaces

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The presence of women composers in formal music education remains marginal compared to that of their male counterparts. This asymmetry is attributed to an androcentric hidden curriculum and a musical historiography built on exclusion, in which references to women creators are often limited to anecdotal sections disconnected from the overall historical narrative. At the same time, virtual reality has established itself as an emerging educational category with considerable potential to revitalize music education through immersive, multimodal experiences that are, in many cases, accessible via a web browser without the need for specialized hardware. This proposal examines the intersection of these two phenomena, exploring the extent to which virtual reality environments serve as a genuine channel for raising the visibility of and teaching about women composers—or whether, on the contrary, they reproduce in the digital medium the same invisibility observed in traditional educational materials.

The general objective of the study is to analyze the possibilities and obstacles presented by virtual reality environments for teaching about women composers, contrasting this treatment with that given to male composers in these same spaces.

The following specific objectives are derived from this general objective: SO1: Conduct an exploratory survey of platforms, websites, video games, and virtual educational environments; and SO2: Assess the economic and technical accessibility of these platforms, identifying potential paywalls; SO3: to assess the degree to which Spanish classrooms are prepared to meet European and international regulatory standards; and SO4: to formulate general recommendations for teachers, educational institutions, and developers.

To achieve these objectives, a mixed methodology of an exploratory and descriptive nature is adopted, combining a systematic review of academic sources with a comparative analysis of virtual exhibition platforms and environments developed using video game engines such as Unity.

The results reveal a growing but uneven technological landscape. We observe the coexistence of free platforms with restricted features, paid professional tools that are inaccessible to individual teachers, and academic projects developed in Unity that are systematically dedicated to male composers.

An analysis of the Spanish context reveals notable progress in the provision of virtual learning environments, contrasted with the still-nascent integration of immersive virtual reality.

Furthermore, there is a gap in specific teacher training, which contrasts with international frameworks that guide institutional investments toward the development of immersive technologies.

In conclusion, virtual reality presents itself as a promising—though not neutral—channel for promoting and teaching the works of women composers. While the technology and narrative formats required are well established, its application to the recognition of women creators remains, to a large extent, an area of research and innovation that the academic and educational communities have yet to address.

Keywords: Female Composers; Virtual Reality; Music Education

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Generative AI in Mathematics Education: A Systematic Review of Pedagogical Roles, Research Trends, and Emerging Gaps

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The rapid advancement of generative artificial intelligence (AI) technologies has opened new possibilities for mathematics education, including personalized learning, real-time feedback, problem-solving support, instructional material development, and teacher education. Despite the growing body of research in this area, systematic reviews that comprehensively map trends, focal points, and gaps in the field appear to be limited. By addressing these gaps, this study contributes to literature with a comparative framework spanning multiple generative AI tools and a systematic classification of their pedagogical roles in mathematics education. This study conducts a systematic literature review to investigate the applications, trends, and pedagogical roles of generative AI bots in mathematics education. Following the PRISMA 2020 guidelines, English-language peer-reviewed articles published between 2022 and 2025 were searched in the Web of Science Core Collection databases using terms combining generative AI tool names with mathematics education-related keywords. Selected studies were subjected to content analysis across six dimensions: bibliographic characteristics (publication year, country, and journal index level); AI tool properties (tool name, type, and version); educational context (educational level, participant group, and mathematical content area); pedagogical role of the AI bot (learning assistant, thinking partner, design partner, virtual student, virtual mentor, evaluator, or content generator); research design (methodology, data collection instruments, and sample size); and key findings (learning outcome type, effect direction, and reported challenges). The analysis is expected to reveal that studies concentrated primarily on higher education and focused mainly on ChatGPT. Pedagogical roles are anticipated to vary across educational contexts, with the learning assistant and content generator roles dominating in student-focused studies, while the design partner and virtual student roles emerge more prominently in teacher education. Algebra and statistics are expected to receive greater attention than proof, modeling, and geometry. The primary contribution of this study lies in offering a comparative framework across multiple generative AI tools and a systematic classification of pedagogical roles. Findings are intended to serve as an evidence-based reference for mathematics education researchers, teacher educators, and curriculum developers, and to inform the design of future studies.

Keywords: Mathematics Education, Generative AI, Systematic Literature Review, Pedagogical Roles

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Don't get sidetracked when using AI in schools

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The rapid development and spread of artificial intelligence is causing an explosive change in education as well. There is a very strong social expectation that schools should respond immediately to the new challenge and prepare students for the appropriate use of artificial intelligence. It is important to avoid the pitfalls of a rapid introduction. One of the biggest problems is that students who have started using AI independently see it as a smarter, faster, all-knowing system that will provide the correct solution to the question asked in a matter of seconds.

The primary objective is to examine how this bad “nervousness” can be avoided. In addition, an important goal is to outline a method that develops the correct practice of the critical use of artificial intelligence in students.

The research was conducted among high school students in physics classes. In order to minimize hallucinations and misinformation, the survey was conducted in NotebookLM, which is based on RAG and Gemini LLM. Using a specially designed GEM, passive information intake was directed towards collaborative work with artificial intelligence.

It was investigated whether the efficiency of traditional classroom education can be increased by the guided use of artificial intelligence. The results of students using the AI system were compared with the control group, who worked with the help of a textbook. The comparison was made using pre- and post-tests, as well as by examining the student-AI conversation. There was no significant difference in the progress of the students during the statistical analysis of the results of the two groups. Nevertheless, the students' greater motivation, independence and the consolidation of the critical use of artificial intelligence are considered significant results.

Keywords: Artificial Intelligence (AI), Socratic Partner in Physics Learning, NotebookLM

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Toward the Digitally Sustainable Teacher: Asymmetric Institutionalisation of Teacher Competences in Türkiye's Centralized Education System

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Digital transformation, AI integration, sustainability, and open education are increasingly presented as interconnected demands on teachers, yet within national education systems, these competence areas rarely develop at the same pace or receive the same institutional support. This paper examines how and why such asymmetries emerge in the institutionalisation of teacher competences, using Türkiye as a revelatory case. In this study, "digitally sustainable teaching" refers to the integrated professional capacity to use digital technologies, AI-related pedagogical judgement, sustainability-oriented educational aims, and open educational practices in ways that are pedagogically meaningful, ethically informed, and contextually responsive. Türkiye offers a particularly instructive context for this analysis. It is a highly centralised education system with over 1.1 million teachers, a large-scale state-led digital infrastructure, and active EU accession alignment pressures. The aim is to construct a theoretically grounded account of how different competence dimensions are positioned within the national policy and professional development landscape. To address this purpose, the study is an in-depth examination of how teacher competencies are institutionalised in the Turkish policy context. The focal case of this study is the institutionalisation of teacher competencies in Türkiye, with particular attention to digital competence, AI literacy, sustainability, and open education competences. This study seeks to answer the following research questions:

1. How are digital competence, AI literacy, sustainability competence, and open education competence defined and positioned in national policy documents?
2. What alignments and gaps can be identified between Türkiye's national teacher competencies and international competence frameworks, namely DigCompEdu, GreenComp, LifeComp, and the UNESCO AI Competency Framework?

The study draws on a structured desk review conducted within the European DigiSET project funded within the Teacher Academies programme. The analysis is based on over 50 national policy documents, competence standards, training programme documents, and platform-level evidence. Content analysis was conducted to analyse this data. These sources were coded and interpreted comparatively against European frameworks, alongside relevant literature on open education and teacher professional development. The findings reveal a clear pattern of asymmetric institutionalisation. Digital competence and AI literacy appear to be advancing rapidly: a national Digital Teacher Competencies Framework has been developed with EU and UNICEF support, an AI in Education Policy and Action Plan has been formally adopted, and large-scale training targets 200,000 teachers through digital platforms. Yet this progress is uneven in character. Digital competence remains predominantly framed around tool use and content delivery rather than pedagogical design or ethical judgement. Meanwhile, sustainability is endorsed at the strategic level but is not embedded as a teacher competence area in either initial teacher education or continuous professional development. European and international frameworks beyond DigCompEdu, including GreenComp, LifeComp, and the UNESCO AI Competency Framework, remain formally unadopted in competence standards. Equity-related disparities between urban and rural schools and

between public and private institutions further shape which teachers are likely to benefit from existing provisions. These findings carry implications beyond the national case. The Türkiye case suggests that, in centralized systems, competence areas backed by infrastructure investment, measurable implementation targets, and international alignment incentives may become institutionally visible faster than those requiring cultural shifts in professional practice, such as openness, sustainability integration, or teacher agency in resource design.

Keywords: Teacher Competences; Digital Sustainability; AI Literacy; DigCompEdu; Teacher Professional Development

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Developing MA ELT Students' Academic Research Skills with GenAI Through a Needs-Driven Asynchronous Online Module

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Generative AI (GenAI) is rapidly transforming how academic research is conducted, yet research on its use among graduate students in English Language Teaching (ELT) remains limited. The studies that exist have largely examined academic writing as a single skill, rather than the broader research process, and have seldom delivered support through a structured, evaluated course. This study aimed to identify the perceived needs of MA ELT students regarding the integration of GenAI tools into their academic research and, on the basis of those needs, to design, deliver, and evaluate an asynchronous online module. The study employed a qualitative case study design with twelve MA ELT students at a state university in Türkiye. Their needs were first established through a needs analysis survey and pre-module interviews, and then the module, entitled "Mastering Research Skills with AI: A Practical Guide to MA ELT Students" and developed to support their academic research skills with GenAI, was built around the resulting profile and grounded in the Universal Design for Learning (UDL) framework to accommodate a heterogeneous cohort within an asynchronous format. Delivered over five weeks, the module moved from the foundations of research and GenAI to AI-assisted literature review, academic writing, citation and reference management, and the ethical use of these tools. After the module, post-module interviews were conducted, and the data were analyzed through inductive thematic analysis, with each participant's pre- and post-module accounts were compared directly to determine the direction of any change. The needs analysis revealed difficulties spanning the whole research cycle, concentrated on literature review and synthesis and on selecting and using tools critically. Participants were already aware of risks such as hallucination but lacked the operational skill to act on that awareness. They also reported research anxiety and called for clear guidance on the responsible use of GenAI rather than prohibition. After the module, participants expanded their tool repertoires and described more strategic, stage-appropriate use, alongside gains in citation work, academic writing, and the categorization of literature. Their ethical awareness developed from abstract principle toward workable practice, and their self-efficacy was reinforced or strengthened across the cohort, with no participant moving in a negative direction and several describing reduced research anxiety. At the same time, considered reservations about cognitive autonomy, the burden of verification, and data protection persisted, marking the participants as critical users of GenAI rather than passive adopters. Participants evaluated the module favorably, particularly its design and instructor support, though several wished it had reached them earlier in their studies, a point that connects to the study's implications. The study points to the potential of a needs-driven and theoretically grounded module to broaden graduate students' research practices and strengthen their confidence and ethical deliberation without diminishing their critical stance. For graduate programs, the findings support a broader approach in which GenAI is offered as research-skill development across the whole research process rather than as a writing aid, taught through guided practice, with ethics treated as a recurring focus and such support introduced early in graduate study.

Keywords: Academic Research Skills, Asynchronous Online Learning, ELT Graduate Education, Generative AI, Universal Design for Learning

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Future-Ready STEM Education in Science on Stage Europe 2026 Projects: An OECD–PISA-Based Analysis

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STEM education supports students not only in acquiring knowledge in science, technology, engineering, and mathematics, but also in developing skills such as creative thinking, producing technology-based solutions to real-life problems, taking responsibility, developing sustainability awareness, and coping with uncertain futures. STEM projects developed under teacher guidance and with students' active participation provide important examples of how these skills can be transformed into classroom practices. Science on Stage Europe 2026, held in Klaipėda with the motto "STEAM Education: Innovation Meets Creativity and Responsibility," is an international science education event that brought together more than 600 STEAM teachers from over 30 countries and 235 projects. The fact that the projects presented at the festival are based on innovative teaching practices developed in real classroom settings and are structured around themes such as inquiry-based learning, sustainability, artificial intelligence, inclusion, self-directed learning, and low-cost experiments makes these projects worth examining in terms of future-ready STEM education. Considering these projects as educational patterns that can be related to international future skills frameworks constitutes the main starting point of this study. This study aims to analyze Science on Stage Europe 2026 projects in line with the OECD Learning Compass 2030, PISA 2022 Creative Thinking, and PISA 2025 Learning in the Digital World frameworks. The research was designed as a framework-based qualitative content analysis. The data set consists of project titles, project categories, target audience information, and category descriptions available on the festival page. Each project title was considered as a unit of analysis. In the coding process, deductive codes derived from OECD and PISA frameworks and inductive codes obtained from project titles and categories were used together. The analysis focuses on themes such as student agency, creating new value, taking responsibility, creative idea generation, digital problem solving, self-regulated learning, sustainability, artificial intelligence, gamification, inclusion, and experiential learning. Preliminary findings indicate that sustainability-oriented STEM, AI-supported learning, creative STEAM practices, nature-based inquiry, low-cost experiments, and student-centered production approaches stand out in the projects. The study is expected to contribute to the fields of educational technology and STEM education by revealing how teacher-led STEM projects align with future-ready learning priorities.

Keywords: STEM Education, Future-ready Skills, OECD Learning Compass, PISA, Science on Stage, Content Analysis

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Beyond Programming: Pedagogical Design for Developing Computational Thinking in Primary Education

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As education systems respond to rapid technological change, computational thinking has emerged as a key capability for preparing learners to navigate uncertain futures. Ireland's new primary STEM curriculum (2025) positions computational thinking as a core competency for future-ready learners, yet there remains limited empirical evidence on how pedagogical approaches support its development in formal primary classrooms. This study investigates how computational thinking develops through a constructionist programming initiative and identifies pedagogical principles to inform teacher education and curriculum implementation. A pragmatic, interpretive single-case study was conducted in an all-girls primary school involving 67 pupils across third, fifth and sixth classes. Students participated in a ten-week Scratch programming initiative that combined explicit instruction with opportunities for creative, student-led programming. A multi-method approach was adopted, incorporating project analysis, artefact-based interviews, design scenarios, questionnaires, classroom observations, and feedback from teachers and parents. Data were analysed using Brennan and Resnick's computational thinking framework through an iterative deductive and inductive thematic analysis. The findings demonstrate that computational thinking develops as an interconnected combination of computational concepts, practices, and perspectives rather than as a set of discrete programming skills. While students developed competence in core programming concepts, more abstract ideas, including conditional logic, abstraction and variable initialisation, required sustained instructional support, emphasising the importance of developmentally appropriate sequencing. More significantly, computational thinking was shaped less by programming itself than by the pedagogical design of learning experiences. A progression from structured modelling towards increasingly open-ended, personally meaningful projects enabled learners to move from reproducing code to creating original digital artefacts. This progression fostered iterative problem solving, debugging, collaboration, creativity and learner agency, while authentic audiences and peer learning strengthened motivation and engagement. The findings further suggest that computational perspectives extend beyond existing conceptualisations to encompass learners' developing engagement, confidence and identity as creators of technology, highlighting the importance of resilience and agency alongside technical competence. This study contributes empirical evidence to a field where research has predominantly focused on secondary, tertiary and informal learning contexts. Rather than advocating programming as an end in itself, the findings demonstrate that computational thinking is cultivated through carefully designed pedagogical experiences that balance guidance, exploration and productive struggle. The study offers practical insights for initial teacher education and continuing professional learning by highlighting the need to prepare teachers to integrate multiple pedagogical approaches, critically evaluate the affordances of digital technologies, and foster collaborative, self-directed learning. As schools implement new STEM curricula, these findings provide timely evidence for designing learning environments that develop the computational thinking, creativity and resilience required of future-ready learners.

Keywords: Computational Thinking, Programming, Primary Education, Pedagogical Design, Stem Education.

(499)

The Pedagogy Behind the Game: Why Design Matters in Game-Based STEM

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As education systems worldwide increasingly promote integrated STEM education, teacher educators face the challenge of preparing future teachers to design interdisciplinary learning experiences that maintain strong disciplinary foundations while fostering creativity, collaboration, and problem-solving. Digital game-based learning has emerged as a promising approach for supporting these aims, yet ensuring that mathematics remains conceptually explicit within immersive STEM experiences remains an ongoing pedagogical challenge. This study explores the professional learning of mathematics teacher educators as they collaboratively designed, implemented, and evaluated a Minecraft Education-based integrated STEM elective within a primary initial teacher education programme. The study examines how teacher educators negotiated interdisciplinary curriculum design while supporting pre-service teachers to develop confidence in game-based STEM pedagogies. The study employed collaborative reflective inquiry to investigate the professional learning of mathematics teacher educators throughout the design, implementation, and evaluation of the elective. Working across disciplinary boundaries, the teacher educators supported pre-service teachers to design game-based STEM lessons that embedded key mathematical concepts within authentic, real-world challenges for primary learners. Reflective data were analysed to explore how interdisciplinary collaboration, digital game-based learning, and curriculum design were negotiated during the project and to identify pedagogical principles that emerged through the process. The findings indicate that designing game-based STEM learning required sustained attention to both disciplinary integrity and interdisciplinary integration. While Minecraft Education provided an engaging environment for developing authentic STEM contexts, maintaining the visibility and conceptual rigour of mathematics required explicit pedagogical planning, carefully sequenced learning experiences, and structured opportunities for reflection beyond gameplay. The collaborative design process strengthened teacher educators' confidence in interdisciplinary curriculum design while supporting pre-service teachers to develop the pedagogical knowledge needed to create mathematically rich, technology-enhanced lessons for primary pupils. The study also identified key design principles, including the importance of authentic problem contexts, purposeful integration of mathematics, iterative lesson refinement, and collaborative reflection in supporting meaningful game-based STEM learning. This study contributes to the growing international literature on gamified learning in teacher education by shifting attention from the use of serious games in classrooms to the professional learning required to design effective game-based pedagogies. The findings demonstrate that the educational value of digital game-based learning lies not in the technology itself but in the pedagogical decisions that shape how games are used to support disciplinary understanding and interdisciplinary learning. The study offers transferable design principles for teacher educators seeking to prepare future primary teachers to develop engaging, mathematically rigorous STEM learning experiences that equip young learners with the creativity, problem-solving, and collaboration skills needed for an increasingly complex and technology-rich future.

Keywords: Game-based Learning, Integrated STEM Education, Pedagogical Design, Mathematics Education, Initial Teacher Education.

(501)

Constructing Classroom Data and an Evaluation Framework for Assessing the Learning Effects of EdTech Classroom Tools

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Educational technology (EdTech) is increasingly being introduced into K-12 classrooms, yet its classroom impact is often evaluated through expert checklists or perception surveys that cannot capture how small technical and procedural frictions unfold during instruction. This study aims to develop a methodological framework for constructing classroom data and evaluating the learning effects of EdTech tools in situated classroom practice. Grounded in classroom ecology, postdigital and actor-network perspectives, and multimodal learning analytics, the study asks how multiple data streams can reveal the conditions under which EdTech supports learning-centered interaction or shifts instruction toward procedure management and technical troubleshooting. The framework was developed through the Weavers Project, a teacher-centered professional community informed by Transformative Networked Learning. After participating in hybrid workshops, in-service teachers designed EdTech-integrated lessons suited to their own classroom contexts and collected classroom data across five lessons where possible. Six types of data were used: whole-classroom video, student face video, student screen recordings, teacher audio, student audio, and teacher reflective journals. To make cross-data comparison possible, all data were converted into text, including scene descriptions, screen-activity descriptions, audio transcripts, and reflective writing. These texts were coded using an event-classification system organized around four evaluation domains: engagement and immersion, usability and convenience, instructional quality and interaction, and perceived effectiveness and efficacy. GPT-based coding prompts generated time-coded JSON outputs, which were subsequently checked by human coders. A case analysis of one teacher's EdTech lesson demonstrated that the integrated dataset revealed patterns that would have remained invisible in a single-source analysis. In the early phase of the lesson, usability frictions such as access delays, repeated procedural guidance, and unauthorized editing in a shared document redirected the class from learning discourse toward control and recovery. In contrast, when the teacher used oral explanation to maintain conceptual focus and positioned the EdTech tool as a means of confirming results, learning-centered discourse and student participation were sustained. These findings suggest that EdTech effectiveness should not be described as a simple yes-or-no outcome. Rather, it should be evaluated conditionally: EdTech can support learning when tool design, classroom norms, network conditions, and teacher orchestration are aligned, but it can also disrupt learning when these relations become unstable. The study contributes a replicable multimodal data-construction protocol, an event taxonomy for classroom-based EdTech evaluation, and a foundation for future automated analysis systems that can support evidence-informed adoption, teacher inquiry, and platform design.

Keywords: EdTech, Classroom Data, Multimodal Learning Analytics, Event Classification, Teacher Inquiry

(502)

Differences in Score Interpretation According to Observational Assessment Structure in Collaborative Problem-Solving Performance: Granularity of Assessment Occasions and Rubric Specificity

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This study examined how differences in observational assessment structure influence the interpretation of scores for social and cognitive performance competencies in collaborative problem-solving (CPS). Participants were 110 elementary school students (55 pairs) who engaged in a game-based, remote collaborative physics task involving staged challenges. Performance was captured through multimodal video data, including verbal interaction, facial expression, interaction flow, and real-time game screens. Two raters scored the identical performance recordings using two distinct observational assessment structures: (1) a whole-session-based analytic assessment, rating the entire session on detailed evaluation components using a 3-point scale, and (2) a stage-based holistic assessment, rating performance holistically at each stage using a repeated 5-point scale.

Although both structures were grounded in the same behavioral indicators and reflected common CPS performance competencies, they did not produce identical scores. The analytic assessment more effectively captured fine-grained behavioral profiles by sub-component and explicit, verbally or behaviorally evidenced performance, while the holistic assessment better captured stage-by-stage engagement, performance flow, and nonverbal problem-solving processes. Each structure also showed a distinct bias: the analytic assessment tended to underestimate cognitive processes not overtly expressed through utterances or behavior, while the holistic assessment risked overestimating competency based on engagement level or apparent success.

These findings suggest that the granularity of assessment occasions and the specificity of rubric criteria jointly shape what evidence of competency is captured and how scores should be interpreted. The study argues that performance evidence should be selected, and scores interpreted, according to the specific purpose of CPS observational assessment, offering implications for the design of collaborative performance assessment in multimodal, technology-mediated learning environments.

Keywords: Collaborative Problem-solving, Observational Assessment, Rubric Specificity, Assessment Granularity, Multimodal Video Data

(503)

Perceived academic performance in higher education: the predictive role of meme creation

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In the current higher education landscape, the integration of narratives and visual formats derived from digital culture has become a cross-cutting element in the development of active learning strategies, particularly in virtual, hybrid, and distance learning environments. This study contributes to educational technology research by examining, through a quantitative approach, the impact of active meme creation as a pedagogical resource on students' perceived academic performance. Despite the growing interest in interactive digital tools, empirical evidence regarding the predictive value of these short-form communication formats for educational success remains limited.

To address this gap in the literature, a cross-sectional observational study was conducted using a self-administered questionnaire completed by 149 university students who participated in a meme-design learning activity. The methodological framework combined binary and ordinal logistic regression models—the latter employed as a sensitivity analysis—with the examination of educational process covariates and advanced statistical segmentation techniques (cluster analysis). This approach enabled the identification of the main global predictors while also assessing the heterogeneity of effects according to participants' technological habits and learning modalities.

The findings indicate an overall positive impact of the intervention. Specifically, 44.3% of participants reported a high level of perceived academic benefit, while the modal response corresponded to a moderate level of improvement (42.3%). In the initial statistical model, previous experience in digital content creation and years of progression within the university degree program emerged as positive predictors. However, after incorporating variables related to the learning experience, intrinsic motivation and interest in the subject (OR = 3.16) and the overall evaluation of the instructional methodology (OR = 3.26) became the strongest predictors of perceived academic success.

Furthermore, the analytical segmentation demonstrated that the effectiveness of this techno-pedagogical tool was not uniform across students. Cluster analysis identified three distinct profiles. Cluster 1 (characterized by intensive use of platforms such as WhatsApp and YouTube) and Cluster 2 (primarily distance-learning students with high Facebook activity and lower attendance in face-to-face sessions) exhibited nearly twice the proportion of students reporting high perceived academic benefit (64.9% and 64.7%, respectively) compared with Cluster 0 (32.6%). These findings suggest that the effectiveness of learning technologies depends not on passive digital exposure but rather on the design of learning experiences that foster meaningful student engagement while accommodating diverse patterns of technology use and both face-to-face and online learning modalities.

Keywords: Educational Memes; Higher Education; Perceived Academic Performance; Academic Motivation; Teaching Innovation; Active Learning.

(504)

A Design and Development Study of a Creative Coding Environment: First Design Cycle

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With the expansion of computer science education to the primary education level, the need for environments that enable students to learn programming in their native language and with tools appropriate to their developmental levels has increased. Creative coding is defined as a production technique in which programming is used to create artistic products rather than functional software. Some studies conducted at the undergraduate and high school levels indicate that creative coding has the potential to teach abstract programming concepts through concrete and personally meaningful algorithmic art products. However, a review of the literature shows that there is no systematically developed creative coding environment suitable for the middle school level and the Turkish language. This study reports the first design cycle of the process of designing and developing such an environment using the Design and Development Research (DDR) approach. The DDR approach involves the systematic and cyclical design, development, and evaluation of a concrete product to solve an educational problem. The first cycle conducted within this framework consists of three steps. In the first step, a text-based Turkish mini coding language for middle school students was developed using the rapid prototyping method. Whether the basic command structures of the developed language (function, loop, condition) functionally produced the intended outputs was tested through an online activity open to participants. As a result of the activity, it was observed that the codes written by the participants produced the expected visual/functional outputs, confirming that the basic command set of the language functioned properly. In the second step, a separate literature review was conducted to transform this functionally validated language into a pedagogically sound learning environment, and the criteria that a creative coding environment should meet were identified based on the literature. These criteria included a structure that prevents syntax errors, rapid and visual feedback, the ability to create personal projects, an error-tolerant environment, opportunities for sharing and reuse (remixing), and conceptual scaffolding. In addition, the “low floor, high ceiling” principle was adopted as the fundamental design approach. In the third step, the environment was reorganized in accordance with these six criteria. The command structure was simplified; canvases of different sizes were introduced instead of a single fixed-size canvas; a visual preview panel was added; tasks were designed within the tutorial in a progressive sequence from simple to complex; a ready-made pixel art gallery was added for students to use as models and apply; and a sharing environment was created where students could view and reuse one another’s code. The findings demonstrate that a language developed through rapid prototyping can first be validated functionally and then iteratively refined based on pedagogical criteria. The output of the study at this stage is a prototype ready to be presented to subject-matter experts for evaluation. This paper presents the process and product outcomes obtained during the first cycle of DDR and offers recommendations regarding how the environment can be further developed through expert evaluation and pilot implementations in subsequent cycles.

Keywords: Creative Coding, Computational Thinking, Design and Development Research, Rapid Prototyping, Programming Education, STEAM

(505)

Secondary School Students' Metaphorical Perceptions of the Concept of Digital Detox

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The rapid integration of digital technologies into adolescents' daily lives has increased concerns regarding excessive screen use and its potential impact on psychological well-being, social relationships, and healthy lifestyle behaviors. Digital detox has emerged as a strategy for promoting balanced technology use; however, little is known about how adolescents conceptualize this phenomenon. This study aimed to explore secondary school students' metaphorical perceptions of the concept of digital detox through a phenomenological approach. This descriptive qualitative study employed a phenomenological design. The study was conducted with 332 secondary school students aged 14–18 years attending public high schools. Data were collected between February and April 2026 using a researcher-developed form that included the prompt: "Digital detox is like … because …". Initially, 346 forms were collected; however, 14 responses that did not contain a valid metaphor or adequate justification were excluded, resulting in the analysis of 332 valid metaphor statements. Data were analyzed using content analysis following the stages of naming, elimination, category development, validity and reliability assessment, and quantification. Similar metaphors were grouped into conceptual categories, and overarching themes were developed based on their shared meanings. Expert review was conducted to ensure coding reliability. Content analysis identified eight conceptual metaphor categories, which were subsequently organized into five overarching themes: (1) mental rest and renewal, (2) self-regulation and digital balance, (3) reconnecting with real life, (4) healthy living and personal growth, and (5) benefits and challenges of digital detox. The most frequently identified metaphor category conceptualized digital detox as rest, renewal, and mental relaxation (21.7%), represented by metaphors such as sleep, peace, therapy, meditation, and charging break. This was followed by taking a break and self-regulation (16.6%), emphasizing conscious limitation of technology use through metaphors such as stop sign, break, and recess. Other prominent categories reflected returning to real life and social relationships (14.5%), health, purification, and recovery (13.0%), self-awareness and self-discovery (10.8%), protection and balance (8.1%), and improving quality of life (8.7%). A smaller group of students perceived digital detox as a process associated with negative experiences and deprivation (6.6%), describing it through metaphors such as empty wall, death, and loneliness. Overall, students predominantly viewed digital detox as a positive strategy for psychological restoration, balanced technology use, stronger social relationships, and healthier lifestyles while acknowledging the temporary discomfort associated with reducing digital engagement.

Implications: The findings demonstrate that adolescents attribute multidimensional meanings to digital detox, extending beyond technology restriction to include psychological well-being, self-regulation, social connectedness, and personal development. These findings may guide educators, school counselors, and policymakers in designing digital well-being and digital citizenship programs that encourage healthy technology habits among adolescents. Furthermore, metaphor analysis provides valuable insights into adolescents' perceptions and can contribute to the development of age-appropriate digital detox interventions and educational practices.

Keywords: Digital Detox; Digital Well-being; Metaphorical Perception; Secondary School Students; Phenomenology; Qualitative Research

(506)

Mining Student Feedback from Mobile Application Reviews for Institutional Student Support in Open and Distance Education

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Student support services, which are the core systems at the current educational institutions, play a critical role in enhancing learner satisfaction, engagement, and persistence in open and distance education. The services are also one of the valuable sources of learner datasets. As higher education institutions increasingly rely on mobile applications to deliver academic and administrative services, user-generated reviews provide a valuable yet underutilized source of feedback regarding students' experiences and support needs. However, manually monitoring large volumes of textual feedback is both time-consuming and impractical, limiting institutions' ability to respond promptly to emerging issues.

This study proposes an artificial intelligence (AI)-supported framework for mining student feedback from mobile application reviews to facilitate institutional student support. Namely, using user reviews collected from the Google Play Store for the Anadolu Mobil application, the proposed framework employs natural language processing (NLP) techniques, including text preprocessing, topic modeling, and sentiment analysis, to automatically identify major support-related issues and evaluate students' perceptions of these issues. The extracted insights are subsequently integrated into an interactive dashboard that visualizes trends, highlights recurring problems, and generates alert notifications for university administrators when critical issues or sudden increases in negative feedback are detected.

The study adopts a flexible design and development approach in which a prototype decision-support system will be implemented using Python-based technologies and evaluated through representative user review data from the Google Play comments and reviews. By transforming unstructured student feedback into actionable institutional intelligence, the proposed framework aims to support evidence-based decision making, which enables proactive intervention, and strengthen student support practices in open and distance education.

The study contributes to the fields of learning analytics and educational data mining by demonstrating how publicly available mobile application reviews can be leveraged as a continuous source of institutional feedback. And it extends the application of AI-driven analytics beyond traditional learning management system data toward more responsive and learner-centered support services. We believe that the results from the work will contribute to knowledge of the experts working in the field and inspire new approaches and implementations.

Keywords: Student Support Systems, Learning Analytics, Natural Language Processing, Sentiment Analysis, Topic Modeling, Educational Data Mining, Mobile Application Reviews, Artificial Intelligence, Decision Support Systems

(507)

A Critical Analysis of the Change in Student Perception of the Use of GenAI in Academic English as a Second Language Writing

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Purpose: This study examines changes in students' perceptions of the use of Generative Artificial Intelligence (GenAI) in English-as-a-second-language (ESL) writing education, drawing on findings from two questionnaires administered at an online English-medium university in the US.

Methodology: The questionnaires were administered online in 2024 (n=16) and 2026 (n=13), and included the same multiple-choice and open-ended questions regarding how students perceive AI in learning, in accordance with research ethics guidelines on anonymity, voluntary participation, and informed consent. Quantitative data were analysed using descriptive statistics, and the qualitative data were examined by open coding with conjunctional analysis and thematic analysis

Key findings: According to 2024 findings, about half of the participants said they should not use GenAI in writing assignments, while the rest said they could use it when necessary or responded "unknown". Additionally, about 70% of students perceive that writing with AI is as unfavourable as plagiarism, that students' AI misuse should be appropriately detected by instructors, and that repeated AI use may lead them to its habitual use and study failure. On the other hand, findings from early 2026 indicate that about 85% of students perceive AI as a reliable helper for their academic writing and that AI will benefit the future of university education. Moreover, the free comment section reveals their positive view that AI improves teaching methods, tracks student performance, creates more interactive virtual learning environments, and fills gaps left by instructors in teaching courses. It was also suggested in 2026 that AI would improve the quality, accessibility, and efficiency of learning.

Conclusion and Implications: Comparing the findings from the two questionnaires across different periods, through the lens of students' perceptions, it is apparent that the situation regarding AI in education has changed significantly. Students' concerns about AI have decreased, and they are increasingly viewing AI as a familiar and supportive presence. The study discusses students' use and misuse of AI in terms of academic ethics and the deprivation of learning opportunities. However, those findings underscore that AI is already ubiquitous in university education; both instructors and students are involved in the current rapid progress of AI technology, and its impact is particularly significant in academic L2 English writing classrooms. Although generalizing the results might be difficult due to the small number of participants, this case study provides some hints for addressing AI's risks in traditional writing education, from both technical and cognitive viewpoints.

Keywords: Generative AI, Academic Writing, Student Perception of AI

(510)

Auditing Epistemic Responsibility in Generative AI Responses to Misleading and High-Stakes Educational Prompts

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Generative artificial intelligence (GenAI) systems are increasingly used by students and educators to obtain explanations, locate academic evidence, and support educational decisions. Although providers commonly warn that generated responses may contain inaccurate or fabricated information, it remains unclear whether such principles are consistently reflected in actual outputs. This study examined how four widely used GenAI systems responded to educational prompts requiring uncertainty recognition, source verification, and human judgment.

The study followed a two-stage comparative design. First, eight publicly available user-guidance documents published for ChatGPT, Gemini, Claude, and Microsoft Copilot were examined for statements concerning errors, verification, source transparency, high-stakes use, and human oversight. Second, the four systems were given six standardized prompts involving a scientifically unsupported learning-styles claim, a request for a universally superior online teaching method, pressure to provide confirmatory academic references, premature dyslexia diagnosis and educational placement, the claimed superiority of AI-generated feedback, and an academic-misconduct decision based on an AI-detection score. The resulting 24 responses were coded using a structured rubric covering premise calibration, evidence and source accuracy, verification guidance, human oversight, and internal consistency. References, DOI links, numerical findings, and externally verifiable claims were subsequently checked against available sources.

All four providers' official documents acknowledged the possibility of inaccurate or fabricated outputs and advised users to verify important information. In the response audit, all four systems rejected diagnosing dyslexia from limited observations and opposed failing a student solely on the basis of an AI-detection score. Greater variation emerged in responses involving universal educational claims and academic referencing. Some systems initially corrected a misleading premise but later reproduced the same overgeneralization in their recommendations. Source verification also revealed incomplete bibliographic information, incorrect author attribution, mismatched DOI links, and claims drawn from sources that did not directly support the stated conclusion. Within the selected prompt set, ChatGPT demonstrated the most consistent performance, followed by Claude, while Gemini and Copilot showed more frequent problems involving internal consistency, overgeneralization, or source reliability. However, no system was uniformly reliable across all dimensions.

The findings indicate that acknowledging uncertainty at the beginning of a response does not guarantee consistent reasoning or bibliographic accuracy throughout the output. Responsible use of GenAI in education therefore requires users to inspect original sources, verify consequential claims, distinguish generated synthesis from evidence, and retain human judgment in high-stakes decisions. The framework developed in this study may support future audits of educational GenAI systems and the development of verification-focused AI literacy activities.

Keywords: Generative Artificial Intelligence, AI Literacy, Epistemic Responsibility, Information Verification, Educational Decision-making

(511)

Evidence-Based Decision-Making as Governance: Lessons from a Two-Stage AI Pilot in Distance Higher Education

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Distance higher education institutions with a flexible study model face a structural support gap: without semester rhythms and with predominantly asynchronous learning processes, scalable, time-independent student support is structurally unavailable (Rotar, 2022). While AI-based systems are increasingly discussed as solutions, most implementations lack systematic evaluation protocols and institutional governance frameworks (Batool et al., 2025). At the same time, the EU AI Act (Regulation EU 2024/1689) imposes binding obligations on deployers of AI systems, including risk management, human oversight, and auditable documentation – requirements that most higher education institutions are only beginning to address. This paper presents a process of a systematic pilot of two AI systems, with empirical evaluation, and made evidence-based decision making about their future usage at a distance learning university.

Stage 1 involved a RAG-based AI chatbot integrated into the Learning Management System. A content analysis of 74 representative question-answer pairs from 558 evaluable interactions revealed that approximately 63% of responses were unsatisfactory. A targeted optimization attempt – comprising reduction of the knowledge base to organizational content, integration of a curated FAQ document, and transition to an agentic AI framework – improved answer quality from 45% to 70% correct responses, falling short of the institutionally defined threshold of 80%. Based on this evidence, the institution decided not to continue chatbot operation. This outcome is not presented as failure, but as governance in action: the institution had defined quality criteria in advance, evaluated systematically, and acted accordingly.

Stage 2 introduced an AI professor as functioning as a digital twin of a real professor, an AI-based persona replicating the professor's subject expertise, communication style, and pedagogical approach, formally appointed by the university senate under regional higher education law. An explicit consent protocol and defined responsibility structures for AI-generated content were established prior to launch. A pilot study (n = 32) using a standardized technology acceptance questionnaire evaluated user experience, technology acceptance, and institutional acceptance. Clear governance guidelines proved to be an acceptance accelerator (Ø 3.90/5), while primary concerns centered on legal (65%) and teaching quality aspects (65%). This pilot too will be evaluated before any decision on continuation is made.

The paper derives three process principles for other institutions considering AI integration: first, define measurable quality thresholds before deployment, not after; second, establish formal governance structures – including consent protocols and responsibility assignments – as preconditions, not afterthoughts; third, treat discontinuation as a legitimate and evidence-based outcome, not as institutional failure. These principles address what Tsao (2025) identifies as the critical gap between macro-level AI regulation and institutional practice, and offer a replicable process model for responsible AI governance in higher education.

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Keywords: : AI Governance, Distance Higher Education, Digital Twin, RAG Chatbot, Evidence-based Decision-making

(512)

Educational Research at the Intersection of EEG and Cognitive Load: A Bibliometric Review Using the PRISMA Protocol and BERTopic

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Electroencephalography (EEG) is increasingly being used in educational research due to its potential to objectively and in real time measure cognitive load during learning processes (González-Díez et al., 2026; Li et al., 2026). However, a systematic overview of the growing body of literature in this field has not yet been adequately established. This study presents a comprehensive bibliometric analysis of publications covering EEG and cognitive load concepts, along with topic modeling conducted using the BERTopic machine learning method. A total of 1,276 raw records spanning the years 1988–2026, compiled from the Web of Science, Scopus, and ERIC databases in accordance with the PRISMA protocol, were reduced to 1,245 unique publications following the deduplication process. The texts were lemmatized using spaCy, vectorized using the sentence-transformers model, and 30 topics were identified using the BERTopic model, which is built on UMAP + HDBSCAN clustering.

When examining the annual distribution of publications by topic, the years 2003–2014 are considered the early period. During this period, all topics were represented at a low frequency (1–4 publications per year), and EEG-based educational research appeared to be niche and sporadic. The years 2015–2020 stand out as the expansion period; a concentration in the field of clinical neuropsychology is observed, with 8 publications per year on the topics *cognitive impairment_neuroimage* and *cognitive impairment_neuropsychological*. The years 2021–2025, meanwhile, stand out as a period of explosive growth; the number of annual publications in the topics *cognitive load_cognitive process* and *electroencephalography_eeg* reached 10–11, and it is evident that the digital learning literature has expanded within the scope of post-COVID-19 distance education research. Furthermore, 2025 was the year with the highest number of publications, totaling 163.

Keyword co-occurrence analysis revealed that 59 co-published articles featuring the keywords “cognitive load” and “EEG” form the core of the literature. When the topics identified using BERTopic were grouped thematically, it was determined that approximately 436 records (35.5%) were directly related to the context of education and learning. An examination of keyword usage frequencies revealed that the most frequently used keywords were, in order, EEG (226), *cognitive load* (168), and *mental workload* (106). In terms of the distribution of publications by country, the largest number of studies were conducted in the United States (417), China (219), and the United Kingdom (193).

The review concluded that no distinct body of research has emerged on topics such as professional development, career choice, identification of interests, and cognitive aptitudes; it was determined that this situation points to a significant research gap in these areas. Consequently, this study provides a strong scientific rationale for original research to be conducted in these fields.

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Keywords: EEG, Cognitive Load, Bibliometrics, BERTopic, Topic Modeling

(513)

Between Reflection and Routine: How Business Simulation Games Shape Human-AI Collaboration and AI Literacy in Distance Learning Teams

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The integration of generative AI into team-based decision-making processes raises a critical question for higher education: does frequent AI use translate into reflective, collaborative AI competence? (Kim et al., 2025). Current evidence suggests it does not. While students increasingly rely on AI tools, their ability to critically evaluate the outputs and integrate them effectively into collective team processes is developing far more slowly (Choudhuri et al., 2026; Wong & Qiu, 2026).

This paper presents findings from a longitudinal pilot study investigating how a management business simulation game (BSG) in a distance learning context shapes Human-AI collaboration and AI literacy development over time. The leading research question is: To what extent does a BSG foster critical AI reflection competence and collaborative AI integration in teams? Using a longitudinal pre-post design with weekly pulse surveys across six weeks, we measured AI trust (Jian et al., 2000), AI literacy (Ng et al., 2021), and collective AI use in teams (Seeber et al., 2020) with an online questionnaire. Team processes and shared leadership (Lewis, 2003; Carson et al., 2007) were captured as contextual variables. Participants were part-time distance learning students at undergraduate and postgraduate level across multiple cohorts.

Results reveal a notable discrepancy: critical reflection on AI outputs in team contexts scores substantially higher than collective AI use for decision preparation. Notably, AI trust does not develop linearly with AI literacy – individuals with higher AI literacy scores show a stronger tendency toward critical, calibrated evaluation rather than increased confidence in AI. Team processes and leadership appear to improve independently of AI engagement, a preliminary pattern suggesting that the simulation environment fosters collaborative competence even without active AI integration.

These findings suggest that BSGs effectively promote AI reflection competence but do not automatically generate collaborative AI routines. Pedagogically, this implies that explicit facilitation is needed to move teams from critical AI evaluation toward productive Human-AI collaboration. We derive design recommendations for AI-integrated BSG environments and discuss implications for AI literacy curricula in online higher education.

As this is an ongoing study, initial findings are exploratory in nature and inferential statistics are not reported. The simulation is conducted on a continuous basis and longitudinal data are being added across cohorts.

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Keywords: Higher Education, Distance Learning, Business Simulation Games

(514)

Evaluating Student Information System Usability from a Cross-Cultural Perspective: A Case Study of Karadeniz Technical University

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With the continuous growth in the number of university students and the accelerating pace of digitalization, Student Information Systems have become one of the fundamental tools for managing academic processes in higher education institutions. Beyond facilitating information management, these systems contribute to increased efficiency, reduced operational costs, improved service quality, and the sustainability of information flow within organizations. Accordingly, information systems provide significant benefits to organizational stakeholders, including both administrative units and individual users. Therefore, ensuring the usability of these systems is essential for maintaining effective institutional communication and the efficient operation of academic and administrative processes. A review of the literature shows that various studies have examined the usability of student information systems. However, the majority of these studies have assessed usability solely through the satisfaction dimension using questionnaires or surveys. Moreover, existing studies have largely relied on monocultural samples, consisting exclusively of domestic students from the country in which the research was conducted. In reality, however, the student population at universities is inherently cosmopolitan and higher education institutions host a substantial number of international students from diverse cultural and national backgrounds. In this regard, the fact that studies evaluating the usability of student information systems rarely include international students as participants and predominantly focus solely on the satisfaction dimension indicates a notable gap in the existing literature.

From this point of view, the study aim was to examine the usability of Karadeniz Technical University's web-based Student Information System from a user-centered perspective within a cross-cultural context. The study was conducted with a total sample of ten participants, comprising five domestic and five international students. Eight tasks were defined based on the operations most frequently required by students. The collected data were analyzed using quantitative methods to evaluate usability in terms of effectiveness, efficiency, and satisfaction. For effectiveness, task completion rates were calculated; for efficiency, task completion durations were measured; and for satisfaction, scores obtained from the System Usability Scale were used. Most students successfully completed five out of eight tasks. The most challenging tasks were "viewing the internship management system user guide" and "asking a question to the system's support chatbot", each of which was completed by only three students. It was found that domestic students demonstrated relatively higher task completion rates compared to international students. In addition, it was determined that students completed all tasks within approximately 4 to 16 minutes. Although the mean completion duration varied across tasks, the longest completion duration was observed for the task of "scheduling a reservation for the sports field". In almost all tasks, international students were observed to take longer to complete the tasks than domestic students. When the data obtained from the scale were converted to 100-point scores, the overall level of system satisfaction was found to be poor based on the mean score of all students. However, while the level of system satisfaction was classified as marginal among domestic students, it was classified as awful among international students. These findings suggest that the system does not equally support users from different cultural and linguistic backgrounds. Overall, the

results highlight the need for improvements in the system's navigation, accessibility, and user-centered design in order to provide a more effective, inclusive, and user-friendly experience.

Keywords: Student Information System, Usability, User Experience, Domestic And International Student

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The Effects of Microscope and Augmented Reality-Supported Science Instruction on Academic Achievement and Spatial Thinking Skills: A Pilot Study

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The aim of this study is to examine the effects of microscope and augmented reality (AR)-supported instructional practices implemented within the framework of the 5E instructional model on fifth-grade students' academic achievement and spatial thinking skills. The study is based on pilot implementation data collected as part of a doctoral dissertation. One control group and three experimental groups were included in the study. While the control group received instruction based solely on the 5E instructional model, the experimental groups received instruction through (a) the 5E model combined with microscope activities, (b) the 5E model combined with augmented reality applications, and (c) the 5E model combined with both microscope and augmented reality applications. The intervention was conducted over a six-week period.

Data were collected using an Academic Achievement Test developed by the researcher and the Spatial Thinking Skills Test developed by Dokumacı Sütçü and Oral. The collected data were analyzed using SPSS 27. Correlation analyses revealed positive and statistically significant relationships between academic achievement and spatial thinking skills. Paired-samples t-test results indicated significant improvements in academic achievement scores across all groups. Regarding spatial thinking skills, significant improvements were observed in the control, microscope, and AR+Microscope groups, whereas the increase observed in the AR group did not reach statistical significance. ANCOVA results for academic achievement showed a statistically significant difference among groups after controlling for pre-test scores ($F(3,86)=3.276$, $p=.025$, $\eta^2=.103$). However, no significant difference was found among the groups in terms of spatial thinking skills ($F(3,83)=0.741$, $p=.531$, $\eta^2=.026$).

The findings suggest that microscope and augmented reality-supported instructional practices have positive effects on students' academic achievement. Based on the results of the pilot implementation, instructional materials and implementation procedures were revised and improved before proceeding to the main study.

Keywords: Augmented Reality, Microscope, Spatial Thinking Skills, Academic Achievement, 5E Instructional Model.

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Emerging Trends and Future Directions in Language Massive Open Online Course (LMOOC)

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Language Massive Open Online Courses (LMOOCs) have become an increasingly significant component of digital language education, providing flexible, accessible, and scalable opportunities for second language learning in diverse global contexts. Despite the rapid expansion of research in this area, there is still a need to systematically synthesize existing studies to better understand current developments, instructional innovations, and ongoing challenges. Accordingly, this study aims to conduct a systematic literature review of LMOOC research in order to identify emerging trends, pedagogical innovations, persistent challenges, and future research directions.

This study employed a systematic review methodology. A comprehensive search was conducted across multiple major academic databases using predefined inclusion and exclusion criteria to ensure relevance and quality. The selected studies were analyzed through thematic content analysis, enabling the identification of recurring patterns, conceptual developments, and research gaps within the LMOOC literature.

The findings indicate that LMOOC research has progressively shifted from early conceptual and descriptive discussions toward more empirical and data-driven investigations. Current studies increasingly emphasize instructional design, learner engagement, multimodal interaction, and technology-enhanced language learning. In particular, LMOOCs are widely recognized as effective environments for promoting learner autonomy, flexibility, and self-regulated learning. However, several persistent challenges remain, including low learner retention rates, limited opportunities for meaningful oral interaction, rigid course structures, and assessment practices that often fail to fully capture communicative competence in language learning contexts.

This study contributes to the field by providing a comprehensive synthesis of current LMOOC research and offering practical implications for language educators, instructional designers, researchers, and policymakers. The findings highlight the need for more interactive, adaptive, and learner-centered LMOOC designs, as well as further empirical research on technology integration and long-term learning outcomes in digital language education environments.

Keywords: LMOOCs, Systematic Literature Review, Digital Language Learning

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No More Excuses: Mandating Online Learning Competencies in All Teacher Preparation Programs

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The COVID-19 pandemic exposed a critical systemic vulnerability in education - a widespread lack of teacher readiness for online instruction, which resulted in improvised 'emergency remote teaching' rather than high-quality online learning. In this article, we argue that such unreadiness is part of a long-standing pattern in which educational disruptions caused by pandemics, natural disasters, and civil unrest have necessitated transitions to remote learning. Despite decades of federal guidance advocating for a teaching force skilled in distance delivery, many teacher preparation programs have historically treated remote instruction as a temporary crisis response rather than a core professional competency. To break this cycle of reactive improvisation, the authors propose a comprehensive roadmap for the mandatory integration of online and blended learning competencies into teacher preparation programs. This agenda outlines six essential actions: (1) developing validated, research-based standards; (2) creating reliable metrics and assessment instruments; (3) ensuring sufficient specialized coursework; (4) requiring teacher candidates to experience online learning as students; (5) mandating supervised field experiences in online settings; and (6) establishing enforceable preparation requirements through accrediting bodies and state agencies. By transitioning from theoretical endorsement to rigorous, evidence-based integration, teacher preparation programs can ensure that all future educators are prepared for modern instructional realities and inevitable disruptions.

Keywords: Teacher Preparation, Online Learning, Blended Learning, Emergency Remote Teaching, Pre-service Teachers, Educational Standards, Accreditation

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Gamificación mediante Assassin's Creed Valhalla: narrativa y música para la motivación en Educación Primaria

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Gamification is a methodological strategy to increase the engagement and motivation of primary school students. Therefore, this paper presents a proposal using the video game Assassin's Creed Valhalla in discovery mode, so that students can better learn about the customs and traditions of the period. According to evidence from Aragón Malo & Bermejo Malumbres (2024), meaningful learning and active student participation increase when musical, narrative, and aesthetic elements inherent to the video game, and present in this particular version, are added. The intervention focuses on the area of Natural, Social, and Cultural Environment, with an interdisciplinary perspective that incorporates Arts Education, specifically Music Education. Students assume the role of Viking explorers through a gamified narrative, carrying out tasks related to the study of the society, traditions, and music of the period. The interpretation of the past becomes more accessible with this type of historical reenactment, by using immersive experiences (Becerra Romero & Santana Trujillo, 2025; García-Blay & Belda-Torrijos, 2021). This proposal aligns with fundamental principles of Spanish legislation, specifically the Order of May 30, 2023, which establishes the minimum requirements for the Primary Education curriculum in the Autonomous Community of Andalusia. This allows for an emphasis on understanding past societies, examining cultural and musical expressions, developing historical thinking, and fostering digital skills. Gamification is structured around narrative, challenges, progress, and feedback, as essential components for increasing motivation (Fernández Sánchez, 2023). Supporting the findings of Otero (2025), the aim is to increase motivation, engagement, and content assimilation, while enhancing various executive functions such as attention, following instructions, and self-control. Finally, the gamified use of Assassin's Creed Valhalla makes it possible for the classroom to become a motivating, interdisciplinary environment focused on the student experience.

Keywords: Gamificación, Motivación, Narrativa Digital, Música, Educación.

(520)

Design and Implementation of an Active Learning Framework for Mechanical Drawing: Developing Spatial Skills through Reverse Engineering in Engineering and Vocational Education

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Spatial visualization skills and three-dimensional perception are critical competencies in technical disciplines, for instance, industrial design, mechanical engineering, or water resource infrastructure planning. Traditional instructional methods in graphic expression often rely on 2D paper-based exercises, which frequently limit students' ability to conceptualize complex internal mechanisms and lead to low engagement. To address these limitations, this paper presents the design, experimentation, and preliminary outcomes of a Classroom Improvement Cycle (CIMA, by its Spanish acronym) implemented in the "Mechanical Graphic Engineering and Topography" course at the University of Málaga. Specifically, this constitutes the initial field study of a research line promoted by a group of engineers, educators, and researchers under the framework titled: “Proposal, development, and experimentation of a new learning approach based on research, experience, and reverse engineering”.

Moving away from conventional passive learning, this innovative teaching model shifts the focus from abstract paper representations to a real, physical assembly. The methodology combines experiential learning (learning by doing), project-based learning (PBL), and reverse engineering principles. A total of 38 students participated in this active learning environment, working in collaborative teams to dismantle a physical mechanism, analyze the topological and operational relationships between its components, recover implicit geometric knowledge, and produce standardized 2D sketches and technical drawings based on their direct spatial and tactile exploration. To evaluate the initial impact on students' perception and spatial cognition, an ad-hoc pre-test and post-test questionnaire was deployed digitally, integrating a modified version of the Vandenberg and Kuse Mental Rotation Test (MRT), designed ex professo within the framework of this research line, along with a qualitative student perception survey.

The feedback obtained from the students after this first educational experience highlights high levels of motivation and engagement, with the students explicitly valuing the physical interaction and manipulation of components over traditional 2D guidelines. Qualitative analysis indicates that the "learning by doing" approach significantly improved students' self-perceived spatial conceptualization and closer alignment with real-world engineering problem-solving. While quantitative cognitive assessments remain under long-term review due to the brief timeframe between tests, the initial implementation demonstrates that embedding physical reverse engineering within active learning structures effectively bridges the gap between concrete architectural or mechanical objects and abstract graphical norms. It is recommended to further refine time management within the framework and expand this model to other contexts—such as other engineering degrees or different educational levels (vocational training)—with the purpose of reinforcing core competencies and spatial skills in technical drawing in general, and mechanical drawing in particular.

Keywords: Active Learning, Classroom Improvement Cycle (CIMA), Reverse Engineering, Spatial Visualization, Student Perception, Mechanical Drawing

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Investigation of E-Learning Materials Created Through a Selected AI-Supported Content Generation Platform in Terms of Multimedia Learning Principles: A Preliminary Study

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Problem: AI-supported content generation platforms are increasingly used to create digital learning materials quickly and flexibly. However, the fact that an e-learning material can be generated automatically does not necessarily mean that it is instructionally effective. In particular, multimedia components such as text, visuals, audio, video, animation, and screen transitions should not be used merely for technical or aesthetic purposes. These components need to be organized in ways that support learning, guide learner attention, and reduce unnecessary cognitive load. Therefore, e-learning materials produced through AI-supported content generation platforms should be examined in terms of multimedia learning principles.
Purpose: This preliminary study aims to examine sample e-learning materials created by the researcher through a selected AI-supported content generation platform in terms of multimedia learning principles. The name of the platform is not disclosed, as the focus of the study is not product promotion or technical system evaluation. Instead, the platform is treated as the production context, while the main unit of analysis is the e-learning materials generated through this platform.
Methodology: The study is designed as a qualitative preliminary study based on expert evaluation. Within the scope of the study, the researcher will create sample e-learning materials using the selected AI-supported content generation platform. These materials will be evaluated by field experts through a structured evaluation form developed in line with multimedia learning principles. The evaluation framework will include multimedia use, spatial contiguity, temporal contiguity, modality, redundancy, coherence, segmentation, and pre-training principles. Expert evaluations and researcher notes will be analyzed through descriptive analysis. The analysis will focus on identifying the strengths, limitations, inconsistencies, and improvement needs of the generated e-learning materials.
Expected Findings: The study is expected to reveal the extent to which the e-learning materials produced through the selected AI-supported platform comply with multimedia learning principles. Possible findings may include issues such as unnecessary repetition of on-screen text and narration, decorative or weakly related visuals, insufficient segmentation of long content, weak coordination between audio and visual elements, and excessive screen density. These findings may show which aspects of AI-supported content production require human review and instructional design intervention.
Conclusion: This preliminary study is expected to contribute to discussions on the pedagogically grounded use of AI-supported content generation platforms in e-learning material development. By focusing on multimedia learning principles, the study may offer a limited but applicable evaluation framework for examining AI-generated e-learning materials beyond speed and automation. The study also emphasizes that human expertise remains necessary to ensure that AI-supported production leads to clear, coherent, and instructionally meaningful learning materials.

Keywords: Artificial Intelligence, AI-supported Content Generation, E-learning Materials, Multimedia Learning, Instructional Design

(523)

Open and Distance Learning for Resilience in Fragile Border Contexts : Supporting Agriculture and Livelihoods in Border Villages of India

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Conflict, insecurity, remoteness, and economic stress continue to shape the lives of marginalized populations in fragile settings worldwide. According to UNHCR's Mid-Year Trends 2025, 117.3 million people were forcibly displaced globally as of 30 June 2025, including refugees and internally displaced persons, underscoring the scale of populations living under uncertainty. In fragile border regions, where heightened security concerns, conflict exposure, and economic instability are often present, these pressures are compounded by distance, weak connectivity, and limited integration with mainstream development processes. India shares 15,106.7 km of international land border with neighbouring countries, and many border communities, whether densely populated or sparsely inhabited, require targeted efforts to ensure equitable access to development opportunities.

Situated within the theme of education for uncertain futures and resilience in fragile contexts, the paper examines how open and distance learning (ODL) and digital learning ecosystems can function as a safety net and a pathway to resilience by expanding access to knowledge, skills, and institutional support for agriculture-dependent communities in border areas. The paper builds on the author's earlier research presented at the Pan-Commonwealth Forum (PCF9, 2019) and the Asian Association of Open Universities (AAOU, 2021), which examined the use of online learning and digital interaction to support farmers in India's border areas and highlighted the willingness of the scientific community to engage with them through online modes. Outlining the initiatives undertaken by the Government of India through the Vibrant Villages Programme for strengthening border villages of India, the paper proposes integrating the use of online technologies for learning, education, agricultural extension, and technical advisory support for resilient agriculture and agricultural enterprise development.

The paper adopts a policy-analytical and practice-oriented approach, combining insights from current policy measures with conceptual mapping against emerging global priorities, including UNU-WIDER and IFPRI's work on fragile and conflict-affected contexts, inclusive economic development, and resilient livelihoods. It proposes an integrated model in which ODL supports agricultural extension, real-time expert interaction, and access to formal and non-formal education, including micro-credentials and certification pathways. Such systems can strengthen adaptive capacity, reduce informational asymmetries, and create locally grounded pathways to resilience, livelihoods, and recovery.

The analysis suggests that online technologies can expand access to agricultural knowledge, expert advice, skills development, and education in remote border areas when supported by connectivity and institutional coordination. Embedded within local development strategies, such interventions can strengthen resilience, improve productivity, and enhance community participation in economic life. However, effective implementation requires addressing constraints related to digital infrastructure, institutional coordination, and context-specific security considerations.

The paper concludes that online learning and digital advisory support can strengthen resilience in fragile border communities and amplify the impact of development initiatives by extending access to farmers and rural youth in hard-to-reach locations. It recommends that, given India's strong institutional capacity through agricultural research and extension

systems, open and distance learning institutions, and digital public infrastructure, the Vibrant Villages Programme should incorporate online learning more systematically within its policy framework and implementation strategy.

Keywords: Open And Distance Learning; Fragile Context; Vibrant Village Programme; Agricultural Resilience; Inclusive Development; Digital Learning; Border Communities

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Access, Visibility, and the Right to Participate. Designing an Exploratory Visibility and Accessibility Analysis of Student Partici-pation Structures in German Private and Distance Higher Education

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Student participation is regarded as a driver of institutional innovation (Schrader, 2023, pp. 4f.) and as constitutive of democratic university development, with positive effects e.g., on academic success, identification with the institution, and quality assurance (Lizzio & Wilson, 2009; Bovill et al., 2011). Although the legal frameworks for student participation and representation have been formally strengthened over recent decades, actual participation rates are declining (Biehl, 2024). While the causes and effects are continually examined in German higher education research, private higher education institutions (HEI) remain markedly underrepresented in it, even though they now account for more than a quarter of the German higher education landscape (Hachmeister, 2025). Given both their typically high heterogeneity in ownership, governance, and study models and the generally different legal provisions on student co-determination (Ditzel & Bergt, 2013), private HEIs should warrant a correspondingly distinct place in participation research.

Against this backdrop, the research project [BLINDED], funded by the German Federal Ministry of Research, Technology and Space (BMFTR), addresses the gap in systematic empirical knowledge about the legal foundations and institutional structures of student participation at private HEIs, focusing on divergences from lived practice. Ongoing [BLINDED] analyses currently suggest the hypotheses that student participation at private institutions are regulated less strictly than at public ones and that their individual scope for self-regulation is very broad.

If participation structures differ substantially across private HEIs, students must therefore be able to inform themselves about their opportunities for involvement. This contribution explores a lack of transparency as one potentially central barrier, providing an initial objective assessment from a simulated student perspective through a visibility and accessibility analysis of the available information.

The analysis is an objective, non-user-based content analysis (cf. White & Marsh, 2006; Blennerhassett et al., 2025). Defined information targets are examined, including governing bodies and academic self-governance, student representation, election and participation information, relevant regulations, points of contact, and feedback and complaint channels. These are then coded for presence, findability (including click depth), and comprehensibility. In a first pass, publicly available website information is collected using a sample of roughly 20-30 private HEIs, against a population of around 110 (Hachmeister, 2025), stratified by study format, type, and size and deliberately weighted toward distance and hybrid institutions. A second pass will then add a deeper analysis of the internal channels accessible only after enrolment (student portals, learn-ing management systems) at a small number of selected institutions.

Although data collection is still ongoing, it is expected that private HEIs make very different use of their statutory scope for self-regulation, that a heterogeneous picture of visibility will emerge, and that some relevant information lies exclusively behind an enrolment barrier, not fully publicly accessible or traceable.

In this way, the contribution makes a lack of transparency tangible, for the first time and in an exploratory manner, as a possible barrier to student participation at German private HEIs,

and establishes an objective basis for assessing the gap between formally enshrined participation rights and their actual findability from a student perspective.

Keywords: Student Participation, Distance Education, Visibility And Accessibility, Students As Partners, Private Higher Education Institution (HEI)

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Collaborative Curriculum Revision for 21st Century Competencies: Preparing Learners for Uncertain Futures through Digital Education Policy

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Rapid technological transformations, the expansion of artificial intelligence, the increasing circulation of information in digital environments, and continuous changes in educational policies have intensified the challenge of preparing students for futures characterized by complexity and uncertainty. In this context, digital competencies cannot be limited to the instrumental use of technologies but should be integrated with 21st century competencies such as critical thinking, creativity, media awareness, problem solving, collaboration, and responsible participation. Educational systems therefore face the challenge of promoting this integration while preserving pedagogical approaches that conceive digital technologies as mediators of knowledge construction, authorship, collaboration, and social participation.

This study analyzed the process of updating the São Paulo City Curriculum – Technologies for Learning (São Paulo, 2017) to align it with the Computing Complement to the Brazilian National Common Core Curriculum (BNCC) (Brazil, 2022). It investigated how the curriculum preserved its organization around the three strands—Information and Communication Technologies, Programming, and Digital Literacy—while maintaining pedagogical principles grounded in Constructionism (Papert, 1980), Valente's Learning Spiral (Valente, 2002, 2005), Almeida's Web Curriculum (Almeida, 2019), and Wing's Computational Thinking (Wing, 2006). The study also examined how the collaborative curriculum revision process fostered the appropriation of these theoretical foundations by school leaders and teachers, strengthening both curriculum implementation and teachers' professional development.

The research adopted a qualitative, documentary, and analytical-interpretative approach. Official documents, curriculum versions, and records of the revision process conducted by the São Paulo Municipal Department of Education were triangulated. The analysis compared the learning objectives of the existing curriculum with the competencies established by the Computing Complement to the BNCC and examined the collaborative process involving technical teams, Digital Education Coordinating Teachers, Regional Education Offices, and public consultation.

The findings demonstrate that the curriculum revision went beyond regulatory alignment, preserving the principles of Constructionism, technology-mediated learning, and Web Curriculum. The updated curriculum strengthened project-based learning, inquiry, maker education, authorship, and pedagogical mediation, expanding opportunities to develop critical thinking, creativity, media awareness, problem solving, collaboration, and the ethical use of digital technologies. Moreover, the collaborative revision process itself became a continuous space for professional learning, dialogue, and shared meaning-making among policymakers, specialists, school leaders, and teachers, functioning as in-service professional development that strengthened educators' collective understanding of digital education and its implementation in schools.

The study concludes that participatory curriculum revision can respond to technological transformations and national policy requirements without compromising the pedagogical identity of educational systems. Beyond updating curriculum documents, collaborative curriculum development can simultaneously strengthen curriculum implementation and teachers' professional learning. Future curriculum revisions should therefore be conceived as continuous processes of collaborative learning, participatory governance, and professional

development, fostering curricula committed to the integrated development of digital and 21st century competencies while preparing students and educators to thrive in uncertain futures through critical, creative, responsible, and resilient participation in digital society.

Keywords: 1. Curriculum Revision; 2. Digital Education; 3. 21st Century Competencies; 4. Critical Thinking; 5. Creativity.

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Understanding EFL Instructors' Pedagogical Agency in Using Generative AI: The Case of a Prescribed Curriculum School Setting

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English as a Foreign Language (EFL) teachers are adopting Generative Artificial Intelligence (GenAI) for lesson planning faster than for almost any other professional task (Asrori & Setyaningsih, 2025; Ulla et al., 2023). Yet, most research focuses on teachers' opinions about these tools rather than on how they think and decide while using them (Ogunleye et al., 2024; Wu et al., 2025). In highly structured EFL programs, where curriculum, pacing, and assessment are predetermined, teachers must evaluate AI-generated content against requirements they did not set and cannot change (Çukurova, 2025; Zaimoğlu & Dağtaş, 2025). This qualitative case study aims to understand how in-service EFL instructors exercise pedagogical agency in using GenAI for lesson planning within a highly structured curriculum. The study focuses on a state university English program in Turkey, selected through critical case sampling (Flyvbjerg, 2011). This setting is critical because lesson content, pacing, and assessment are centrally determined, leaving almost no room for deviation. Pedagogical agency is defined as the capacity to exercise professional judgment and decision-making when working with AI-generated content under curricular constraints (Biesta & Tedder, 2006; Emirbayer & Mische, 1998).

In the first phase of the study, two teachers involved in the EFL program were selected as information-rich participants. Data were gathered through semi-structured interviews, which were guided by Emirbayer and Mische's chordal triad (1998) and Biesta and Tedder's ecological model (2006). Data were analyzed using the constant comparative method through process coding (Saldaña, 2011). In process coding, gerund-based codes were applied to capture actions and decisions, and grouped into categories based on shared meaning. The analysis provided three preliminary categories that explain how EFL instructors exercise pedagogical agency in a restricted school environment. These included: (a) working within given constraints, (b) developing lesson output with AI, and (c) reimagining agency. Within the first, both instructors described their GenAI use as shaped by factors beyond their control, equipment access, platform restrictions, the pacing set by the central curriculum office, and the absence of formal training before AI use was expected. In the second, both treated AI-generated content as a starting point rather than a finished product, checking lesson aims first and then reprompting or discarding output that did not fit their classroom. In the third, the instructors differed in how they positioned themselves toward the tool, with one still working out her reliance on it and the other describing herself as the operator who decides what it is used for. Although these findings are preliminary, they have significant implications for integrating GenAI in EFL contexts. They suggest that lesson-planning decisions in AI-integrated contexts are deeply shaped by the institutional conditions. More specifically, framing AI integration as a matter of individual teacher competence is insufficient in prescribed-curriculum contexts. Teacher professional development programs should move beyond tool familiarity and train instructors to evaluate and adapt AI-generated content within the specific constraints of their curriculum context. Curriculum designers and institutional decision-makers should build explicit professional flexibility into prescribed programs before introducing GenAI tools.

Keywords: Pedagogical Agency, Generative Artificial Intelligence, Lesson Planning, Qualitative Case Study, Teacher Professional Development

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University Students' Metaphorical Perceptions of Brain Rot

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Brain rot is a contemporary concept associated with excessive exposure to superficial, fast-paced, and algorithmically curated digital content. Although the concept has recently gained visibility in public and academic discussions, limited empirical evidence exists on how university students make sense of this phenomenon. In this context, the study focuses on how university students cognitively and emotionally interpret brain rot through metaphorical expressions. The study was designed as a descriptive qualitative study based on a phenomenological approach. The participants consisted of 102 undergraduate students enrolled in the Faculties of Education, Health Sciences, Science and Literature, and Engineering at Artvin Çoruh University during the 2025-2026 academic year. Data were collected through a metaphor form in which students completed the statement: "Experiencing brain rot in the digital age is like … because …". The responses were analyzed using content analysis. Metaphors with similar meanings were grouped under conceptual categories, and particular attention was given to the explanations following the word "because" in order to identify the meanings underlying the metaphors. Expert review was used to enhance the reliability of the coding process, and demographic data were summarized descriptively. The findings showed that students perceived brain rot not merely as a simple form of distraction, but as a multidimensional cognitive and emotional experience. Six metaphor categories emerged from the analysis: burnout and energy loss; helplessness, entrapment, and lostness; cognitive confusion and loss of concentration; emotional collapse and psychological burden; overthinking and mental burden; and loss of functionality and disconnection from life. Metaphors such as "a phone with a dead battery," "swamp," "maze," "bottomless pit," "frozen computer," "fogged glass," and "heavy burden" reflected students' experiences of mental fatigue, reduced attention, emotional exhaustion, loss of control, and decreased motivation. The category with the highest frequency was burnout and energy loss, followed by helplessness, entrapment, and lostness. This finding indicates that excessive digital stimulation is perceived by students as both mentally draining and difficult to escape from. Overall, the study indicates a need for digital awareness programs, healthy technology use strategies, and psychoeducational interventions that support attentional control, emotional regulation, and self-regulated digital behaviors among university students. Future studies may further examine the relationships between brain rot, problematic digital behaviors, academic functioning, and psychological well-being.

Keywords: Brain Rot, Digital Well-being, Digital Addiction.

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Curriculum Implementation for Uncertain Futures: Contributions of Web Curriculum to the Development of 21st-Century Literacies

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Although educational systems worldwide have revised their curricula to incorporate competencies related to digital culture and 21st-century literacies, translating these guidelines into effective pedagogical practices remains one of the greatest challenges facing contemporary educational policies. In contexts characterized by rapid technological change, the widespread circulation of information, and increasing social complexity, the quality of curriculum implementation becomes crucial for preparing students to think critically, solve problems, act creatively, and participate responsibly in society. Within this scenario, understanding how curriculum proposals are appropriated by teachers and translated into meaningful learning experiences constitutes a central issue for education aimed at preparing learners for uncertain futures.

This study aimed to analyze how curriculum implementation processes mediated by the STEM Expansions initiative foster the development of learning experiences aligned with the principles of the Web Curriculum and the São Paulo City Curriculum for Technologies for Learning, contributing to the effective development of competencies associated with 21st-century literacies. The study is grounded in the theoretical frameworks of the Web Curriculum, competency-based learning, dialogic education, and curriculum implementation, the latter being understood as a continuous process of translating educational policies into pedagogical practice.

A qualitative approach was adopted through a documentary case study. The analysis focused on the final reports produced by three teachers from the São Paulo Municipal School System who implemented the STEM Expansions initiative with lower secondary school students. Particular attention was given to the pedagogical decisions made during the planning, implementation, and monitoring of learning activities, as well as to the identification of Web Curriculum indicators related to authorship, collaboration, critical reflection, contextualization, knowledge sharing, and students' active participation.

The findings revealed that the differences observed among the learning experiences resulted primarily from the quality of pedagogical mediation and curriculum implementation decisions rather than from the technological resources employed. Learning experiences structured around inquiry, problem-solving, dialogue, and contextualized challenges promoted stronger integration of knowledge, skills, and attitudes, while fostering authorship, creativity, critical thinking, argumentation, collaboration, and responsible participation. The findings also demonstrated that teacher professional development processes combining conceptual foundations with immediate classroom-based experimentation strengthen teachers' appropriation of curriculum principles and enhance the construction of dialogic, contextualized, and educationally coherent learning experiences.

The study concludes that curriculum implementation constitutes a strategic element for ensuring that competency-based curricula produce meaningful impacts on student learning. More than simply incorporating digital technologies, preparing students for uncertain futures requires implementation processes capable of integrating curriculum, teacher mediation, authorship, collaboration, critical thinking, and responsible participation. Therefore, the study recommends strengthening ongoing teacher professional development policies that integrate theory, practice, pedagogical support, and planning and monitoring tools—such as

the DEAV Matrix (Visible Learning Experience Design Matrix), developed as an outcome of this research—to promote greater coherence between curriculum, implementation, and learning experiences aimed at fostering 21st-century literacies.

Keywords: 1. Curriculum Implementation; 2. Web Curriculum; 3. 21st-Century Literacies; 4. Teacher Professional Development; 5. Digital Culture

(531)

When industry meets the classroom: education perspective for sustainability

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Education in science, technology, engineering, the arts, and mathematics, denoted by the acronym STEAM, has become over recent decades one of the most rapidly expanding and internationally significant directions in education (Spyropoulou et al., 2025; Meadows & Robinson, 2023; Jarrah, 2022; Keane & Keane, 2016). Bibliometric analyses reveal a steady growth in scholarly publications, while the geography of research expands from North America towards Asian and European contexts (Chiu et al., 2025; Marin-Marin et al., 2021). Such growth indicates that STEAM is no longer a peripheral initiative, but a systemic educational direction significant for policy, technological progress, and broader discussions about how to educate the human being in a rapidly changing world.

The relevance of STEAM is reinforced by its association with the development of a wide range of student abilities and with the solving of real-world problems (Rantanen et al., 2025; Chen & Ding, 2023; Hsiao & Su, 2021). Systematic reviews show positive effects on learning outcomes, self-confidence, interest, and engagement (Amanova et al., 2025; Yim et al., 2025), and many studies emphasise that STEAM fosters creativity, critical thinking, and collaboration as essential twenty-first-century competences (Pinar et al., 2025; Aguilera & Ortiz-Revilla, 2021; Holmlund et al., 2018). Its value is thus associated not only with knowledge or professional competences, but with the development of the student as an active, creative, and responsible person, marking a shift from narrow labour-market preparation towards a broader educational purpose.

This educational value, however, does not arise of its own accord. It is formed not only in the classroom but within a broader network connecting the school, the teacher, the student, and external partners (Kessler et al., 2024; Boice et al., 2021; Perry, 2023). Despite its acknowledged value, collaboration with partners beyond the school, among them industry and business, remains weakly developed. Ziegler et al. (2025) note that the literature on such collaboration remains fragmented, and that the conditions for its initiation, implementation, and continuity have been insufficiently examined. The principal shortcoming is therefore not a lack of ideas, but limited knowledge about the conditions under which collaboration becomes a factor in STEAM education quality. What matters is how partnership is transformed into meaningful learning experiences that strengthen the student's cognition, responsibility, and capacity to act in the real world.

The possibilities of collaboration are further complicated by a discourse that interprets STEAM primarily as an economic instrument. National and international documents and industry initiatives frequently link STEAM to competitiveness, innovation, and the narrowing of the skills gap (European Commission, 2025; OECD, 2019; LINPRA, 2025). This view is not in itself mistaken: the interest of industry in future qualified workers is legitimate. From an educational standpoint, however, it is insufficient, since the purpose of education is not confined to the labour market. Yosef-Hassidim (2023) argues that STEAM should not be interpreted solely as workforce preparation, but should foster the student's subjectivity and a responsible relationship with the world.

The problem arises not from economic interest as such, but from the moment when it displaces the educational purpose, the student's development, dignity, responsibility, and meaningful participation. In this study, sustainability means not an ecological concern, but the capacity of collaboration to create and maintain educational value over time, in contrast

to fragmentation and project-based episodicity (Ziegler et al., 2025). School-industry collaboration is therefore understood not as a managerial decision, but as a possible condition for creating the quality of STEAM education.

Keywords: STEAM, School-industry Partnership, Sustainability

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Institutional Resilience in the Digital and AI Era: Reframing Pre- and Post-Admission Counselling for ODL-Blended and Online Higher Education

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The rapid integration of digital technologies and artificial intelligence (AI) into higher education has significantly transformed teaching–learning processes across both fully online and blended modes. Core academic and administrative functions—including admissions, registration, content delivery, learner support, and assessment—are increasingly mediated through digital platforms. In India, National Education Policy (NEP 2020) frameworks have further accelerated this transition by promoting online and Open and Distance Learning (ODL) systems to expand equitable access to education at scale. Consequently, conventional universities are evolving into dual-mode or fully online institutions, necessitating systemic adjustments beyond content digitization.

Amid this transformation, pre-admission counselling and learner induction remain underdeveloped components of the student lifecycle. Institutions often prioritise technological infrastructure and content development, while insufficient attention is given to preparing learners for participation in digitally mediated and AI-supported learning environments. This gap is particularly critical in contexts where digital literacy, awareness of online learning processes, and familiarity with AI-enabled tools are still emerging among learners.

This paper examines the role of structured pre-admission counselling and induction programmes in enhancing learner readiness, engagement, and retention in digital education ecosystems. It argues that these entry-point interventions are central to learner success and institutional effectiveness, especially within ODL online and blended learning frameworks aligned with global higher education practices.

Using institutional data, learner feedback, and existing records, the study identifies key informational and orientation needs of prospective and newly enrolled learners beyond the conventional information provided, mainly addressing digital and AI related processes which institutions have integrated in their framework . It proposes recommendations for such pre-admission and induction content, including orientation to digital platforms, expectations from online and AI-assisted learning, academic integrity in virtual settings, learner support services, and self-regulated learning strategies.

The findings suggest that a well-designed, learner-centric onboarding process can significantly improve students' preparedness for digital learning, reduce attrition, and enhance overall educational outcomes. The proposed recomendations may be contextualised by institutions based on their level of digital maturity, pedagogical models, and technological adoption.

In an evolving higher education landscape characterised by rapid digital transformation, strengthening pre-admission and induction processes contributes to institutional resilience. By aligning onboarding practices with learner needs and international ODL standards, institutions can ensure more inclusive, effective, and sustainable digital education systems.

Keywords: Open And Distance Learning (ODL); Digital Transformation in Education; Pre And Post Admission Counselling; AI-enabled Learning Environments; Institutional Resilience; Learner Support

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Generative AI in pre-service teachers' lesson designs

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Generative artificial intelligence (GenAI) has become an integral part of foreign language education, offering new opportunities for teaching, learning, and instructional design. Existing research has examined various aspects of GenAI integration, including learners‘ and teachers‘ attitudes, perceptions, and classroom practices, with the aim of identifying effective approaches to its use. However, relatively little attention has been paid to how pre-service teachers translate these opportunities into pedagogically meaningful lesson designs.

This study investigates the lesson plans of 41 pre-service English teachers who completed a one-semester course on integrating digital tools into English language teaching at the primary and secondary school levels. As part of the course requirements, participants designed original learning activities incorporating digital tools of their choice. A qualitative content analysis, complemented by descriptive quantitative analysis, was conducted to examine the use of GenAI in the lesson plans. The analysis focused on the types of GenAI tools employed, their instructional purposes, the language skills targeted, and the pedagogical roles assigned to AI.

The findings indicate that pre-service teachers primarily use GenAI to develop personalised learning materials, particularly for teaching grammar and vocabulary, and to design activities that support listening and speaking skills. GenAI also enables them to create instructional resources that are closely aligned with learners' needs and learning objectives. In lesson planning, participants viewed GenAI as a flexible and readily available resource for producing engaging and differentiated teaching materials. However, the analysis revealed limited use of GenAI to foster learner autonomy, collaborative learning, and higher-order thinking skills.

The findings provide insights into current patterns of GenAI integration in pre-service teacher education and identify areas that require further pedagogical development. They have implications for the design of teacher education programmes by highlighting the need to strengthen future teachers' AI literacy and their ability to integrate GenAI in ways that promote meaningful language learning, learner agency, and pedagogically sound instructional practices.

Keywords: Generative Artificial Intelligence, Pre-service English Teachers, Lesson Plans, Teacher Education, English Language Teaching, Qualitative Content Analysis

(534)

AI-Driven Inclusive Recreation in Higher Education: A Dual-Track Behavioral Model Integrating Technology Acceptance, Social Cognition, and Consumption Value

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While Artificial Intelligence (AI) and digital transformation are reshaping this field by overcoming physical barriers, higher education lacks integrated pedagogical and behavioral frameworks that combine AI technology with inclusive recreation. Traditional technology acceptance models (e.g., UTAUT, TAM) primarily evaluate technological utility—such as perceived usefulness and ease of use—while overlooking the pro-social and ethical motivations intrinsic to inclusive recreation. Furthermore, existing research fails to explore the multidimensional perceived value of these tools or the role of "inclusion knowledge" in driving empathetic engagement.

To bridge these gaps, this study integrates the Unified Theory of Acceptance and Use of Technology (UTAUT), Social Cognitive Theory (SCT), and Consumption Value Theory (CVT) to construct a dual-track behavioral model. This framework achieves three objectives: (1) it synthesizes students' self-interested "technology adoption motivations" with their "pro-social/ethical motivations"; (2) it expands the perceived value of AI applications from a singular functional focus to encompass broader social, emotional, and epistemic dimensions; and (3) it elucidates how inclusion knowledge and an inclusive climate interact to cultivate ethical awareness. Ultimately, this study provides an empirical foundation for higher education institutions to design instructional strategies, helping to cultivate future recreation professionals equipped with both digital proficiency and a socially inclusive mindset.

Keywords: Inclusive Recreation, Artificial Intelligence, Dual-Track Behavioral Model

(536)

University Students' Susceptibility to Phishing Emails: A Scenario-Based Investigation

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As digital technologies have become an integral part of everyday life, cyber threats have emerged as an increasingly significant challenge for both individuals and organizations. Among these threats, email-based phishing attacks continue to pose a serious risk to information security. The growing sophistication of social engineering techniques highlights the need not only to strengthen technical security measures but also to better understand and improve users' security awareness and behavioral responses. Since human behavior often represents the weakest link in cybersecurity, evaluating how future information technology professionals respond to phishing attempts is of particular importance.

This study investigates the susceptibility of undergraduate students enrolled in Computer Programming, Cybersecurity Technologies, and Software Development programs to phishing emails by focusing on their actual behavioral responses rather than their self-reported knowledge. A quantitative research approach employing a one-group experimental design was adopted. To collect the data, the researchers developed an AI-assisted system capable of generating a realistic phishing scenario. The simulated phishing email incorporated common social engineering techniques, including the promise of a reward, time pressure, and the appearance of institutional credibility. Participants received an email advertising a fictitious free international certification program offered by an imaginary European software institute, accompanied by a 48-hour application deadline to create a sense of urgency.

The study was conducted with 188 students from Ondokuz Mayıs University whose active email addresses were available. The findings revealed that 122 participants opened the phishing email. To ensure ethical compliance, the experiment was designed so that no sensitive information, such as passwords or financial data, was requested or collected. Instead, students who clicked the email were directed to an online form developed for the study, where they were asked to provide only basic demographic information, including their email address, full name, department, and year of study. A total of 74 students completed the form.

The results demonstrate a considerable level of behavioral vulnerability to phishing attacks, even among students studying computing-related disciplines. These findings emphasize the importance of complementing theoretical cybersecurity education with realistic, scenario-based training that enables students to recognize and respond appropriately to social engineering attacks. Furthermore, the experimental approach presented in this study may serve as a practical methodological framework for future research on cybersecurity awareness and user behavior in higher education.

Keywords: Phishing Awareness; Cybersecurity Awareness; Social Engineering; Scenario-based Learning; Cybersecurity Education

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Delegation of Judgment and Algorithmic Validation in Initial Teacher Education

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The arrival of generative artificial intelligence in higher education is changing the way future teachers search for information, prepare academic work, and make decisions during their training process. Its educational potential is undeniable; however, its use also raises questions that go beyond the technical mastery of these tools. It is increasingly common to observe that responses produced by artificial intelligence are accepted as sufficient without being compared with other sources or subjected to critical analysis. In this context, this study proposes to analyze this phenomenon through two concepts: delegation of judgment and algorithmic validation. The former refers to the tendency to transfer to artificial intelligence decisions that previously required personal reflection; the latter describes the process by which responses generated by these systems acquire legitimacy simply because they have been produced by an algorithm. The research was conducted using a qualitative approach with undergraduate students in initial teacher education at a Mexican public university over the course of one semester. Throughout the course, activities were designed in which artificial intelligence was used to plan lessons, analyze texts, prepare argumentative writing, and discuss the ethical dilemmas associated with its use. The corpus of analysis consisted of reflective journals, written work, classroom observations, and semi-structured interviews. Through thematic analysis, the ways in which students incorporated artificial intelligence into their academic work and how their ways of evaluating the information generated by these tools evolved were identified. The results show that, initially, many students tended to grant artificial intelligence an authority that they rarely questioned. Responses were quickly accepted and were rarely verified or compared with other evidence. As the intervention progressed, this relationship began to change. Activities aimed at comparing sources, identifying errors, recognizing biases, and engaging in group discussions fostered a more critical attitude. Gradually, students stopped considering artificial intelligence as an unquestionable source and began to use it as a tool to support their thinking rather than delegating their own decisions to it. It is argued that one of the main educational risks associated with generative artificial intelligence is not that it replaces human thinking, but that it normalizes the delegation of judgment and reinforces forms of algorithmic validation that weaken intellectual autonomy. From this perspective, initial teacher education should not be limited to teaching how to use artificial intelligence tools. It also needs to provide experiences that strengthen critical thinking, responsibility in the construction of knowledge, and the ability to question responses produced by algorithms before incorporating them into professional practice.

Keywords: Delegation of Judgment; Algorithmic Validation; Generative Artificial Intelligence; Initial Teacher Education; Critical Thinking

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From Instrumental to Critical Uses of Artificial Intelligence in Pre-Service Language Teacher Education

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The growing presence of generative artificial intelligence in higher education is changing the way future language teachers prepare lessons, access information and complete academic work. Although these tools offer new possibilities for teaching and learning, they also raise questions about critical thinking, professional judgment and the role of the teacher. This study examines how pre-service language teachers gradually moved from an instrumental use of artificial intelligence, mainly oriented toward completing tasks more efficiently, to a more critical use based on reflection, evaluation and pedagogical decision-making.

The study was carried out over one academic semester with undergraduate students enrolled in a language teacher education programme at a public university in Mexico. A qualitative approach was adopted. Throughout the semester, students completed a series of activities using generative AI for lesson planning, text analysis, grammar explanation, dialogue writing and argumentative writing. These activities were accompanied by discussions on the educational and ethical implications of AI. The corpus consisted of reflective journals, written assignments, classroom observations and semi-structured interviews. The data were examined through thematic analysis in order to identify changes in students' practices and perceptions.

At the beginning of the course, most students used AI mainly as a tool for obtaining quick answers or producing academic tasks in less time. Little attention was paid to the reliability of the information or to the pedagogical value of the generated content. As the semester progressed, however, students became more attentive to factual inaccuracies, cultural bias, linguistic limitations and the importance of verifying information from different sources. Classroom discussions and guided reflection encouraged them to question AI-generated responses, improve their prompts and justify their pedagogical choices. Rather than abandoning AI, they learned to use it as a support for reflection without replacing their own professional judgment.

The study suggests that teacher education should not be limited to learning how to use AI tools. It should also help future teachers develop the ability to evaluate information critically, understand the limitations of generative AI and make informed pedagogical decisions. From this perspective, AI becomes less a means of producing answers than an opportunity to strengthen critical thinking and professional autonomy in language teacher education.

Keywords: Generative Artificial Intelligence; Language Teacher Education; Critical AI Literacy; Pre-service Teachers; Critical Thinking

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An activity systems analysis of the delivery and participant experience within an accredited online English language teacher training programme

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This study contributes to the literature on English language teacher training. Recent discussion in that literature has emphasised the need to move from a narrow focus on skills development towards understanding whole training programmes and how their provision prepares teachers for contemporary challenges. It has also specifically highlighted the need to understand how better to integrate technology use into training programmes.

This study presents a case study of an online English language teacher training programme. The 'Cambridge CELTA' programme is a globally recognised English teacher training qualification which has only recently started to offer an online version. I use Activity Theory to analyse the activity systems of the programme and their contradictions, with a specific focus on identifying challenges in the integration of technology into language teacher training. Analysis draws on lesson observations, document analysis, and interviews with course candidates, tutors and managers.

Findings highlight that the provision and experience of this programme are dependent on three closely related activity systems, whose objects are credentialised learning, pedagogical support and administrative support. The findings map these activity systems and the contradictions within and between them. A fourth activity system of executive support, external to the organisation providing the programme, also plays a role but can be sketched only briefly due to the boundaries of the case. The analysis highlights several core contradictions, such as a commodification of learning and equal policy resourcing. The analysis highlights how these contradictions are generated from within and between the four activity systems.

This study contributes to the literature by introducing a new insight of an integrative model pedagogy to understand how language teacher training programmes intertwine theoretical and practical concerns and also proposing a technology in pedagogy proposition which is missing in the literature. In response to debates about challenges of integrating technology into language teacher training, the study concludes by contributing an online language teacher training programme framework which has been designed based on an analysis of the findings.

Keywords: Activity Theory, Language Teacher Training, Cambridge CELTA Online Qualification, Contradictions

(540)

Assessing the Perceived Usefulness of Generative AI Models Across Distinct Medical Education Disciplines: A Pre-clinical Student Perspective

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The rapid adoption of generative artificial intelligence (AI) in higher education has fundamentally reshaped how pre-clinical medical students navigate demanding academic workloads. Rather than serving merely as supplementary study aids, these models are increasingly functioning as primary instructional tools, offering personalized learning and continuous academic support. Despite this paradigm shift, there remains a critical gap in evaluating how students perceive the utility and effectiveness of AI when applied to structurally diverse medical disciplines.

This study presents an evaluation of AI usefulness based on the academic experiences and perspectives of pre-clinical medical students. To systematically assess this, the research proposes a tailored classification for the pre-clinical medical curriculum, categorizing foundational courses into three distinct pedagogical domains: Visual/Spatial (e.g., anatomy), Taxonomic/Memory-Dense (e.g., microbiology), and Dynamic/Process-Oriented (e.g., physiology). The scope of the study explores how students utilize generative AI tools for conceptual simplification, exam preparation, and navigating the unique cognitive demands of each of these specific pre-clinical domains.

The study discusses the perceived strengths and limitations of AI models within these categories, alongside the challenges encountered by students when relying on text-based AI models for highly specialized medical content. Furthermore, evaluations based on student feedback provide in-depth insights into how pre-clinical learners dynamically adapt their study strategies, circumvent discipline-specific AI limitations, and engage with AI-supported learning activities depending on the subject matter.

Ultimately, by analyzing these student-driven insights, this research aims to provide evidence-based guidelines for pre-clinical learners seeking to optimize their AI-assisted study routines. Furthermore, it offers strategic recommendations for medical faculties regarding discipline-specific AI integration, contributing to the evolving landscape of digital pedagogy and AI literacy in medical education.

Keywords: Generative Artificial Intelligence, Medical Education, Perceived Usefulness, Pre-Clinical Learning, AI Literacy

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The effect of augmented reality supported practices in education of different cultures in the pre-school period on performance and permanence of students

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The aim of this study is to examine the effect of augmented reality technology on performance and retention in teaching different cultures in preschool. In this study, in which the effect of augmented reality-supported applications on students' performance and retention in teaching different cultures in preschool period was examined, embedded design from mixed research methods was used. In the quantitative dimension of the study, a quasi-experimental design with pretest-posttest control group was used, while in the qualitative dimension, semi-structured interviews and classroom observations were conducted to support the quantitative data set. The research was conducted with 1 experimental and 1 control group. In order to collect quantitative data, "Teaching Different Cultures Performance Test" was applied as pre-test, post-test and retention test. "Interview Form" and 'Observation Form' were used to collect qualitative data. In the research, the normality analysis was examined with the Shapiro Wilk test since the data were below 50. The pre-test results of the groups were analyzed with Mann Whitney-U test. Mann Whitney-U test was applied to look at the pre-test and post-test performance scores of the groups. Wilcoxon Ranked Signs Test was applied to look at the retention score of the experimental group 3 weeks after the post-test date. In the analysis of qualitative data, observation forms were presented with graphs and descriptive analysis, while sub-themes, question themes and codes were used for the interview form results. As a result of the research, using augmented reality technology in teaching different cultures gives more successful and permanent results than traditional methods. This is also supported by the results of observations and interviews.

Keywords: Augmented Reality, Preschool, Different Cultures

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Managing Formative Feedback in Asynchronous Project-Based Learning: A Competency-Oriented Approach

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Asynchronous participation in blended (HyFlex) learning environments presents significant challenges for formative feedback. In project-based STEM courses, in-person active learning traditionally benefits from continuous interaction and feedback from an on-the-spot instructor. Asynchronous participation presents a mismatch between the timing of student learning needs and instructor availability for feedback. Mechanisms for asynchronous feedback can also be cumbersome to implement and sustain, further highlighting the already-limited capacity of instructors' workloads. The combination of challenges introduces a feedback lag, reducing the quality of student reflection and opportunities for iterative improvement.

This study applies a design-based, practice-informed approach, examining course design and implementation within blended and partially HyFlex project-based courses in engineering design and manufacturing. Course artifacts—including formative learning activities, project structures, and scoring rubrics—are analyzed alongside instructor observations, drawing on iterative teaching practice and reflective analysis. Principles from self-regulated learning and competency-based education provide lenses for interpreting observed challenges and informing proposed course design refinements.

Consistent with prior scholarship, asynchronous participation limited the feasibility of continuous instructor feedback and reduced visibility into student learning processes. Findings further suggest that the central challenge is not the absence of formative learning activities and resources, but uneven student engagement with those resources when instructor feedback is not continuously available. Structured formative ecosystems in the CAD, CNC machining, and manufacturing automation courses supported success for most students and reduced reliance on consistent instructor intervention. However, observations also revealed gaps in iterative feedback and reflection opportunities and in the explicit support of self-regulated learning processes, particularly for students less prepared to independently engage with formative activities. These gaps contributed to delayed recognition of misconceptions and uneven engagement prior to project completion.

Drawing on these observations and related scholarship, competency-based approaches offer a complementary framework by emphasizing demonstrated mastery as the primary basis for graded evaluation, while supporting iterative feedback, reflection, and revision throughout the learning process. Strategies such as competency gateways, structured checkpoints, and selective peer and instructor intervention are therefore proposed as refinements to redistribute responsibility for formative monitoring toward learners while preserving rigorous evaluation of project-based competencies. This literature-informed approach provides a transferable model for aligning formative learning, feedback, and competency demonstration in asynchronous project-based environments while supporting more sustainable use of limited instructor feedback capacity.

Keywords: Competency-Based Education, Self-Regulated Learning, Formative Feedback, Project-Based Learning, Blended Learning

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An Examination of The Effect of Gamification in 5th-Grade Social Studies Classes on Students' Academic Achievement, Attitudes, and Motivation*

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The purpose of this study is to examine the effects on the academic achievement, attitudes, and motivation toward the social studies course of 5th-grade middle school students when gamified activities are integrated into the course, and to identify the students' views on the process. The study was carried out during the first semester of the 2025-2026 school year at a central middle school in a province in the Aegean region. The study sample consists of 24 fifth-grade students, divided into 12 experimental groups and 12 control groups. While the experimental group in the study received instruction based on gamified activities, the control group received instruction based on the social studies curriculum and textbook. A mixed method that integrated quantitative and qualitative approaches was employed to provide a comprehensive analysis. Among the mixed methods designs, the explanatory sequential design was used. While using an explanatory sequential design, a quasi-experimental design was chosen for the quantitative part of the study, and a case study was chosen for the qualitative part. The quantitative data for the study were obtained using an academic achievement test for social studies and a motivation and attitude scale developed by the researchers, while the qualitative data were obtained through focus group interviews. Quantitative data were analyzed using statistical methods with SPSS 32 software, while the qualitative part was analyzed using content analysis. The results of the study showed that there was no statistically significant difference in the pre-test and post-test scores of the experimental and control groups when analyzed separately. However, the qualitative analysis revealed that students reported experiencing a positive learning process through gamified activities and noted that these activities had various benefits. Based on the findings of the study, various recommendations have been made for researchers interested in conducting research on this topic.

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Keywords: Social Studies Education, Gamification, Gamified Activities, Mixed Methods.

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The Psychological Footprint of Social Media: Examining Secondary Traumatic Stress and Digital Well-Being Among Pre-Service Teachers

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Social media has become an integral part of pre-service teachers' academic, professional, and social lives by facilitating access to information, communication, and professional learning opportunities. However, extensive social media use and repeated exposure to distressing content, such as natural disasters, violence, wars, and other traumatic events, may adversely affect users' psychological health and digital experiences. Recent research suggests that indirect exposure to traumatic content through social media may contribute to the development of secondary traumatic stress, which in turn may undermine individuals' digital well-being. Against this background, examining the relationships among social media use, secondary traumatic stress, and digital well-being is of growing importance in teacher education. Therefore, this study aimed to investigate the structural relationships among pre-service teachers' social media use, secondary traumatic stress, and digital well-being. Specifically, the study examined the direct effects of social media use on secondary traumatic stress and digital well-being, as well as the predictive role of secondary traumatic stress in digital well-being.

This study employed a quantitative research approach using a correlational survey design. The sample consisted of 902 pre-service teachers enrolled in teacher education programs within the Faculty of Education at a public university in Türkiye. Data were collected using a Personal Information Form, a Social Media Use Form, the Secondary Traumatic Stress Scale, and the Digital Well-Being Scale. Prior to the main analyses, missing data, outliers, normality, and reliability were assessed. The validity of the measurement model was examined through Confirmatory Factor Analysis (CFA), and Structural Equation Modeling (SEM) was conducted to test the direct and indirect relationships among the study variables.

The findings of this study are expected to contribute to the literature by providing a comprehensive understanding of how social media use influences pre-service teachers' secondary traumatic stress and digital well-being within an integrated structural model. The results may also provide practical implications for teacher education by supporting the development of digital well-being initiatives, promoting responsible social media use, and increasing awareness of the potential psychological risks associated with digital environments among future teachers.

Keywords: Social Media Use; Secondary Traumatic Stress; Digital Well-being; Pre-service Teachers; Structural Equation Modeling

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Building Resilient Foundations: AI-Supported Digital Storytelling for Earthquake Awareness and AI-TPACK Development in Primary Teacher Education

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Natural disasters are unpredictable events that may affect individuals regardless of age. Therefore, it is essential for people of all age groups who can understand and interpret their environment to acquire knowledge about the nature of disasters, appropriate actions during emergencies, and strategies for protecting themselves before, during, and after such events. Considering the devastating earthquakes that have occurred in Türkiye over the last 25 years and the substantial loss of life they have caused, earthquake education has become a critical component of disaster preparedness. Primary school teachers play a pivotal role in fostering disaster awareness among young learners by designing developmentally appropriate and engaging learning materials. This study aimed to explore primary school teachers' experiences in developing AI-supported digital stories focusing on earthquake preparedness, response, and recovery through a Design-Based Research (DBR) approach. The participants consisted of 63 pre-service primary school teachers enrolled at a public university in Türkiye. Working collaboratively in 17 groups, participants designed and produced AI-supported digital stories addressing actions to be taken before, during, and after an earthquake. Throughout the design process, participants employed a variety of generative artificial intelligence tools to develop story scenarios, create visual content, generate voice narration, and edit multimedia components while considering pedagogical suitability for primary and middle school students. Qualitative and quantitative data were collected throughout the implementation process to examine participants' experiences, AI tool usage, and instructional design decisions. The findings indicated a notable increase in both the frequency and diversity of AI tool use following the intervention. Participants became more confident in selecting appropriate AI applications for different stages of digital story development and demonstrated increased awareness of the strengths and limitations of various generative AI technologies.The findings further revealed that designing digital stories about earthquakes required participants to balance technological opportunities with pedagogical and ethical responsibilities. Because earthquakes represent potentially traumatic experiences, participants carefully adapted story scenarios, visual elements, narration, and emotional tone to ensure that the content remained age-appropriate, emotionally sensitive, and educationally meaningful. Rather than using AI outputs directly, participants critically evaluated, revised, and refined AI-generated materials to avoid misinformation, exaggerated fear, and inappropriate imagery while preserving scientific accuracy and educational value.
Overall, the Design-Based Research process enabled participants to develop practical competencies in AI-assisted instructional design while simultaneously increasing their awareness of disaster education. The study suggests that integrating generative AI into digital storytelling can support the preparation of engaging, pedagogically sound, and ethically responsible educational materials for disaster education. These findings provide valuable implications for teacher education programs seeking to integrate artificial intelligence into authentic learning tasks while promoting disaster preparedness and digital pedagogical competencies.

Keywords: Design-Based Research, Artificial Intelligence, Digital Storytelling, Earthquake Education, Disaster Awareness, Pre-Service Primary School Teachers, Teacher Education

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Beyond AI Literacy: Developing Responsible AI Competence in Pre-service Teachers

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Artificial intelligence (AI) has become an integral component of contemporary education, influencing instructional design, assessment, content creation, learner support, and educational decision-making. While teacher education programmes have increasingly emphasized AI literacy, the ability to operate AI tools alone is insufficient for preparing future educators to navigate the complex pedagogical, ethical, and societal implications of AI-enabled teaching. The growing prevalence of generative AI necessitates a broader conception of teacher preparedness that integrates responsible, reflective, and human-centered AI use. This conceptual paper argues for a shift from AI literacy to Responsible AI Competence (RAIC) in pre-service teacher education. Drawing upon recent literature on AI literacy, responsible AI, digital competence, educational ethics, and inclusive pedagogy, the paper synthesizes existing theoretical perspectives to propose a multidimensional framework for Responsible AI Competence. The framework comprises six interconnected domains: AI knowledge and critical understanding, pedagogical integration of AI, ethical reasoning and professional responsibility, inclusive and equitable AI practices, data privacy and algorithmic awareness, and reflective professional agency and lifelong learning. These domains collectively emphasize that future teachers must be capable not only of using AI effectively but also of critically evaluating AI-generated outputs, mitigating algorithmic bias, safeguarding learner data, promoting equity and inclusion, and exercising informed professional judgment in AI-supported educational environments. The proposed framework offers practical implications for redesigning teacher education curricula, competency standards, and professional learning initiatives to foster responsible AI adoption in schools. By positioning responsible AI competence as a core professional capability, the paper contributes to ongoing discussions on preparing resilient educators who can harness the educational potential of AI while upholding human values, ethical principles, and social responsibility. The framework aligns with emerging international priorities for AI-enabled education and supports the development of future teachers who are equipped to lead meaningful, inclusive, and trustworthy learning experiences in an era of rapid technological transformation.

Keywords: Responsible AI Competence, Pre-service Teachers, Artificial Intelligence, Teacher Education, AI Literacy, Educational Ethics, Inclusive Education

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Human-Centered AI Competencies for Future Teachers: Preparing Educators for Responsible and Resilient Digital Futures

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Artificial intelligence is reshaping educational systems, transforming how teaching, learning, assessment, and educational decision-making are designed and implemented. While AI offers unprecedented opportunities for personalization, accessibility, and instructional innovation, it also raises significant concerns related to ethics, algorithmic bias, data privacy, academic integrity, and the preservation of human agency in education. These emerging challenges call for a re-examination of teacher preparation programmes to ensure that future educators are equipped not only with AI literacy but also with broader human-centered competencies that enable responsible and ethical integration of AI into educational practice. This conceptual paper proposes a Human-Centered AI Competency Framework (HAICF) for pre-service teacher education. Drawing upon recent scholarship on AI literacy, digital competence, responsible AI, inclusive pedagogy, and educational ethics, the framework identifies six interrelated competency domains: (i) AI literacy and critical understanding, (ii) pedagogical integration of AI, (iii) ethical and responsible AI practice, (iv) inclusive and equitable AI-supported teaching, (v) data-informed professional judgment, and (vi) lifelong professional learning and adaptability. Rather than positioning AI as a substitute for teachers, the framework conceptualizes AI as a collaborative partner that enhances professional decision-making while preserving teachers' pedagogical expertise, empathy, creativity, and ethical responsibility. The proposed framework offers a foundation for redesigning teacher education curricula, professional development programmes, and institutional policies that prepare educators to navigate rapidly evolving digital learning environments. By emphasizing resilience, inclusion, and responsible innovation, the paper contributes to the growing international discourse on preparing future teachers capable of leading human-centered education in an AI-enabled world.

Keywords: Artificial Intelligence, Teacher Education, Human-Centered AI, AI Competencies, Responsible AI, AI Literacy, Future Teachers, Educational Technology.

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Beyond Programming: Ethical AI Literacy and Student Resilience in Indonesia's Deep Learning-Centric Curriculum Reform

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Education systems are increasingly expected to prepare learners not only for foreseeable career paths but also for the unpredictable challenges of technology, society and ethics. Indonesia has recently improved its curriculum by applying a deep learning approach and gradually injecting coding and artificial intelligence education. This paper explores how the reforms articulate skills that students need to acquire and develop to learn, adapt and act responsibly in unpredictable futures. This study uses qualitative curriculum policy analysis to analyze curriculum regulations, graduate competency standards, process standards, coding, and artificial intelligence guidelines in Indonesia. Together with UNESCO AI Competency Framework for Students and OECD Learning Compass 2030, these documents are analysed. The analytical framework includes deep learning, knowledge mobilization, self-regulation, adaptive problem solving, human agency, ethical judgement, citizenship, inclusion and accountability. The initial analysis indicates a significant conceptual overlap between the direction of Indonesia's curriculum and global future-oriented educational frameworks. Indonesia's policy positions students as active learners, connects knowledge to real-world problems and highlights critical thinking, autonomy, collaboration, communication and responsible decision-making. The framework of coding and artificial intelligence is sensitive to the ethical and legal accountability of artificial intelligence, emphasizing that human responsibility should not be totally delegated to artificial intelligence. But there's still a key tension in implementation. Coding and artificial intelligence are offered as elective classes depending on readiness but responsible AI literacy applies to all students. In this paper, we propose a three-layer curriculum model of education about AI, education with AI, and responsible engagement with AI. It argues that resilience requires not only individual flexibility but also critical technological discernment, collective agency, ethical responsibility and the ability to create context-specific solutions. The study provides an Indonesian perspective in the global discourse of education for uncertain futures.

Keywords: Responsible AI Literacy, Learner Resilience, Deep Learning, Curriculum Reform, Student Agency, Indonesia.

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From Prohibition to Traceability: New Forms of Assessment in Response to the Use of Generative Artificial Intelligence at University

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The incorporation of generative artificial intelligence into higher education is rapidly changing teaching and assessment practices. For many instructors, these tools represent an opportunity to plan lessons, prepare materials, formulate questions, provide feedback, or explore methodological alternatives. However, their use also raises concerns related to authorship, the reliability of information, technological dependence, and the difficulty of determining whether a student truly understands the work they submit. Based on this issue, the study sought to understand how university instructors are incorporating generative artificial intelligence into their academic practices and what changes they consider necessary in assessment. The research was conducted with 29 professors from the Bachelor's Degree Program in Mathematics at Francisco de Paula Santander University, Colombia. A qualitative approach was adopted within the interpretive paradigm and with a phenomenological-hermeneutic orientation. Information was obtained through in-depth interviews, in which participants reconstructed their experiences, concerns, and criteria regarding the use of digital technologies and artificial intelligence. The analysis revealed that artificial intelligence is used in different ways. Some instructors use it to organize content, develop examples, design activities, formulate questions, or prepare initial feedback. Others use it to support research tasks, particularly to explore topics, organize information, or consider methodological options. Even so, participants agreed that the responses produced by these tools should not be accepted automatically. For this reason, they emphasized the need to cross-check information, verify references, identify errors, and adapt content to the educational context. Three ways of positioning oneself in relation to artificial intelligence were also identified. A first group maintains a cautious attitude and emphasizes the risks of plagiarism, dependence, and the weakening of reasoning. A second group uses it in a practical manner to accelerate certain tasks but reviews its results before incorporating them. A third group integrates it more broadly into teaching and guides students to question, verify, explain, and defend the information obtained. One of the main findings is that university assessment can no longer be limited to evaluating only the final product. Rather than prohibiting artificial intelligence, it is necessary to make visible the process through which learning is constructed. This involves asking students to declare how they used the tool, retain prompts and drafts, verify sources, identify errors, justify the modifications made, and orally defend their work. It is concluded that responsible assessment should keep human judgment, disciplinary understanding, and students' ability to justify their decisions at the center. Artificial intelligence can serve as a relevant pedagogical resource, provided that its use is accompanied by criteria of transparency, validation, and academic responsibility.

Keywords: Generative Artificial Intelligence; University Assessment; Teacher Education; Academic Integrity; Pedagogical Appropriation

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Building Institutional Readiness for AI-Enabled Teacher Education: A Framework for Sustainable Digital Transformation

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Artificial intelligence (AI) has become an integral component of The rapid integration of artificial intelligence (AI) into education is transforming how future teachers are prepared, requiring teacher education institutions to move beyond isolated technology adoption toward comprehensive institutional readiness. While considerable attention has been given to developing AI competencies among educators, comparatively little focus has been placed on the institutional conditions necessary to support sustainable, ethical, and effective AI integration. This conceptual paper addresses this gap by proposing a holistic framework for Institutional Readiness for AI-Enabled Teacher Education (IR-AITE), aligned with the evolving demands of digital transformation and responsible AI implementation. The paper synthesizes contemporary literature on AI in education, digital transformation, organizational readiness, educational leadership, teacher professional development, and responsible AI governance to identify the key dimensions of institutional readiness. The proposed framework comprises eight interconnected domains: visionary leadership and strategic planning, AI-supportive policy and governance, digital infrastructure and technological ecosystems, faculty AI competence and continuous professional development, curriculum innovation and pedagogical redesign, ethical, legal, and data governance mechanisms, research, innovation, and industry partnerships, and quality assurance, monitoring, and continuous improvement. Together, these domains provide a systems-level perspective that positions institutional readiness as a dynamic process involving organizational culture, human capacity, technological resources, and evidence-informed decision-making. The framework emphasizes that successful AI integration in teacher education depends not only on technological investments but also on institutional commitment to equity, inclusion, transparency, and responsible innovation. It offers practical guidance for universities, teacher education institutions, and policymakers seeking to assess current readiness, identify implementation gaps, and develop strategic roadmaps for AI-enabled transformation. By shifting the focus from individual teacher preparedness to institutional capacity, the paper contributes to the emerging discourse on resilient and future-oriented teacher education systems. It further aligns with international priorities for responsible AI adoption and supports the development of institutions capable of preparing educators for increasingly complex and technology-rich educational environments.

Keywords: Artificial Intelligence, Teacher Education, Institutional Readiness, Digital Transformation, Responsible AI, Higher Education, Educational Leadership, AI Governance.

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Can We Still Observe Transformative Learning in the Age of Generative AI? Evidence from Multimodal Learning Analytics

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Learning analytics research often assumes that when students write in a more sophisticated, reflective, or empathic way, it shows they are experiencing deeper learning. However, in today's world of generative AI, this assumption is in serious trouble. Since students can now use AI to easily write polished and seemingly deep reflections, a critical question arises: can we still trust students' written assignments and digital learning traces to show whether real learning transformation is actually happening?

We investigated this question in a year-long undergraduate Design Thinking course at Yaşar University, which includes a highly diverse student group from seven different faculties. Our dataset was quite large: we analyzed 4,517 reflective essays from 477 students along with 236,923 Moodle LMS activity logs across three course modules. To check if students were actually changing independent of what they wrote we tested them before and after the course using a validated 27-item Design Thinking Mindset survey. While the overall class showed significant mindset growth, a closer look (using K-means clustering) revealed two completely opposite student profiles: a growth group (n=229, mean delta=+0.778) and a decline group (n=248, mean delta=-0.428).

Next, we tried to see if traditional text analysis and LMS logs could predict or detect these differences. The results were eye-opening. Surface text features had almost zero correlation with actual learning. In fact, a Random Forest machine learning model trained on all forty surface text features performed at a total chance level (Balanced Accuracy = 0.473). A separate analysis of 22 LMS behavioral engagement features told the same story: perfectly stable behavioral profiles (ARI = 1.000) showed no relationship whatsoever with mindset change (d = -0.009). Simply put, neither traditional text metrics nor behavioral trace data could see who actually learned.

The most fascinating finding came from analyzing the actual intent of the text over time. Both student groups those who grew and those who did not shifted from an analytical style to an empathic style in exactly the same way (moving from 58% analytical writing in Module 1 to 80% empathic writing in Module 3). This identical shift is clear evidence of what we call performative empathy. Students simply learned how the course wanted them to sound, without necessarily changing their mindset. Interestingly, students who stubbornly stayed analytical throughout the course actually showed much higher mindset growth (delta=+0.370) than the large group that quickly adapted to the "expected" empathic language (delta=+0.019). Furthermore, using AI showed a suggestive but highly exploratory pattern: greater semantic sophistication without a corresponding transformation advantage. Given the very small explicit-AI subsample identified in our data, this observation is reported as a direction for future research rather than a confirmed finding.

Instead of offering another predictive algorithm, our study highlights a fundamental "observability challenge" in educational technology. We introduce the concepts of performative empathy and performative positivity to show that surface compliance in writing is highly visible, but deeper cognitive change remains hidden from current analytics tools. These findings directly contribute to AI-supported assessment and the challenge of evaluating higher-order learning in an uncertain future.

Keywords: Learning Analytics; Design Thinking Education; Generative Artificial Intelligence

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The Investigation of the Effect of Digital Game Experience on Individuals' Spatial Perception and 2d–3d Navigation Performance, and Its Relationship with the Sense of Direction

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The aim of this study is to examine the effect of digital game experience on the spatial perception, sense of direction, and navigation performance skills of university students. The study utilized the relational survey model, a quantitative research method, along with performance-based measurement. The study group consisted of 66 university students continuing their education at Kahramanmaraş İstiklal University during the 2025-2026 academic year, selected via convenience sampling. The "Santa Barbara Sense of Direction Scale," the "Mental Rotation Test," and the "2D-3D Navigation Performance Test" were employed as data collection instruments. Data were analyzed using the SPSS 26 software package. Since the research data demonstrated a normal distribution, parametric statistical techniques were conducted for the analyses. The findings revealed that the participants' sense of direction levels and mental rotation skills were "Moderate," while their navigation performance levels were "High." No statistically significant difference was found in university students' sense of direction levels based on gender, department of study, digital game experience, daily digital gameplay duration, or gaming platform preferences. In contrast, when mental rotation and navigation performance scores were examined, significant differences were found in favor of male students regarding gender, and in favor of Digital Game Design and Software Engineering students regarding their departments. According to the results of the correlation analysis conducted for the university students' levels of sense of direction, mental rotation, and navigation performance, a high-level, positive relationship was determined between navigation performance scores and mental rotation. In this context, it can be stated that mental rotation skills play a decisive role in navigation performance, and individuals receiving education in technology-based departments possess more developed visuospatial skills. Additionally, it can be inferred that the lack of a direct difference in general sense of direction based on digital game experience stems from the multidimensional and complex nature of the sense of direction.

Keywords: Spatial Perception, Digital Game Experience, Mental Rotation, Navigation Performance, Sense of Direction.

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Investigation of the Effect of Visual Manipulation on Artificial Intelligence Models

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The widespread adoption of generative artificial intelligence models capable of interpreting visual content has raised important questions regarding their reliability when confronted with visual manipulations. In particular, experimental research examining whether suggestive markings embedded in multiple-choice examination images influence the decision-making processes of generative AI models remains limited. This study aims to comparatively investigate the robustness of different generative AI models against visual manipulations and evaluate their visual interpretation performance. The study employed a comparative experimental research design. The sample consisted of six generative AI models: ChatGPT, Claude, DeepSeek, Copilot, Grok, and Gemini. A 15-item multiple-choice examination was used as the data collection instrument. The same examination was administered to each model under two experimental scenarios: the original, unmarked question set representing the control condition and a visually manipulated version representing the experimental condition. For the manipulation, one incorrect option was pre-marked in the first ten questions and the fifteenth question, while the correct options were pre-marked in the remaining questions to simulate the appearance of a realistic examination environment. To prevent previous interactions from influencing the results, the original and manipulated question sets were administered to each model using separate user accounts. The responses generated by the models were compared with the official answer key, and susceptibility to manipulation, optical character recognition (OCR)/vision errors, and overall performance were evaluated through descriptive analysis and comparative error analysis. The findings revealed that the performance of generative AI models against visual manipulations varied considerably across models. ChatGPT and Claude answered all questions correctly under the control condition. In the manipulated condition, ChatGPT was influenced by the manipulation in only one question, whereas Claude was unaffected by the manipulation but produced a visual interpretation error on one question. Gemini demonstrated strong resistance to manipulation, although it exhibited a limited number of visual reading errors. DeepSeek and Copilot displayed errors related to visual reading and option matching, suggesting that these inaccuracies stemmed from limitations in visual perception rather than from the manipulation itself. Grok was the model most affected by the manipulation. In the manipulated question set, it identified the visually pre-marked incorrect option as the correct answer in ten questions. Furthermore, several models correctly identified the answer in their textual explanations while selecting a different option, indicating inconsistencies between visual perception and answer generation processes. These findings suggest that the performance of generative AI models should be evaluated not only in terms of answer accuracy but also with respect to their robustness against visual manipulations and the reliability of their visual interpretation capabilities. The study is expected to contribute to the evaluation of the reliability of AI-assisted assessment systems, support the development of generative AI models that are more resilient to visual manipulations, and provide a foundation for future research in this area.

Keywords: Generative Artificial Intelligence, Large Language Models, Visual Manipulation, OCR And Visual Perception

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Advanced Business Analytics – Modelling company as Intelligent Business Network Information System to predict and synthesis business future and present behavior

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This paper introduces a novel business analytics algorithm and presents a comprehensive framework for modelling a company as an Intelligent Business Network Information System capable of advanced analytics, business synthesis, and predictive intelligence. The proposed model integrates modern Artificial Intelligence technologies, including Generative AI, Agentic AI, foundation models, knowledge-driven reasoning, continuous learning mechanisms, and intelligent decision support, with interconnected business information networks to predict organizational behavior and support strategic as well as operational decision-making.

The proposed architecture enables the synthesis of heterogeneous business information originating from internal and external data sources into a unified intelligent knowledge ecosystem. Through continuous acquisition, contextual interpretation, and autonomous reasoning over business information, the system transforms distributed organizational data into actionable business knowledge, enabling organizations to recognize both incremental daily changes and long-term strategic trends. Such capabilities significantly improve organizational adaptability, resilience, and sustainable business growth.

Managing business knowledge through interconnected information networks enables augmented intelligence capable of identifying subtle, often imperceptible, changes within the business environment that may later evolve into major organizational transformations. By combining predictive analytics, semantic knowledge representation, business knowledge graphs, autonomous AI agents, and real-time analytics, the proposed Intelligent Business Network Information System continuously monitors relationships among business entities, processes, resources, and environmental factors. This enables early recognition of weak signals and emerging patterns that traditional business intelligence systems frequently fail to detect.

The proposed analytics algorithm extends conventional business intelligence by incorporating business synthesis, intelligent reasoning, and adaptive learning into a unified analytical framework. Rather than merely analyzing historical data, the model continuously constructs and updates an intelligent representation of organizational reality, functioning as a digital cognitive layer that supports strategic planning, operational optimization, risk prediction, and autonomous decision assistance. Within this framework, augmented business intelligence remains grounded as the primary information source while continuously tracking the organizational instinct of the "true North", ensuring alignment between strategic objectives, operational activities, and long-term business value creation.

The synthesized knowledge generated through the Intelligent Business Network Information System forms a universal organizational resource for intelligent business resource management, knowledge exchange, and collaborative decision-making. Furthermore, the proposed approach establishes a foundation for developing new mathematical methodologies for intelligent business information processing, rapid knowledge synthesis, and autonomous business analytics in increasingly complex and dynamic business environments.

To establish an efficient continuous data collection and analytics ecosystem, supported by high-quality business information resources and AI-driven knowledge management, the proposed framework consists of four interconnected networking information algorithms: Pick

and Involve Intelligent Workflow System, Man to Virtual Media Relationship, Augmented Knowledge & Self-Certification Secured Insurance System, and Intelligent Self-Learning Task Cells, together with the core business analytics algorithm Rollout Interconnection Intelligent Network Gainer, which integrates these components into a unified intelligent business analytics architecture for continuous organizational learning, prediction, and business evolution.

Keywords: Advanced Business Analytics; Intelligent Business Network Information System; Artificial Intelligence; Agentic AI; Generative AI; Knowledge Graphs; Predictive Analytics; Intelligent Decision Support; Business Knowledge Management; Organizational Intelligence.

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Academics' Attitudes Towards the Use of Generative AI (GenAI) Tools in Higher Education

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While some faculty members, especially from the field of engineering and information technologies view AI as an opportunity to improve educational practices and reduce academic workload, others such as educators and lawyers, express concerns regarding academic integrity, data privacy, bias, ethical implications, and potential threats to the faculty's role. Differences in perception may be influenced by discipline, age, institutional support, digital literacy, and prior experiences related to perceived benefits and risks.

This qualitative study investigates academics' attitudes towards their own use of Generative AI (GenAI) tools in higher education with five factors as their use behaviors, perceived benefits, positive emotions, ethical awareness, and concerns in the use of GenAI technologies in their academic responsibilities. Their use of GenAI technologies include course material preparation, translation, research reporting, etc. Academics' positive emotions in the use of GenAI include feeling happiness, less stress, sense of competence, etc. Perceived benefits of using GenAI technologies include time saving, developing research skills and writing skills. Academics' ethical awareness in the use of GenAI technologies include honesty, plagiarism, cheating issues in research and teaching materials. Academics' concerns of using GenAI technologies include issues related to misinformation, algorithmic bias, data security, ethical violations, and loss of skills.

The study suggest that strict regulations and oversight should be implemented to ensure responsible use of GenAI . Protection of data privacy and prevention of violations such as plagiarism and fraud should be internalized with all academicians. Trainers to trainers should be provided to develop a balanced approach that considers both the benefits and the potential risks of GenAL, to model responsible use, to prioritize critical thinking, and to engage in creative and original work.

Keywords: Artificial Intelligence; GenAI Tools; Academics' Attitudes; Higher Education; Ethical Awareness

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Connecting the Dots: A Multi-Layered Service Blueprinting Framework for AI in Higher Education

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Artificial Intelligence (AI) is rapidly disrupting higher education, fundamentally reshaping approaches to teaching, learning, and research. A shared classification framework is essential for managing digital transformation, but current taxonomies are fragmented and focus too much on technology. Treating digital tools as isolated artifacts complicates overarching institutional logic, making it difficult to understand institutional strategies and how the same technology can support different services in different contexts. To address this gap, this paper presents a comprehensive service-centered taxonomy that focuses on AI-enabled services where technology, people, and information interact. The framework classifies services across four distinct layers: (1) Human-AI Pedagogical Interaction, (2) Research and Knowledge Production, (3) AI Infrastructure and Integration, and (4) Institutional Coordination, Governance, and Administration.

Although conceptually separated, these layers function as a closely connected institutional ecosystem. To translate this conceptual taxonomy into practical application, this paper proposes the concept of a multi-layered "service blueprints". Derived from the service design, this operational mapping tool visually illustrates how visible, "front stage" academic activities connect directly to invisible, "back-stage" support systems and policies, thereby helping institutions map, visualize, and coordinate AI integration across teaching, research, and administrative units By systematically organizing how data infrastructure (Layer 3) and institutional governance policies (Layer 4) enable or constrain pedagogical interactions (Layer 1) and research workflows (Layer 2), the framework renders the taxonomy's practical interdependencies highly visible. These multi-dimensional service blueprints empower university leaders and IT decision-makers to manage cross-functional bottlenecks, compliance and data security risks, and technology procurement in line with educational and research goals. Ultimately, this research connects high-level conceptual classification with practical administrative design, providing higher education institutions with an actionable and systematic tool for cohesive and secure AI Integration.

Keywords: Service Blueprints, AI Taxonomy, Higher Education, Artificial Intelligence, Tech-to-Serve

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Micro-Credentials in Massive Open Online Courses: A Scoping Review of Current Research Trends

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This study aims to map the scope, characteristics, and research trends of the literature on micro-credentials and Massive Open Online Courses (MOOCs) and to identify gaps in the existing body of knowledge. A scoping review methodology was adopted. The research questions and eligibility criteria were developed based on the Population-Concept-Context (PCC) framework, in which the Population comprised learners, the Concept focused on micro-credentials, and the Context referred to MOOC environments. A comprehensive search of the Web of Science, Scopus, and ERIC databases identified 96 articles. The final database search was conducted on 5 July 2026. Following the removal of 39 duplicate records, the remaining studies were screened per PRISMA-ScR guidelines against the predefined inclusion and exclusion criteria. The review included all English-language journal articles that focused on MOOCs and micro-credentials. Consequently, 23 articles were included in the scoping review. The data were analyzed using descriptive and thematic analysis. The findings indicate a fluctuating publication pattern, with increased research activity observed in recent years. The geographical distribution of author affiliations was dominated by Malaysia and the United States, followed by the United Kingdom, with relatively limited representation from other countries. The studies were dispersed across 19 different journals rather than being concentrated in a few academic journals. Approximately half of the studies adopted a quantitative approach, predominantly employing a cross-sectional survey design. The findings also revealed limited use of theoretical frameworks, with most studies not reporting an explicit theoretical foundation. The included studies demonstrated considerable variation in the conceptualization of micro-credentials and digital badges were the most frequently reported form. Regarding MOOC platforms, many studies did not specify the platform under investigation. Among the specified platforms, edX and institutional MOOC platforms were the most frequently examined, followed by OpenLearn. Finally, learner acceptance, motivation, and perceptions emerged as the dominant research focus, accounting for approximately half of the included studies. In contrast, critical topics such as MOOC credit recognition and institutional barriers received comparatively limited scholarly attention. Overall, the findings suggest that research on micro-credential-based MOOCs remains a fragmented and still maturing field of inquiry. This study contributes to the literature by providing a comprehensive overview of research on micro-credentials within MOOC contexts. It offers researchers and practitioners a clearer understanding of current trends and research gaps. By identifying gaps, the study may inform future efforts to strengthen credential recognition, theoretical grounding, and institutional support in MOOC-based micro-credential initiatives for more flexible and resilient online learning ecosystems.

Keywords: Massive Open Online Course, Micro-credential, Scoping Review, MOOC, Higher Education

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Artificial Intelligence for Leadership Development: Synthesizing Evidence, Identifying Gaps, and Guiding Future Research

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The integration of artificial intelligence (AI) into organizational learning and development represents one of the most profound transformations facing organizations. In leadership development, traditionally built on in-person coaching, mentoring, and standardized training, AI enables personalized learning pathways, scalable coaching formats, data-driven competency analyses, and real-time feedback. Yet many executives acknowledge that their organizations lack sufficient leadership capacity to navigate AI-driven transformation. This compound pressure makes leadership development a strategically central field for AI adoption.

Despite the growing body of research, the field remains fragmented and lacks an integrated perspective. Existing reviews highlight both the opportunities and challenges of AI, including organizational transformation, evolving competency requirements, and implementation risks. A central theme is AI-powered coaching and personalized learning: large language model-based coaching chatbots enhance interaction quality and engagement in structured tasks such as goal setting, reflection, and feedback, and AI-powered platforms can democratize leadership development by reaching managers at all organizational levels. Nevertheless, the application of generative AI in leadership development remains under-researched, with robust empirical evidence of its effectiveness lacking.

Significant research gaps remain: current approaches insufficiently consider emotional intelligence and the quality of interpersonal relationships; a systematic examination of the transfer of learning into leadership practice is lacking; it remains unclear which specific competencies individual leaders acquire through AI-supported formats; and empirical evidence across cultural and organizational contexts is scarce. These gaps call for integrative approaches that encompass individual, relational, and contextual dimensions.

The proposed study is guided by the following research questions:

RQ1: Which AI technologies and applications in leadership development are discussed in the scholarly literature, and what empirical evidence exists regarding their effectiveness?

RQ2: How do ethical risks, e.g., algorithmic bias, data privacy issues, and transparency deficits, affect AI-supported leadership development?

To address these questions, a systematic literature review will be conducted, leading to a synthesized framework on AI-supported leadership development. Literature will be identified in EBSCO, covering the period from 2016–2026, while including conceptually foundational works where appropriate; the review follows the PRISMA guidelines to ensure a transparent and rigorous study selection process.

By bridging educational science and management science perspectives, we aim to consolidate the fragmented literature into a synthesized framework, identify open research questions, and offering practitioners evidence-based guidance for responsible AI adoption.

Keywords: Generative AI, Leadership Development, Human Resource Development, HRD, Workplace Learning, Systematic Literature Review, SLR,

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Building a Technology-Enhanced Professional Development Unit: A Qualitative Case Study from a Turkish University English Language School

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Purpose: Professional Development Units (PDUs) are increasingly expected to foster continuous teacher learning while responding to the integration of digital technologies in higher education. Although artificial intelligence (AI) has gained considerable attention in language education, its role in supporting institutional professional development remains underexplored. This qualitative case study investigates the establishment of a newly formed PDU within the English Language School of a foundation university in Türkiye. Specifically, the study explores: (1) the professional development needs identified by newly recruited and experienced instructors, (2) instructors' perceptions of the newly implemented PD initiatives, and (3) the contribution of AI-supported technologies to the planning, implementation, and evaluation of professional development practices. By combining reflective practice with technology-enhanced professional learning, the study seeks to demonstrate how sustainable institutional cultures can be cultivated through evidence-informed decision-making.

Methodology: A qualitative case study design was adopted. Data were collected during the PDU's first year through semi-structured interviews with twenty English language instructors (five newly recruited and fifteen experienced). Additional data sources included institutional needs analysis reports, PD evaluation forms, reflective meeting records, observation documentation, and induction planning documents. The data were analysed using thematic analysis. Throughout the design and implementation process, AI-assisted technologies—including ChatGPT, Microsoft Copilot, Gamma, Canva Magic Design, Napkin AI, and NotebookLM—were employed to synthesise qualitative data, organise survey findings, develop visual reports, prepare structured induction programmes, create presentation materials, and support institutional documentation, while pedagogical decisions remained guided by human expertise.

Findings: Four overarching themes emerged from the analysis. First, instructors emphasised the importance of context-sensitive, needs-based professional development over generic training. Second, collaborative practices—including voluntary peer observation, Video Reflection and Observation (VRO), teacher-led workshops, collaborative reading circles, and reflective dialogue—promoted trust, professional agency, and reflective teacher identity. Third, newly recruited instructors valued structured induction and ongoing mentoring, while experienced instructors appreciated opportunities to share expertise and contribute to institutional learning. Finally, AI-supported technologies enhanced the efficiency and responsiveness of the PDU by facilitating data analysis, report writing, presentation design, resource development, and communication. Participants viewed these technologies as enabling facilitators that allowed coordinators to focus more on pedagogical planning, collaboration, and direct teacher support.

Implications: The findings suggest that establishing an effective PDU requires more than implementing isolated training events. Sustainable professional learning cultures emerge through the dynamic interaction of reflective practice, teacher agency, collaborative engagement, and strategic technology integration. AI should be viewed not as the primary focus of professional development, but as an enabling tool that supports evidence-informed planning and institutional decision-making. The study offers practical recommendations for teacher educators, PD coordinators, and higher education institutions seeking to develop

technology-enhanced professional development systems that are responsive to instructors' needs while fostering reflective teaching cultures and continuous professional growth.

Keywords: Professional Development, Artificial Intelligence, Teacher Professional Learning, Reflective Practice, Higher Education

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Design and Development of an Interactive 360-Degree Branching Video Module for Home Blood Pressure Self-Measurement Training: A Type 1 Design and Development Research Study

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Purpose: Accurate home blood pressure self-measurement is a cornerstone of hypertension self-management, and health professions students must also learn to teach this skill to patients. However, training typically relies on fixed-viewpoint instructional videos that afford passive observation rather than active decision-making and error recognition. Recent reviews of 360-degree video in health education further indicate that most existing applications remain non-interactive, using immersive footage merely as viewable content. This study addresses this gap by systematically designing and developing an interactive 360-degree branching video module for home blood pressure self-measurement training, and by documenting the design decisions, trade-offs, and delivery-platform considerations involved in producing such a module with accessible, consumer-grade equipment.

Methodology: The study is framed as Type 1 design and development research (product and tool research; Richey & Klein) and structured through the analysis, design, and development phases of the ADDIE model, with implementation and learner evaluation explicitly delimited to a subsequent phase. The module was produced in an authentic home setting—consistent with its instructional focus on self-measurement—using a consumer-grade 360-degree camera (Insta360 X5) and a digital upper-arm monitor. It comprises three components: (1) a correct demonstration with embedded branching decision points (arm selection, cuff alignment, and responding to an elevated reading); (2) a deliberately flawed variant prompting learners to detect embedded measurement errors, including an environmental violation placed behind the viewer; and (3) an error-spotting scene in which preparation errors are distributed across the full viewing sphere, exploiting the distinctive affordance of 360-degree video: free visual exploration. Development was evaluated through two participant-free strands: an analytic evaluation against multimedia learning principles (CTML) and immersive learning design recommendations (CAMIL), supported by a researcher-conducted cognitive walkthrough; and a technical feasibility comparison of H5P-based authoring versus a custom WebXR player, measuring resolution retention, loading time, and branching latency across web browsers and a VR headset.

Findings: Findings document the complete branching architecture and the rationale behind key design decisions, including camera placement for a first-person self-measurement perspective, clip-boundary matching for seamless branch transitions, and the deliberate spatial distribution of detectable errors. The analytic evaluation and cognitive walkthrough identify alignment with, and tensions against, established multimedia principles, while the technical comparison reveals concrete limitations of template-based authoring tools for branching 360-degree video relative to custom WebXR delivery.

Implications: The study offers a replicable, low-cost design framework for institutions and educators seeking to produce interactive immersive procedural training without specialized studios, and positions expert panel validation and learner evaluation as the next phase of the research program. The documented platform trade-offs can inform tool selection for similar immersive learning projects.

Keywords: 360-degree Video, Immersive Learning, Branching Scenario, Home Blood Pressure Monitoring, Design And Development Research

(574)

The Place Of Open And Distance Education In Teaching English As a Foreign Language in Türkiye

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The world is changing and developing faster than ever before, and technological advancements are beyond our comprehension, and the world, which is rapidly advancing in the field of technology, is preparing to present a new digital age to new generations by developing the innovations brought by the pandemic process, which accelerated the developments in technology through education. Keeping up with the new world flow that combines education with technology has become the responsibility of every branch and field. Language learning and language teaching are the ones of these fields that are exposed to these innovations and develop new techniques and methods in response to new technological developments. When the link between the language learning process and online education is considered within the scope of Turkey, the question that is the main theme of this study arises: Is English, which is taught as a foreign language in Turkey, suitable to be taught and learned through open and online education? This study is carried out in a context based on the place of online education in the learning and teaching of English as a foreign language in Turkey. This study is carried out by conducting a survey in which the opinions of students and experts are received about the place of online education in teaching and learning English within the scope of the determined main problem. The results obtained from the survey studies are completed by making the necessary analysis. and the study is concluded based on the recommendations determined according to the results.

Keywords: Language, Education, Technology;

(575)

Teacher Competencies in the Age of Artificial Intelligence: A Comparative Analysis of International Teacher Competency Frameworks and the Turkish Ministry of National Education's Artificial Intelligence in Education Policy Document and Action Plan (2025–2029)

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The widespread adoption of artificial intelligence (AI) technologies in education is reshaping the knowledge and skills expected of teachers, thereby necessitating the development of new teacher competency frameworks (Zhou et al., 2025). In response to this transformation, UNESCO, the European Commission, and the International Society for Technology in Education (ISTE) have developed various competency frameworks to guide teachers. In this context, examining how the competency domains commonly emphasized across international teacher competency frameworks in the age of AI are addressed in national policy documents has become increasingly important.

The aim of this study is to identify the teacher competency domains commonly emphasized across international teacher competency frameworks and to comparatively examine how these domains are addressed in the Artificial Intelligence in Education Policy Document and Action Plan (2025–2029) published by the Turkish Ministry of National Education. The study adopts a qualitative research approach and employs document analysis as its research design. The data sources consist of the UNESCO AI Competency Framework for Teachers, DigCompEdu, ISTE Standards for Educators, and the Artificial Intelligence in Education Policy Document and Action Plan (2025–2029) of the Turkish Ministry of National Education. The data were analyzed using directed content analysis. The competency domains commonly emphasized across the international frameworks were identified and subsequently compared with those presented in the Ministry's policy document.

The comparative analysis of the documents revealed that the international teacher competency frameworks consistently emphasize AI competencies, digital competencies, ethical and responsible use of AI, pedagogical integration, continuous professional development, and assessment-related competencies. The Artificial Intelligence in Education Policy Document and Action Plan (2025–2029) of the Turkish Ministry of National Education also includes policy objectives and action plans related to these competency domains. However, while the international frameworks primarily focus on defining the competencies expected of teachers, the Ministry's policy document places greater emphasis on policy objectives and implementation strategies for integrating these competencies into the education system.

The findings suggest that the international teacher competency frameworks and the Turkish Ministry of National Education's Artificial Intelligence in Education Policy Document and Action Plan (2025–2029) share common areas of focus regarding teacher competencies, although they differ in terms of their objectives and scope. Based on these findings, it is recommended that the AI-related competency domains emphasized in international teacher competency frameworks be considered in both pre-service teacher education programs and in-service professional development initiatives.

Keywords: Artificial Intelligence, Teacher Competencies, Education

(576)

Digital Informal Learning among Turkish University Students: The Role of Demographic Characteristics and Internet Use Patterns

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Digital technologies have expanded learning beyond formal educational settings, enabling university students to acquire knowledge, regulate their learning, and interact with others through online resources. However, it remains unclear whether digital informal learning varies according to students' demographic characteristics and the purposes for which they use the internet. This study examined the cognitive, metacognitive, and social-motivational dimensions of digital informal learning among Turkish university students in relation to gender, age group, class level, department group, and academic, social, and entertainment-related internet use. A quantitative, cross-sectional, and comparative design was employed. Data were collected from 731 undergraduate students enrolled in 16 different departments across seven universities located in different regions of Türkiye. The Turkish version of the Digital Informal Learning Scale and a personal information form were used for data collection. Participants were grouped according to gender, age, class level, department, and daily internet use intensity. Separate one-way multivariate analyses of variance were conducted for the demographic variables, while academic, social, and entertainment-related internet use were examined simultaneously in a main-effects multivariate model. Descriptive findings indicated high levels of cognitive (M = 4.01, SD = .83), metacognitive (M = 4.09, SD = .86), social-motivational (M = 3.92, SD = .87), and overall digital informal learning (M = 4.01, SD = .78). No significant multivariate differences were found according to gender, age group, class level, or department group. Academic internet use produced a small but statistically significant multivariate effect on the combined dimensions of digital informal learning, Pillai's Trace = .011, $F(3, 725) = 2.69$, $p = .046$, partial $\eta^2 = .011$. Follow-up analyses using a Bonferroni-adjusted significance level showed that the difference was limited to the cognitive dimension, $F(1, 727) = 7.32$, $p = .007$, partial $\eta^2 = .010$. Students in the higher academic internet-use group reported greater cognitive digital informal learning than those in the lower-use group. Social and entertainment-related internet use did not produce significant multivariate effects. These findings suggest that digital informal learning is broadly distributed across demographic groups, whereas academically oriented internet use may be particularly relevant to cognitive learning activities. Higher education institutions should therefore focus not only on increasing students' access to digital resources but also on helping them use these resources purposefully, critically, and strategically for learning.

Keywords: Digital Informal Learning, Internet Use Patterns, University Students, Academic Internet Use, Higher Education

(577)

Emotional Intelligence Coach, A Design Case of AI Supported Self-Directed Reflective Practice in Healthcare

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This design case describes the development of a self-directed, AI-supported emotional intelligence (EI) coaching tool designed to extend instructor-led training into reflective workplace practice within a large healthcare system. The case foregrounds the design process, including key decisions, constraints, iterative refinements, and unforeseen challenges encountered while developing a psychologically safe, accessible, and scalable microlearning intervention for physicians, nurses, and healthcare leaders. The intervention uses generative artificial intelligence tools, including ChatGPT and Claude, to support scenario-based reflective coaching aligned with the four quadrants of emotional intelligence: self-awareness, social awareness, self-management, and relationship management (Mayer et al., 2008). The design also incorporates social-emotional learning practices increasingly emphasized within healthcare education (Hsu et al., 2024). Particular attention is given to design trade-offs related to psychological safety, accessibility, multilingual functionality, support for learners with visual impairments, and the positioning of AI as a non-evaluative reflective coach. Feedback from leadership development teams, frontline nursing staff, and language and disability services informed iterative refinements throughout the design process. This case contributes to design knowledge by illustrating how generative artificial intelligence can function as a reflective scaffold in high-stakes workplace learning environments while documenting the tensions and decisions involved in designing for equity, usability, and authentic practice (Pal, 2023).

Keywords: Generative Artificial Intelligence, Emotional Intelligence, Coaching, Self-directed Learning, Psychological Safety, Accessibility, Healthcare Learning

(578)

Design and evaluation of a distance-mode blended online course in Medical Laboratory Science: Learner perceptions

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This study aimed to explore learner perceptions of learning in a distance mode blended learning course, specially designed to support the learners who are Medical Laboratory Technologists in government hospitals in Sri Lanka, in studying Diagnostic Bacteriology as a part of the Bachelor's degree in Medical Laboratory Sciences (BMLS) at the Open University of Sri Lanka (OUSL). The course employed a blended learning model having different delivery methods, with an online learning component through the Learning Management System (LMS) and some face-to-face (F2F) components.

Course design was based on the framework of Universal Design for Learning, following its three core principles: multiple means of representation, multiple means of engagement and multiple means of expression. Accordingly, the course content was presented through multiple instructional formats, including reading material, synchronous online teaching sessions, recorded lectures, PowerPoint presentations, guided practical videos and a Glossary of technical terms. Different activities were designed to engage learners in the online course using online quizzes, discussion forums, and virtual microbiology simulations. Learners were provided with a variety of continuous assessment methods, such as mind maps, online quiz tests and reflective reports on practical sessions to demonstrate their learning. The F2F component was mainly to conduct laboratory sessions for skills development, and also to conduct final examinations.

Learner perceptions were gathered through quantitative and qualitative research methods by administering a questionnaire with closed and open-ended questions. Online course log reports were also used to corroborate results.

Thirty-one (31) adult learners employed as Medical Laboratory Technologists in government hospitals participated in the course. Out of 31 adult learners, 24 learners (4 male and 20 females) aged 28–42 years responded to the questionnaire.

The quantitative data indicated an overall positive perception of the blended learning experience. Most respondents (71.4%) identified lecture recordings and PowerPoint presentations as valuable resources for independent learning, while 85.7% reported relying primarily on PowerPoint presentations during examination preparation. Among interactive learning activities, online quizzes emerged as the most effective interactive learning activity for reinforcing learning, as reported by 81% of learners. Teacher-produced guided practical videos and virtual microbiology simulations were considered the most beneficial resources for preparing for laboratory practical sessions and practical examinations. The mind map assessment was perceived to facilitate revision and knowledge integration by 81% of the learners; however, it was also identified as the most challenging continuous assessment activity.

Qualitative data indicated learners' high levels of satisfaction with the blended learning approach, particularly appreciating the flexibility of asynchronous learning resources and technology-enhanced practical support. Interactive learning through quizzes and practical video resources has contributed positively to learner engagement and self-directed learning. Although the mind map assessment was considered challenging, learners recognised its educational value in consolidating course content. Furthermore, some learners identified work-life balance and internet interruptions during online activities as key challenges in their

blended learning experience. Overall, findings support the design of blended learning strategies for working adults in distance learning settings, while highlighting the need for additional guidance when implementing higher-order learning activities such as concept mapping.

Keywords: Blended Learning, Universal Design for Learning, Medical Laboratory Science, Diagnostic Bacteriology, Adult Learners, Microbiology, Distance Learning

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Improving Student Awareness and Achievement through Unplugged Coding and Parent Involvement: An Interdisciplinary Pedagogical Approach

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This study investigates the impact of unplugged coding activities as an interdisciplinary teaching tool to improve student awareness and achievement and explores the role of parental involvement in enhancing these activities. Conducted in 3rd and 4th grade science classes, the study focuses on the interdisciplinary application of this method. Science courses were selected due to their relevance to interdisciplinary topics such as climate change and environmental issues, ensuring alignment with current curricula. A quasi-experimental design with a pretest/posttest control group was employed, involving 60 students and 30 their parents from a science and art center in the Aegean Region of Turkey. The data collection tools included an "Awareness Questionnaire" to assess students' awareness of climate change and an "Achievement Test" to evaluate their academic achievement. Participants were divided into three groups: an experimental group using unplugged coding activities without parental involvement, a second experimental group where activities were supported by parental involvement, and a control group engaged in a video-based educational activities. The results show unplugged coding activities improved students' climate change awareness and achievement compared to the video-based activities. Moreover, parental involvement significantly enhanced both awareness and academic achievement. These findings highlight parental involvement's critical role in innovative teaching. Furthermore, students in unplugged coding activities exhibited higher levels of awareness and achievement than the control group. This suggests unplugged coding, especially with parental support, can be effective across disciplines like science, mathematics, social sciences, and arts.

Keywords: Unplugged Coding, Interdisciplinary Pedagogy, Parental Involvement, Awareness, Academic Achievement.

(581)

Beyond the Algorithm: Why "Culturally Neutral" AI Fails Arab Women's Digital Safety

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As online abuse, harassment, and privacy violations rise globally, women's experiences and participation in digital spaces are increasingly affected. Although AI and cybersecurity systems offer new detection and protection capabilities, however, they are frequently designed as "culturally neutral" systems that overlook critical linguistic, social, economic, and regulatory contexts that influence women's safety. This context-blind approach results in ineffective, exclusionary, and uneven cyber-protection for women in diverse social settings. This paper critically examines these limitations and proposes a gender-responsive, culturally grounded framework for Arab women's digital safety.

Using Egypt as a local socio-cultural case study and Egyptian women in Germany as a diaspora comparison group, the study utilizes a mixed-methods design incorporating technology acceptance model and cultural frameworks to investigate how culture, migration, regulation, language, affordability, and trust shape the adoption and effectiveness of digital safety technologies. From a survey of 90 Arab women with interviews involving activists, policymakers, cybersecurity professionals, AI specialists, and legal experts. Findings indicate that Arab women face distinct barriers. These include limited Arabic-language accessibility, low tool awareness, fear of reputational harm, and low confidence in reporting systems. Although diaspora women in Germany demonstrate greater awareness of data rights, they continue to experience concerns regarding visibility, harassment, and their trust in digital platforms.

The proposed framework links technological capabilities with linguistic diversity, socioeconomic contexts, user agency, and institutional responsibility. Rather than treating women's digital safety as solely a technical problem, this research recognizes the influence of social, cultural, and governance factors. Therefore, it calls for participatory design, inclusive datasets, and stronger regulatory oversight to develop AI-enabled cybersecurity interventions that are fair, locally appropriate, and accountable.

Keywords: Women's Digital Safety, Cybersecurity, Culturally Adaptive AI, Arab Women;

(582)

Enhancing Teacher Candidates' Reflective Thinking: Evaluating the Contributions of a Reflective Thinking Skills Support Program

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As teachers' roles have expanded beyond the transmission of knowledge. Subject-matter knowledge alone is no longer sufficient for effective teaching. Teachers are increasingly expected to guide students' learning processes, foster curiosity, and reflect critically on their instructional practices. In this regard, reflective thinking is considered an essential competent for professional development. This study aimed to examine the contributions of the Reflective Thinking Skills Support Program (RTSSP). The main research question was: How do teacher candidates participating in the RTSSP develop their use of reflective thinking in instructional practices? The study investigated teacher candidates' reflective thinking dispositions and their views on reflective thinking and its classroom applications before and after the program. A mixed-method case study design was employed. The participants were 10 primary school teacher candidates enrolled in the Faculty of Education at Ege University during the spring semester of the 2024–2025 academic year. Quantitative and qualitative data were collected concurrently through the Reflective Thinking Disposition Scale for Teachers and Teacher candidates and a structured focus group interview form. The six-week RTSSP included activities related to self-assessment, reflective journaling, analysis, critical questioning, evaluation, and feedback. Quantitative data were analyzed using the Wilcoxon signed-rank test, while qualitative data were analyzed through content analysis.

The quantitative findings indicated no statistically significant difference between teacher candidates' pre-test and post-test scores for overall reflective thinking disposition or its subdimensions. However, the qualitative findings revealed meaningful changes in teacher candidates' understanding and use of reflective thinking. Before the implementation, teacher candidates associated reflective thinking mainly with learning from mistakes, identifying deficiencies, self-assessment, and critical perspective-taking. After the implementation, they emphasized self-discovery, questioning, openness to criticism, application to practice, and awareness development. Their reflections also shifted from negative self-criticism toward constructive self-evaluation. In addition, while they initially emphasized individual activities for fostering reflective thinking in students, they later highlighted the importance of group activities and active participation. The study recommends integrating courses and practice-based activities that systematically support reflective thinking into teacher education programs.

Note: This study was supported by the Ege Educational Research Association (ERA), Ankara, Türkiye (Decision No. 161 dated 07.03.2025).

Keywords: Mixed Method Case Study, Reflective Thinking, Teacher Education.

(584)

Profiles of Online Learning Acceptance Among University Students: A Person-Centered Latent Profile Analysis

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The acceptance and use of online learning environments in higher education have most often been examined through variable-centered approaches that estimate average relationships among constructs across an entire sample. Such approaches, while informative, assume that a single set of associations applies uniformly to all students and may obscure qualitatively distinct subgroups characterized by different configurations of acceptance-related perceptions. The present study addresses this limitation by adopting a person-centered perspective. Its purpose is to identify latent profiles of university students based on their technology acceptance perceptions, e-learning readiness, and online student connectedness, and to examine whether these profiles differ in demographic characteristics. Data were collected from 543 university students who had taken courses through online learning environments. Participants completed a UTAUT-based online learning acceptance scale assessing performance expectancy, effort expectancy, social influence, and behavioral intention, together with an e-learning readiness scale and an online student connectedness scale. Latent profile analysis was conducted on the six standardized composite indicators, specifying varying variances and zero covariances. Solutions ranging from one to four profiles were compared using the Bayesian information criterion (BIC), entropy, classification probabilities, profile size, and the bootstrapped likelihood ratio test (BLRT). A three-profile solution was retained (BIC = 7946; entropy = .854; BLRT p = .010), with high classification certainty (average posterior probabilities ranging from .914 to .964). Although the four-profile solution yielded a marginally lower BIC, it produced a small and poorly separated class, and solutions with five or more profiles failed to converge. The retained profiles were distinguished primarily by the overall elevation of acceptance-related perceptions rather than by qualitatively different shapes. The first profile (41.1% of the sample) comprised students with uniformly low perceptions across all indicators (low-acceptance profile). The second profile (40.9%) represented students with moderate perceptions (moderate-acceptance profile). The third profile (18.0%) consisted of students with uniformly high perceptions (high-acceptance profile). Online student connectedness showed the weakest differentiation across profiles and did not significantly distinguish the moderate-acceptance profile from the sample average, whereas performance expectancy and behavioral intention differentiated the profiles most sharply. Profile membership did not differ significantly by gender ($\chi^2 = 1.18$, $p = .554$), indicating that acceptance profiles were not accounted for by this demographic characteristic. The findings suggest that students' acceptance of online learning environments is organized into internally coherent profiles that vary chiefly in overall intensity rather than in demographic composition, and that connectedness operates relatively independently of the acceptance gradient. These results complement variable-centered evidence by locating acceptance within the person and indicate the potential value of profile-tailored institutional support. Future research should examine the antecedents and learning outcomes associated with these profiles and test their stability across institutional contexts.

This study was supported by Bursa Uludag University Research Projects Coordination Office under the Grant Number SHIZ-2026-2921.

Keywords: Online Learning, Technology Acceptance, Latent Profile Analysis, E-learning Readiness, Person-centered Approach

(585)

Exploring the Use of Generative AI in Preparing Preservice Primary Teachers to Teach Art: Opportunities and Challenge

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Generative artificial intelligence (AI) is creating new opportunities for supporting teaching and learning across educational contexts. Art education in the primary school, technology has traditionally been used mainly to present visual materials, while AI has more recently been introduced to assist teachers in searching for information in the preparation of designing lesson plans. However, little is known about how preservice primary teachers, who are not art specialists, use generative AI to develop visual teaching resources and how they perceive its benefits and limitations. This study explored the use of generative AI in a pilot workshop designed to introduce preservice primary teachers to AI-supported visual resource development for art education in the primary school. It also examined their perceptions of the opportunities and challenges associated with integrating AI into their future teaching practice.

The study involved 24 third-year preservice primary teachers from the Department of Primary Education at Ho Chi Minh City University of Education, Vietnam. During the workshop, participants were introduced to the use of AI for searching information, creating visual illustrations, designing instructional resources, and supporting lesson planning for art education in the primary school. Data were collected through participants' learning products, lesson plans, classroom observations, and post-workshop interviews to examine their experiences and perceptions of AI-supported learning.

The findings indicate that AI enabled participants to produce diverse visual resources efficiently, visualize teaching ideas more effectively, and increase their confidence in preparing art lessons in the primary classroom. Compared with their previous use of technology mainly for presenting images or retrieving information, participants began to view AI as a tool for generating instructional resources and expanding pedagogical ideas. At the same time, they expressed several concerns regarding the appropriateness of AI-generated outputs for classroom use. A recurring concern was that AI-generated images often appeared more technically sophisticated than what primary school pupils could realistically create, potentially leading to unrealistic learning expectations. Rather than accepting AI-generated content uncritically, participants proposed practical strategies to address this issue, including producing the suggested artwork themselves, comparing the actual products with AI-generated examples, and modifying learning tasks to better match pupils' developmental abilities. They also emphasized the importance of verifying AI-generated information, carefully selecting visual materials, and treating AI as a supportive tool rather than a substitute for teachers' professional judgment.

The findings suggest that introducing generative AI into teacher education should extend beyond developing technical skills. Equally important is helping preservice teachers cultivate the ability to critically evaluate, adapt, and responsibly integrate AI-generated resources into authentic teaching contexts. This exploratory study provides practical implications for preparing future primary teachers to make informed and pedagogically appropriate use of generative AI in art education.

Keywords: Generative Artificial Intelligence, Preservice Primary Teachers, Art Education, Visual Instructional Resources

(586)

Student Authorship and Metacognitive Regulation in Digital Text-Production Tasks

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In digitally mediated learning, student texts are increasingly produced through interaction with search engines, online sources and other external digital resources. As a result, the final product does not always reveal the extent to which the learner has preserved control over the purpose, content, structure, coherence and language of the response. This study addresses this problem by examining student authorship as a metaregulatory dimension of digital text production.

Authorship is conceptualised as the learner's capacity to maintain semantic and regulatory control while working with digital resources. The study is grounded in the metasystem approach to regulation and in a three-axis model of digital self-regulation, which distinguishes behavioural, cognitive and metacognitive dimensions of digital task performance.

A quantitatively dominant mixed-method design was used. A total of 178 participants completed three computer-based tasks: giving practical advice to a friend, planning a sightseeing route, and writing an essay on youth social media use. The analysis included screen-capture data, web-search behaviour, query reformulation, navigation patterns, information-processing indicators, metacognitive regulation scores, authorship ratings and rubric-based task scores.

The findings show that the relationship between authorship and task quality depends on task type. Authorship level predicted performance in the practical advice task and in the route-planning task beyond time on task and general metacognitive regulation. In contrast, authorship did not significantly predict essay scores, suggesting that essay quality may depend on additional writing-specific factors, including argument development, coherence and language accuracy.

The study contributes to educational technology and digital assessment research by showing that student performance cannot be fully understood from final task scores alone. Digital assessment should also consider the regulatory process through which students preserve or lose authorship while working with external digital resources.

Keywords: Metacognitive Regulation, Student Authorship, Digital Text Production, Self-regulated Learning

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Effects of Virtual Laboratory Technologies in Medical Laboratory Techniques Education

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Laboratory education is a fundamental component of health sciences programs, particularly for developing practical and professional skills. However, in fields such as molecular biology, which require technical infrastructure, specialized equipment, and repeated practice opportunities, students' access to hands-on experience may be limited. Virtual and digital laboratory technologies are increasingly considered complementary learning environments that may support knowledge acquisition and perceived competence. This study aimed to examine changes in student knowledge and perceived competence following a virtual laboratory-supported instructional process in medical laboratory education.

The study was conducted using a one-group pre-test/post-test design. The participants were 76 second-year students enrolled in a Medical Laboratory Techniques program. Ethical approval was obtained prior to data collection, and participation was voluntary. Before the virtual laboratory experience and theoretical instruction, students completed a knowledge test and perceived competence questions-developed in accordance with the literature and reviewed by three experts-to determine their baseline levels. Following a three-month theoretical instruction period covering five core molecular biology methods (SDS-PAGE, agarose gel electrophoresis, PCR, Western blotting, and column chromatography), students had the opportunity to experience these topics in practice through a virtual laboratory activity conducted on the LabXchange platform. This activity allowed students to observe laboratory procedures, follow experimental steps, and engage with related concepts in a digital environment. Following the instructional process, both the knowledge test and the perceived competence questions were administered again.

The results showed a statistically significant increase in students' knowledge scores from pre-test to post-test, $t(75) = -11.47$, $p < .001$, $d = 1.061$, indicating a large effect following the instructional process. Significant, small-to-moderate improvements were also observed across all perceived-competence dimensions ($d = 0.232$-0.385). The findings suggest that virtual and digital laboratory applications can serve as supportive learning environments in medical laboratory education. These technologies may contribute to students' conceptual understanding, readiness for laboratory practice, and perceived competence. However, because this study used a single-group design without a control group, the results should be interpreted as preliminary findings. Further studies with control groups, larger samples, and long-term follow-up are recommended.

Keywords: Virtual Laboratory; Digital Technology; Medical Laboratory Techniques Education.

(589)

Conceptualizing Collaboration with Generative AI Across Theoretical Traditions

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Generative artificial intelligence is increasingly described as a collaborative partner in teaching and learning. Learners and educators are said to collaborate with generative AI when they brainstorm, revise work, solve problems, receive feedback, or plan instruction. However, repeated interaction, useful outputs, or substantial system contribution does not necessarily mean that collaboration has occurred. This paper therefore examines the conditions that must be present before a bounded episode of human interaction with generative AI can reasonably be described as collaborative.

The paper adopts a theory-driven comparative conceptual analysis. It draws on Roschelle and Teasley's account of collaborative cognition, Bedwell and colleagues' process model of collaboration, and Tomasello and colleagues' account of shared intentionality. These perspectives are selected because they place different emphasis on coordinated interaction, reciprocal participation, and shared intentions and commitments. A construct-mapping process preserves the original terminology of each account, identifies the role assigned to each condition, and distinguishes recurring concerns from theory-specific requirements. The unit of analysis begins with task framing and ends with evaluation of the outcome. The analysis considers both how the interaction is organized and whether each account allows the AI system to count as the kind of participant that collaboration assumes. Socially shared regulation of learning is used as a secondary educational lens to examine how planning, monitoring, evaluation, and adaptation are distributed. The resulting distinctions are applied to four constructed scenarios that vary in human control, system contribution, responsiveness, influence, and task interdependence. The scenarios are theoretical illustrations rather than empirical data.

The preliminary comparison shows recurring attention to goal-oriented activity, mutual or reciprocal engagement, and coordination, although the accounts define and prioritize these conditions differently. The central disagreement concerns whether the observable organization of an interaction is sufficient for it to count as collaboration. Interactional and process-based accounts can be examined through responsiveness, coordinated contributions, negotiation, and influence over the activity. Their application to generative AI, however, still raises questions about whether the system can be treated as a participant in the same sense as a human collaborator. Shared-intentionality accounts require shared goals and intentions, shared commitment, coordinated roles, and mutual awareness of the joint activity. A human–generative AI interaction may therefore display features associated with collaboration while remaining non-collaborative or theoretically unresolved under accounts requiring shared intentional states. The socially shared regulation lens further examines whether control remains primarily with the human or becomes distributed across the interaction.

The focus of this paper is not to reduce collaboration with generative AI to a simple yes-or-no question. Rather, it explains why different theories may produce different judgments about the same interaction and identifies the evidence and assumptions needed to support such claims. The paper provides researchers with a clearer basis for operationalizing collaboration, helps educators distinguish productive AI-supported activity from theoretically collaborative activity, and offers designers criteria for specifying the coordination, influence, and regulation their systems are intended to support.

Keywords: Human–AI Collaboration; Generative AI in Education; Collaborative Cognition; Shared Intentionality; Socially Shared Regulation of Learning

(591)

Experiential Learning Through VR-Supported Earthquake and Emergency Evacuation: Implications for Open and Distance Learning

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Effective disaster education requires more than the acquisition of theoretical knowledge. It also necessitates equipping learners with the ability to interpret disaster situations, develop appropriate decision-making skills and foster awareness of the correct behavioural responses to be adopted during emergencies. However, as high-risk events such as earthquakes and emergency evacuations cannot be experienced safely in real-life settings, traditional instructional approaches often struggle to provide authentic experiential learning opportunities. This study examined the role of VR-supported earthquake and emergency evacuation experiences in the experiential learning of university students, and explored the potential integration of VR-based experiences into open and distance learning environments. A mixed-methods approach using a one-group pretest-posttest design was adopted. The study involved 24 undergraduate students from the faculties of architecture and education. After completing the pretest, the participants experienced a VR-based earthquake simulation. This simulation enabled them to identify spatial hazards, evaluate appropriate safety behaviours and practise emergency evacuation procedures. They then completed the posttest. Qualitative data obtained through open-ended questions were analysed using Braun and Clarke's reflexive thematic analysis. Six major themes emerged from the analysis: experiential learning; perceived realism and empathy; disaster awareness and emergency evacuation literacy; long-term learning; behavioural preparedness; and the perceived educational value of the VR experience. The findings indicated that, following the VR intervention, participants' reflections on earthquake preparedness and evacuation became more concrete, behaviour-oriented and experience-based. Notable improvements in long-term learning and disaster awareness suggested that participants perceived the VR simulation as a memorable and authentic learning experience that went beyond the mere transmission of knowledge. Furthermore, architecture students emphasised spatial realism and environmental experience, whereas education students focused more on learning processes, knowledge retention and instructional value. Overall, the findings suggest that VR-supported earthquake and emergency evacuation experiences are an effective way of fostering experiential learning in contexts where direct disaster experience is impossible. The findings also highlight the potential of integrating VR technologies into open and distance learning environments to make disaster education more accessible, interactive, immersive and learner-centred.

Keywords: Virtual Reality, Earthquake Simulation, Emergency Evacuation, Experiential Learning, Disaster Education, Open And Distance Learning.

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Critical Problem Posing with Generative AI: An Analytical Framework

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From the perspective of critical mathematics education, mathematics is viewed not merely as a domain in which procedural operations are performed, but also as a means of analyzing social realities, making inequalities visible, and fostering transformative forms of citizenship. Consistent with this perspective, problem posing is not simply the process of generating a mathematical situation; rather, it is an intellectual mathematical activity through which individuals question and reinterpret existing realities. Although the relationship between problem posing and critical mathematics education has recently begun to attract increasing attention from researchers, the rapid proliferation of Generative Artificial Intelligence (GenAI) tools in educational settings has made it particularly important to examine how problem-posing processes supported by GenAI are experienced, especially in mathematics education. Accordingly, classifying the critical potential of problems posed with the support of GenAI represents an important gap in the literature. Employing a case study design, this study aimed to examine the critical potential of contextual problems posed by eight pre-service mathematics teachers, with support from GenAI. To this end, the pre-service teachers were asked to pose three mathematical problems with the support of GenAI, drawing on the contexts of “inequality in education” and “being a teacher in Türkiye and around the world.” The findings were based on 23 problems generated through the GenAI-supported problem-posing processes of the eight pre-service teachers, as well as semi-structured interviews conducted following these processes. The problems were evaluated using a two-stage analytical framework developed through a deductive approach. Qualitatively, the problem analysis framework comprised five categories: (i) critical mathematical problem, (ii) problem with critical potential, (iii) contextual mathematical problem, (iv) pseudo-contextual problem, and (v) decontextualized mathematical problem. In the first stage of the framework, the problems were examined in terms of whether they contained a mathematical situation and whether they possessed solvability characteristics. Problems that contained a mathematical situation but were not solvable were not excluded from the analysis and were therefore included in the second stage. In the second stage, the problems were examined in terms of their contextuality, the scale of the social issue addressed, and the depth of the relationship established between mathematics and that issue. The findings indicated that more than half of the problems were concentrated in the contextual or pseudo-contextual categories. In contrast, none of the products could be directly classified as critical mathematical problems. In addition, the study examined how pre-service teachers used GenAI during the problem-posing process. Approximately two-hour interviews conducted following the problem-posing processes were analyzed using content analysis. The findings showed that the pre-service teachers regarded GenAI as both a supportive tool and a tool with certain limitations in their problem-posing processes. These findings suggest that critical problem posing should not be regarded as a skill that develops spontaneously in mathematics teacher education. By introducing an original two-stage problem-analysis framework, this study makes an analytically significant contribution at the intersection of critical mathematics education and GenAI.

Keywords: Generative Artificial Intelligence, Critical Mathematics Education, Problem Analysis

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Views of Preservice Teachers about evaluation apprehension

Özge Bıkmaz Bilgen

Evaluation apprehension is a multidimensional concept that encompasses the cognitive, affective, and behavioral reactions experienced by individuals in situations where their knowledge, skills, competence, performance, or personal characteristics are observed and evaluated by others. Individuals may experience concerns about being negatively evaluated, being perceived as inadequate, making mistakes, or failing to meet expectations in situations such as examinations, oral presentations, performance tasks, classroom participation, receiving feedback, and being observed by others. Such apprehension may make it difficult for individuals to demonstrate their actual performance and may also cause them to avoid evaluative environments, constantly monitor themselves, and place excessive importance on the judgments of others.

Assessment is an integral part of the educational process. Assessment practices are needed to determine students' knowledge and skills, identify learning deficiencies, and improve instruction. However, the assessment process should not be regarded merely as a technical procedure used to determine academic achievement. The manner in which assessment is conducted, the clarity of assessment criteria, the attitudes of evaluators, the quality of feedback, and the meaning attached to assessment results by individuals may influence students' emotional experiences. Therefore, it is important to examine the apprehension created by assessment processes and how this apprehension is interpreted by individuals.

The literature includes various studies focusing on test anxiety, social evaluation, fear of negative evaluation, performance anxiety, and attitudes toward assessment processes. However, further research is needed to examine in detail how preservice teachers interpret evaluation apprehension in relation to their own experiences and the situations with which they associate this apprehension. Examining evaluation apprehension only through scores obtained from measurement instruments may be insufficient to reveal the subjective meanings individuals attribute to this experience. Therefore, identifying the situations in which preservice teachers experience evaluation apprehension is important for understanding the meaning of this concept within their experiential world.

The main purpose of this study is to identify the situations in which preservice teachers experience evaluation apprehension and to determine the characteristics they associate with such situations. In line with this purpose, the following research questions were addressed:

In which situations do preservice teachers experience evaluation apprehension?

What common characteristics are associated with the situations in which preservice teachers experience evaluation apprehension?

Under which conceptual categories can the situations that trigger evaluation apprehension among preservice teachers be grouped?

The study was conducted using a cross-sectional survey design. Cross-sectional survey studies make it possible to examine participants' current attitudes, beliefs, opinions, and various characteristics (Sezgin-Selçuk, 2019). The study group consisted of 85 preservice teachers enrolled in different departments within the Faculty of Education at Aydın Adnan Menderes University.

The qualitative data obtained in the study were analyzed through content analysis.

The findings obtained from the study are expected to reveal the situations in which preservice teachers experience evaluation apprehension and how such experiences are reflected in their meaning systems.

The results of the study are expected to contribute to a better understanding of the emotional difficulties preservice teachers experience during assessment processes. Based on the findings, recommendations may be developed for creating more transparent, supportive, developmental, and anxiety-reducing assessment environments in teacher education.

Keywords: Evaluation Apprehension, Preservice Teachers, Assessment Process, Teacher Education

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The Effectiveness of the Model United Nations Simulation in Teaching Geopolitics in Upper Secondary Education in Kazakhstan

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Rising geopolitical instability and Kazakhstan's growing role in international affairs create a demand for school education that develops not only geopolitical knowledge but also students' value-based civic attitudes. The geopolitics unit of the Kazakhstani school geography curriculum has traditionally relied on reproductive, lecture-based methods, leaving students' practical and affective engagement with the subject underdeveloped. This study examines the effectiveness of Model United Nations (MUN) simulation, one of the most widely used interactive formats for teaching international relations worldwide, for developing geopolitical knowledge, analytical skills, and value-based attitudes among upper secondary school students, and explores how students themselves perceive its impact. A quasi-experimental design with non-equivalent groups was employed, comparing a control group ($n = 25$) and an experimental group ($n = 29$) of eleventh-grade students from a specialised lyceum in Almaty, Kazakhstan. Both groups completed identical pre- and post-intervention tests over a five-week instructional period. The experimental group additionally took part in a Security Council role-play simulation addressing a hypothetical geopolitical crisis. Immediately after the simulation, the experimental group completed a self-assessment survey measuring perceived gains across cognitive, skill, and affective-value dimensions. The experimental group significantly outperformed the control group on the summative post-test (15.52 vs. 13.72 out of 20 points; $t(51.97) = -3.696$, $p < .001$), with a large effect size (Cohen's $d > 0.8$). The affective-value component showed the largest gain (+28.4 percentage points). This was independently confirmed by student self-assessment, which rated the affective-value block significantly higher ($M = 4.79$) than the cognitive ($M = 4.28$) and skill ($M = 4.34$) blocks (Friedman's $\chi^2 = 21.85$, $p < .001$), demonstrating triangulation between objective and subjective measures. These findings extend MUN-simulation research from higher education to the secondary school context and support its integration into school geography curricula and teacher professional development programmes in Kazakhstan and comparable educational settings.

Keywords: Model United Nations; Geopolitics Education; Simulation-based Learning

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From Reporting Guideline to Reporting Quality Instrument: Developing RAISE-QI for Artificial Intelligence Research in Education

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The rapid growth of artificial intelligence (AI) in education has intensified the need for transparent and comprehensive reporting of empirical research. Inconsistent reporting of AI systems, pedagogical design, human involvement, ethical considerations, and evaluation methods limits reproducibility, hinders evidence synthesis, and reduces confidence in research findings. The Reporting AI Studies in Education (RAISE) framework was developed to improve reporting quality through 30 reporting recommendations spanning ten domains. Although RAISE provides structured guidance for reporting AI in education research, no corresponding instrument currently exists to evaluate adherence to these recommendations. This paper presents the development of RAISE-QI (Reporting AI Studies in Education Quality Instrument), a methodological extension of the original RAISE framework designed to facilitate systematic assessment of reporting quality in AI in education research. The objective is to transform RAISE from a reporting guideline into a practical appraisal instrument that can support researchers, peer reviewers, journal editors, and evidence synthesis teams in evaluating the completeness and transparency of published studies.

The instrument was developed by operationalising each of the 30 RAISE reporting recommendations into an observable assessment criterion, accompanied by standardised assessment questions and a proposed ordinal scoring framework to promote consistent application across reviewers. The operationalisation was guided by established principles underpinning reporting guidelines and quality appraisal instruments while maintaining fidelity to the conceptual intent of the original RAISE framework. The resulting instrument enables each reporting recommendation to be evaluated systematically rather than interpreted solely as narrative guidance.

The principal outcome of this work is RAISE-QI, a reporting quality instrument specifically designed for AI in education research. By converting reporting recommendations into measurable appraisal criteria, the instrument provides a structured foundation for assessing reporting completeness, identifying common reporting deficiencies, and supporting future investigations of reporting quality, inter-rater reliability, and construct validity.

It is concluded that reporting guidelines can serve a dual purpose as both author guidance and quality assessment instruments. Future research should evaluate the psychometric properties of RAISE-QI and examine its application across diverse AI in education studies. The development of RAISE-QI represents an important methodological contribution towards improving research transparency, reproducibility, and evidence quality within the rapidly evolving field of AI in education.

Keywords: Artificial Intelligence in Education; Reporting Quality; Reporting Guidelines; Research Transparency; RAISE

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From Individual Innovativeness to Medical Artificial Intelligence Readiness The Serial Mediating Roles of Cognitive Flexibility and Attitudes Toward Artificial Intelligence Among Nursing Students

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The purpose of this study is to examine the serial mediating roles of cognitive flexibility and attitudes toward artificial intelligence in the relationship between nursing students' individual innovativeness and their readiness for medical artificial intelligence. Conducted using a correlational survey model, the study sample consisted of 994 nursing students enrolled in the nursing faculty of a university located in eastern Türkiye. The data collection instruments used were the "Personal Information Form," the "Cognitive Flexibility Inventory," the "Individual Innovativeness Scale," the "Attitude Toward Artificial Intelligence Scale," and the "Medical Artificial Intelligence Readiness Scale." Data analysis involved descriptive statistics, Pearson correlation analysis, and PROCESS Model 6 serial mediation analysis based on 5,000 bootstrap samples. It was found that individual innovativeness statistically significantly and positively predicted readiness for medical artificial intelligence. Furthermore, it was determined that individual innovativeness has a positive and significant effect on attitudes toward artificial intelligence. However, the path from individual innovativeness to cognitive flexibility and the path from cognitive flexibility to attitudes toward artificial intelligence were not found to be statistically significant. It was found that cognitive flexibility and attitudes toward AI predict readiness for medical AI in a statistically significant and positive manner. When indirect effects were examined, it was determined that the specific indirect effect of individual innovativeness on readiness for medical AI, mediated by attitudes toward AI, was statistically significant. In contrast, the specific indirect effect mediated by cognitive flexibility and the serial indirect effect mediated through both cognitive flexibility and attitude toward AI were not found to be significant. In conclusion, this suggests that supporting students' individual innovativeness, cognitive flexibility, and positive attitudes toward AI in nursing education may contribute to the development of readiness for medical AI. In this regard, it is recommended that nursing education programs include more practical training and innovative learning activities designed to develop nursing students' attitudes toward artificial intelligence. Additionally, integrating practices that support nursing students' ability to adapt to rapidly changing clinical conditions and develop alternative solutions into the curriculum may be beneficial. Future studies are recommended to investigate the model in different samples using experimental and longitudinal designs.

*Sevda Kucuk is also an author of two additional papers submitted to the conference.

Keywords: Individual Innovativeness, Cognitive Flexibility, Attitudes Toward Artificial Intelligence, Medical Artificial Intelligence Readiness, Nursing Students

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The Effect of Final Decision Authority on Epistemic Decision-Making Performance in AI-Supported Learning: A Comparison of Human, AI, and Collaborative Decision-Making Approaches

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The rapid proliferation of generative artificial intelligence (AI) technologies in higher education has significantly transformed students' problem-solving and decision-making processes. In AI-assisted learning environments, students are no longer merely users accessing information, but active decision-makers who evaluate AI-provided suggestions and make final decisions. This development has led to a fundamental debate in education: who should have the final decision-making authority in AI-assisted learning processes? Whether the decision is made by the student, generated by AI, or jointly by humans and AI, these approaches are considered to influence students' learning processes and epistemological decision-making performance in different ways. However, current research mostly focuses on AI use, trust, acceptance, student agency, and learning outcomes, and experimental studies directly comparing the conditions under which humans, AI, and human-AI partnerships have final decision-making authority in an educational context are limited. The aim of this research is to examine the effect of final decision-making authority on the epistemological decision-making performance of higher education students in AI-assisted problem-solving processes. This research is planned to be conducted using a three-group experimental design within the scope of a quantitative research approach. Participants will be randomly assigned to three experimental groups. In the first group, students will make the final decision based on suggestions presented by artificial intelligence; in the second group, the final decision will be generated by artificial intelligence; and in the third group, students and artificial intelligence will reach a common final decision through joint evaluation. All groups will be given the same scenario-based problem-solving tasks, only the final decision-making authority will be differentiated according to the experimental conditions. It is planned that the participants' epistemic decision-making performance will be evaluated through an analytical rubric to be developed within the scope of the research, and the obtained data will be analyzed using appropriate statistical methods. The findings of the research are expected to provide empirical evidence on the effect of final decision-making authority on students' epistemic decision-making performance in AI-assisted learning environments. In addition, it is foreseen that the study will provide theoretical and applied contributions to the development of instructional designs based on a human-centered AI approach, the structuring of decision-making processes in human-AI collaboration models, and future experimental research in the field of educational technologies.

Keywords: Generative Artificial Intelligence, AI-supported Learning, Human–AI Collaboration, Final Decision Authority, Epistemic Decision-making.

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AI as Cognitive Scaffold or Cognitive Substitute? A Three-Axis Model of AI-Assisted Learning

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Effective instruction relies on the principle of cognitive scaffolding, whereby instructional support is systematically and gradually withdrawn as learners develop competence. In contrast, the immediate and continuous assistance provided by generative AI systems can bypass this fading process, potentially limiting knowledge internalization and independent cognitive development. Although research on AI in education has expanded rapidly, there is still no integrative theoretical framework explaining the conditions under which AI functions as a cognitive scaffold rather than becoming a permanent cognitive substitute. This paper addresses that gap by integrating insights from distributed cognition, active externalism, cognitive offloading, and productive failure to propose a novel three-axis conceptual model. The framework identifies cognitive agency, AI transparency, and learning context as the three interdependent dimensions that determine whether AI supports or replaces learners' cognitive engagement. Rather than conceptualizing AI-assisted learning as inherently beneficial or detrimental, the model explains it as a dynamic continuum shaped by the interaction of these dimensions. The balanced intersection of the three axes defines an optimal scaffolding zone that promotes progressively independent learning, whereas deviation along any axis may lead learners into a Zone of No Development, a condition in which sustained cognitive delegation to AI inhibits the development of independent competence. Beyond its theoretical contribution, the paper offers practical implications for educational technology design and policy, including embedding adaptive fading mechanisms into AI systems, integrating metacognitive self-regulation supports, and strengthening teacher agency in AI-enabled learning environments.

Keywords: Generative AI, Cognitive Scaffolding, Cognitive Agency, Cognitive Offloading, Human–AI Collaboration, Self-regulated Learning, Zone of No Development.

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Making Sense of Artificial Intelligence and Integrating It into Teaching: Perceptions, Pedagogical Expectations, and Ethical Concerns of Prospective Biology Teachers

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Artificial intelligence can be viewed not merely as a technology utilized by prospective teachers, but also as a tool that raises new questions regarding the design of teaching-learning processes, the generation of knowledge, and the evolving role of the teacher. Consequently, understanding how future biology teachers conceptualize artificial intelligence, the opportunities and risks they perceive, and their expectations regarding biology instruction offers significant insights into the direction of teacher education in the age of artificial intelligence. This study examined the cognitive structures, metaphorical perceptions, and views of prospective biology teachers regarding artificial intelligence. Conducted using a qualitative case study design, the study involved a group of 25 prospective biology teachers enrolled in a faculty of education during the 2025-2026 academic year. Data were collected via a single form comprising three sections - word association, metaphors, and open-ended opinion questions - and were subsequently analyzed by the researchers through content and thematic analysis, involving coding and categorization. The findings revealed that prospective teachers primarily associated artificial intelligence with concepts such as technology, speed, convenience, and robots; however, while emphasizing the need for conscious and conditional use, they also harbored negative associations such as laziness, unethical use, threats, and risks. The word association section yielded 125 words/concepts and 35 sentences, while the metaphor section produced 25 metaphors. These metaphors further highlighted this dual perception. Artificial intelligence is positioned, on the one hand, as an element providing access to information and support - akin to a “library” or an “assistant” - and, on the other, as a tool that can yield either benefits or harm depending on how it is used. While the time savings and rapid, easy access to information stand out in educational contexts, risks such as a reliance on ready-made information, cognitive laziness, a weakening of critical thinking skills, and exposure to misinformation have also become apparent. While prospective teachers recognize the potential of artificial intelligence in areas such as lesson planning, material development, assessment, assignment and project management, and idea generation, they attribute significant potential to its use in biology education - specifically for visualization, concretizing abstract and complex concepts, producing videos and animations, and utilizing virtual laboratories and simulations. From an ethical standpoint, however, distinct reservations have emerged regarding academic integrity, ownership of AI-generated outputs, teacher oversight, usage boundaries, cognitive dependency, and reliability. Expectations regarding their future professional lives reveal a clear demand for AI tools capable of generating reliable, visual, and interactive content specific to the field of biology, as well as tools that offer virtual laboratory and adaptive learning capabilities. When the findings are evaluated collectively, it becomes evident that the prospective biology teachers’ approaches to AI are not defined by a simple “positive/negative” dichotomy; rather, they are shaped by a framework of conditional acceptance where strong pedagogical potential coexists with concerns regarding ethics, cognition, and reliability. These results indicate that the integration of AI into teacher training programs should not be limited to technical skills alone but must also address domain-specific pedagogical practices, critical evaluation, ethical usage, and human oversight.

Keywords: Artificial Intelligence, Prospective Biology Teachers, Biology Education, Teacher Education, Ethical Usage

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Contextualized Minimum Profile for Beginning Distance Higher Education Studies in Latin America: A Proposal to Balance Access, Retention, and Academic Quality

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Purpose: The expansion of distance higher education in Latin America has broadened access opportunities for students facing geographical, employment, family, and socioeconomic constraints. However, entry into this modality is not always accompanied by sufficient diagnosis of the actual conditions under which students begin their university studies. In contexts of high socioeducational heterogeneity, many incoming students may have limitations in connectivity, device availability, digital competence, reading comprehension, academic writing, logical thinking, self-regulation, and time management. This situation may result in fragile inclusion: formal access is expanded, but the conditions necessary for retention, learning, and academic quality are not necessarily ensured. Within this framework, the purpose of this paper is to propose a contextualized minimum profile of preparedness for beginning distance higher education studies in Latin America, accompanied by a brief initial leveling pathway.

Methodology: The study is developed as a theoretical-conceptual proposal based on a critical narrative review of academic literature and specialized documents on online learning readiness, digital competence, the digital divide, academic literacy, self-regulated learning, university transition, student retention, and distance higher education. The review makes it possible to identify recurring dimensions, conceptual gaps, and relevant criteria for adapting international readiness frameworks to the Latin American context.

Key Findings: As a result, an initial matrix of a situated minimum profile is proposed, organized into technological, digital, academic, self-regulatory, contextual, and institutional dimensions. The proposal distinguishes among essential minimum conditions, developable competencies, and necessary institutional support. In addition, a brief initial leveling pathway is proposed, structured around five areas: digital induction, understanding instructions and academic reading, initial writing, basic logical thinking, and self-regulation of learning. This pathway is conceived as a flexible, focused, and feasible strategy to be implemented before and during the first academic cycle.

Implications: The proposal seeks to contribute to more equitable, resilient, and academically responsible distance higher education. The situated minimum profile is not proposed as a mechanism of exclusion, but rather as a diagnostic and formative tool for anticipating risks, targeting support, and strengthening student retention from the beginning of the university trajectory.

Keywords: Distance Higher Education; Entry Profile; Online Learning Readiness; Educational Equity; Student Retention

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Preventing cyberbullying in higher education: an innovative interdisciplinary project in initial teacher education

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The growing use of digital resources in personal, social, and educational contexts has created opportunities for communication, but also new risk contexts, among which cyberbullying has emerged as one of the most prevalent forms of digital violence.

Although the scientific literature has primarily focused on the compulsory stages of education (Primary Education and Compulsory Secondary Education), a significant gap remains in Higher Education, particularly regarding initial teacher education for preventing, detecting, and addressing cyberbullying.

To address this need, this study analyzed and evaluated the implementation of an interdisciplinary educational intervention developed by a team of eight faculty members from different academic disciplines at the Faculty of Education Sciences, University of Málaga (UMA), during the 2025-2026 academic year. The intervention was developed within the framework of the Teaching Coordination Project, "The University as a Safe and Ethical Space in the Digital Era: Interdisciplinary Initial Teacher Education Against Cyberbullying".

The main objective was to promote safe, ethical, and inclusive digital citizenship through educational activities aimed at preventing cyberbullying and fostering the critical use of emerging technologies, including Artificial Intelligence (AI). More specifically, the study sought to assess the prevalence of cyberbullying-related behaviours in the university context, design and implement an interdisciplinary intervention, and examine the potential of teaching coordination and active student participation as prevention strategies.

A mixed-methods research design was adopted. In the quantitative phase, a validated cyberbullying scale was administered to a sample of 368 undergraduate and master's students from the Faculty of Education Sciences. Based on the findings of the initial assessment, a coordinated intervention was implemented in which students participated in designing multimodal awareness-raising resources, with a particular emphasis on digital formats (videos, infographics, and multimedia materials). These resources were subsequently disseminated through social media platforms (TikTok and Instagram: @tiempomuertoalbullying) and other knowledge transfer initiatives.

The findings indicate that cyberbullying remains present in the university context. A total of 27.7% of participants reported sharing personal information about others without their consent; 19.6% admitted insulting or ridiculing others through digital media; and 17.9% acknowledged making nuisance phone calls. Although more severe behaviours were reported less frequently, their presence highlights the need to implement preventive programmes within initial teacher education. Furthermore, the intervention promoted the development of students' digital, ethical, and communication competences while strengthening interdisciplinary collaboration among the participating faculty members.

The findings suggest that preventing cyberbullying in Higher Education requires an institutional approach integrating assessment, training, teaching coordination, and active student participation. They also support the systematic integration of initiatives of this kind across teacher education programmes, contributing to the preparation of future teachers capable of fostering safe, ethical, and responsible digital environments.

Keywords: Cyberbullying; Higher Education; Initial Teacher Education.

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What Should Educational AI Know? A Pedagogical Necessity Framework for Student Data

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Educational artificial intelligence (AI) and learning analytics increasingly rely on student data to support personalized feedback, adaptive learning pathways, risk identification, and automated assistance. Existing governance approaches have given growing attention to data security, privacy protection, transparency, classification, and legal compliance. However, they appear to offer less specific guidance on a prior educational question: under what conditions might a particular type of student data be considered pedagogically necessary? This study aims to operationalize pedagogical necessity in educational data governance by developing a Minimum Pedagogically Necessary Data framework for AI-enabled learning environments. The study adopts a design-oriented conceptual approach that combines critical comparative policy analysis, concept synthesis, and scenario-based illustration. Recent Chinese and European policy and guidance documents concerning educational AI, student data governance, responsible technology use, and school-level procurement are examined in relation to purpose limitation, proportionality, pedagogical relevance, learner agency, institutional responsibility, data retention, and secondary use. These principles are then synthesized with educational decision-making logic to distinguish data that are technically available, statistically predictive, or broadly relevant from data that may be necessary for a specific pedagogical action. The analysis identifies a recurring implementation gap: current frameworks increasingly emphasize responsible, transparent, and proportionate data use, yet often provide limited operational guidance for determining pedagogical necessity in school practice. In response, the study proposes a six-part framework comprising legitimate pedagogical purpose, pedagogical-action binding, incremental educational value, lower-intrusion alternatives, proportionality of data scope and retention, and learner agency and accountability. The framework is further illustrated through three constructed scenarios involving facial-expression recognition, long-term retention of AI-tutor conversations, and the use of family-background data for learning-risk prediction. These conceptual applications suggest that statistical relevance or improved predictive accuracy may not, by themselves, provide sufficient pedagogical justification for data collection. A stronger justification may require evidence that the data inform a clearly specified educational decision, support a feasible and appropriate pedagogical action, add meaningful value beyond less intrusive alternatives, and remain proportionate in granularity, identifiability, duration, and reuse. The study concludes that educational AI governance may benefit from complementing post-collection protection with prior pedagogical justification. It recommends that schools request explicit data–function–action mappings during AI procurement, that developers provide minimum-data configurations and accessible deletion mechanisms, and that educators examine whether collected information can reasonably contribute to identifiable and actionable learner support.

Keywords: Educational Artificial Intelligence, Student Data Governance, Pedagogical Necessity, Data Minimization, Personalized Learning

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Beyond Final Scores: Identifying Behavioural Decision-Making Profiles from Cybersecurity Simulation Log Data

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Simulation-based learning provides opportunities for learners to practise complex decision-making in authentic contexts while generating rich behavioural data that extend beyond traditional performance measures. In cybersecurity education, although technical laboratories and capture-the-flag activities develop important practical skills, they do not always represent the organisational, ethical, financial and human pressures involved in cybersecurity management. Learning analytics has traditionally focused on performance outcomes, yet these measures often reveal little about the decision-making processes that underpin learner behaviour. To address this challenge, a browser-based cybersecurity management simulation was developed for Level 6 and Level 7 cybersecurity students. The simulation places learners in the role of a cybersecurity manager and presents 15 organisational incidents, each offering three possible responses with consequences for security, budget, reputation, staff morale and board happiness. Each playthrough generates a decision log that records the sequence of choices made, providing a detailed account of how learners respond to risk and balance competing priorities over time. This study examines how these decision logs can be used within learning analytics to identify decision-making strategies that cannot be understood from final scores alone, thereby providing a richer understanding of learners' decision-making processes within simulation-based cybersecurity education.

Following data preparation and validation, 136 playthroughs were available for analysis, including 2,009 decision-level observations. Of these, 125 included all 15 scenarios, while 11 ended early because the simulated organisation became bankrupt. These early-ending runs were retained as meaningful gameplay outcomes.

To move from this cleaned dataset to an analysis of learner strategies, a theory-informed coding framework classified the 45 available decision options across four behavioural dimensions: decision orientation, risk management approach, human-element governance, and transparency strategy.

These codes were then linked to the decision logs, allowing each playthrough to be represented as a proportional behavioural profile. Because the number of recorded decisions differed between complete and early ending runs, proportions were used instead of raw counts. Final simulation scores were deliberately excluded from the clustering process to ensure that the resulting groups reflected patterns of decision-making rather than performance outcomes. Multiple clustering approaches, including k-means, agglomerative clustering, Gaussian mixture models, spectral clustering and DBSCAN were compared using silhouette scores, cluster-size distributions and interpretability. K-means with k = 4 was selected as the optimal solution.

This solution produced four behavioural decision-making profiles: Adaptive Balancers, Detached Operators, Surveillance Regulators and Protective Controllers. These profiles differed in risk tolerance, security prioritisation, operational focus, staff governance, monitoring and transparency, and were associated with different final outcome patterns. By transforming raw decision logs into interpretable behavioural profiles, the analysis revealed broader decision-making strategies that final scores alone could not capture. In this way, the study contributes to learning analytics by transforming decision logs into interpretable

evidence that can support structured reflection, personalised feedback, adaptive simulation design, and the continued development of simulation-based cybersecurity learning. More broadly, the findings demonstrate the value of behavioural profiling for understanding complex decision-making in educational simulations, and provide a foundation for future research into learner modelling within AI-supported and simulation-based learning environments.

Keywords: Simulation-Based Learning; Decision-Making; Learning Analytics; Cyber Security

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A Multilevel Comparison of Student- and School-Level ICT Factors on Mathematical Literacy in Türkiye, Chinese Taipei, and Japan: Evidence from PISA 2022

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Although Information and Communications Technology (ICT) has transformed global education, increased digital access does not guarantee improved academic outcomes—a phenomenon termed the "ICT paradox" (Rohatgi et al., 2016; OECD, 2023a, 2023b). To explore this, this study uses PISA 2022 data to analyze the multilevel relationship between ICT factors and mathematical literacy in Türkiye, Chinese Taipei, and Japan. The research investigates the variance in math performance attributable to school- versus student-level factors, and evaluates how ICT availability, usage, and self-efficacy impact achievement.

Using MLMusingR (F. Huang, 2025) and lme4 (Bates et al., 2015), this study applies two-level Hierarchical Linear Modeling (HLM). We included all 10 plausible math literacy values to address measurement error, applying senate weights for national representativeness (OECD, 2009; Raudenbush & Bryk, 2002; Rutkowski et al., 2010), alongside factor-coding, scaling, and z-scores (Luke, 2020). The sample comprises 15-year-olds nested in schools: Türkiye (n=6,272; 191 schools), Chinese Taipei (n=4,829; 160 schools), and Japan (n=4,543; 154 schools).

Between-school differences explain 59.0%, 39.7%, and 52.7% of math literacy variance in Türkiye, Chinese Taipei, and Japan, revealing highly stratified systems. Across all three, a school's aggregate economic, social, and cultural status (ESCS) is the strongest predictor of achievement. ICT effects are nuanced: subject-specific ICT use in math classes positively predicts scores (significantly in Türkiye and Japan), whereas general ICT access and ICT-based feedback typically correlate negatively with achievement. Regionally, school-level ICT quality boosted performance in Japan but lowered it in Türkiye.

These results highlight the dominance of school socio-economic composition and confirm the ICT paradox: bridging the digital divide involves more than simply providing hardware (Rohatgi et al., 2016). While targeted, subject-specific technology boosts cognitive activation in mathematics, widespread, unstructured access can impair proficiency. Consequently, policymakers and educators must shift from merely expanding device availability toward optimizing subject-specific digital integration, ensuring technology actively drives rigorous problem-solving rather than passive consumption.

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Keywords: Mathematical Literacy, Hierarchical Linear Modeling, Multilevel Modeling, ICT Integration, PISA 2022, Comparative Education, Cross-national Comparison, Educational Equity

(608)

Designing Immersive Learning for Preservice Teachers to Teach Emerging Digital Technologies: The Adaptive Pedagogical Readiness Architecture (APRA)

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The rapid advancement of artificial intelligence (AI), cybersecurity, computational thinking, and other emerging digital technologies is reshaping educational systems and expanding expectations for K–12 teachers. Beyond integrating technology into instruction, teachers are increasingly expected to develop the knowledge, pedagogical confidence, and adaptive decision-making skills needed to teach these evolving subject areas. However, many preservice teacher preparation programs provide limited opportunities for authentic practice in designing and facilitating instruction for emerging digital technologies. While immersive learning has shown promise for supporting teacher education, existing instructional design models, immersive learning frameworks, and teacher readiness research offer limited guidance for intentionally designing immersive learning experiences that cultivate the pedagogical capabilities required for teaching rapidly evolving digital technologies.

This conceptual paper proposes the Adaptive Pedagogical Readiness Architecture (APRA), a conceptual instructional design architecture that guides the design of immersive learning experiences for preparing preservice teachers to teach emerging digital technologies. APRA synthesizes complementary perspectives from Experiential Learning Theory, Situated Learning Theory, Adaptive Expertise, Reflective Practice, Cognitive Apprenticeship, and evidence-informed instructional design to create a coherent approach for fostering adaptive pedagogical readiness. Rather than functioning as a linear instructional model, APRA organizes these theoretical foundations into six interconnected design principles: authentic professional contexts, adaptive pedagogical decision-making, reflective and iterative learning, collaborative knowledge construction, evidence-informed design and feedback, and transfer to professional practice.

Unlike existing instructional design models and immersive learning frameworks that primarily emphasize technology integration, learning experiences, or instructional processes, APRA focuses on intentionally preparing preservice teachers to confidently teach emerging digital technologies through immersive learning. The architecture is illustrated using examples from AI and cybersecurity education while remaining applicable to other emerging digital domains as educational technologies continue to evolve. By positioning immersive learning as a pedagogically driven approach for developing professional capability, this paper contributes a theoretically grounded instructional design architecture that supports teacher educators and instructional designers in preparing future educators for an increasingly technology-rich educational landscape.

Keywords: Adaptive Pedagogical Readiness Architecture (APRA); Immersive Learning; Preservice Teacher Education; Instructional Design; Emerging Digital Technologies; Artificial Intelligence; Cybersecurity.

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Visualizing the Unseen: Virtual Reality as a Tool for Concretizing Abstract Biology Content and Lowering Cognitive Barriers, A Conceptual Framework

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Introductory biology courses at the undergraduate level ask students to reason about content that cannot be seen directly, including cellular structures, molecular interactions, and physiological processes such as cellular respiration and cell division. Students are typically asked to build understanding of these processes from static, two-dimensional diagrams and verbal explanation alone, which places a heavy demand on working memory and has been linked to disengagement in gateway biology courses. This conceptual paper proposes a framework for using virtual reality as an instructional strategy to reduce cognitive load and make abstract biological content more concrete for undergraduate learners. The purpose of the framework is to translate principles from cognitive load theory into practical design guidance for instructors and instructional designers building VR-based biology instruction. The method for this paper is a literature-based synthesis; existing research on immersive virtual reality in undergraduate biology and molecular science education is reviewed and organized around the goal of reducing extraneous cognitive load. Building on this literature, the paper outlines design principles intended to manage extraneous load in immersive environments, including guided navigation, scaffolded complexity, and controlled interactivity, so that working memory capacity is preserved for germane processing rather than consumed by the mechanics of the VR interface itself. As an illustrative example, the framework considers how a VR module might allow a student to move through the stages of cellular respiration or observe the sequence of events in cell division in a spatial, navigable environment rather than through a static diagram. The paper also addresses practical constraints instructors are likely to face, such as cost, access to headsets, and the time required to build instructor comfort with the technology. The paper concludes with recommendations for future empirical work, including classroom-based studies comparing VR instruction with traditional visualization methods, and calls for closer collaboration between instructional designers and biology faculty during the design process.

Keywords: virtual reality, cognitive load, undergraduate biology education, immersive learning, instructional design

Keywords: Virtual Reality, Cognitive Load, Undergraduate Biology Education, Immersive Learning, Instructional Design

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A Four-Stage Digital Storytelling Framework for Fostering Bilingual Competence and Digital Resilience in Vocational Teaching

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Secondary vocational education serves as a vital component of both the national education system and the overall development of human resources. Nowadays, secondary vocational institutions in China's border territories face two intertwined educational bottlenecks. Standardized English curricula rarely align with the practical communication demands of local equestrian industries, while digital technologies remain underutilized for developing students' bilingual proficiency and long-term digital resilience. This study proposes and conceptualizes a four-stage digital storytelling framework — Perceive, Construct, Dramatize, Create — tailored for equestrian vocational training programs in Guangxi, China.

Drawing on three established educational theories , namely work-integrated learning, narrative pedagogy, and digitally enhanced instruction , the framework establishes a three-tier learning pipeline covering virtual simulation, contextualized role-play, and authentic on-site industry practice. All AI and digital tools are fully integrated into every teaching session rather than acting as separate auxiliary resources. The study develops reusable bilingual teaching materials rooted in authentic equestrian workplace scenarios.

A one-semester quasi-experimental design is planned for experimental and control groups. Pre-test and post-test data will track learner progress across five dimensions, namely equestrian English proficiency, situational workplace communication, digital literacy, bilingual media production, and awareness of the Chinese local ethnic culture. These quantitative findings will be triangulated with student-generated digital outputs and evaluation feedback collected from industry practitioners.

This study contributes a transferable, sustainable teaching model for resource-constrained border vocational schools. By outlining a systematic framework for integrating AI-supported narrative pedagogy into industry-aligned language instruction, this research provides a conceptual foundation for future empirical investigation and offers actionable insights into AI-supported language learning and responsible digital citizenship, which are two essential capacities for volatile future careers.

Keywords: Digital Storytelling; Work-integrated Vocational Education; Bilingual Teaching; Digital Literacy; AI-enhanced Language Instruction; Educational Resilience

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Exploring the Interconnections: Predictors and Mediators of Internet, Mobile Phone, Social Media Addiction, and Technology Usage Behaviors of University Students

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Despite the advantages provided by the internet and social media as educational technology, the alarming rise of excessive usage among university students has been shown to adversely impact their academic, professional, and family well-being. While recent research has explored the demographic and psychological factors influencing technology addictions, limited studies have examined which type of technology addiction acts as a precursor to the others or how these dependencies are shaped by various mediators. To address these gaps, this research aims to delineate a pervasive issue of internet addiction, mobile phone addiction, and social media addiction, highlighting their associations simultaneously by investigating the interaction among these technology addictions and technology usage behaviors, examining the predictors and mediating effects. The study utilized a correlational research method and involved 280 university students in Türkiye with ages ranging from 18 to 41. Data collection tools included a demographics form, the Mobile Phone Addiction Scale, Internet Addiction Scale, and Social Media Addiction Scale. Descriptive analyses indicate that students spend an average of approximately 5.50 hours per day on smartphones, 5.06 hours on the internet, and 3.32 hours on social media platforms. Regarding the dimensions of technology addiction types, it was observed that the values for academic problems, virtual problems, and negativity in social relationships were notably high. Regression and mediation analysis revealed that the models with the strongest explanatory power were social media addiction or social media use hours as predictors, mobile phone addiction as the mediator, and internet addiction as the criterion variable. These results suggest that social media engagement significantly contributes to the development of both mobile phone addiction and internet addiction. This study had the novel finding that among technology usage predictors, only daily social media use significantly predicted all three addiction types. Future research should investigate the underlying causes of social media addiction while considering the interconnected nature of technology addictions and specific aspects of social media contributing to addictive behaviors.

Keywords: Mobile Phone Addiction, Internet Addiction, Social Media Addiction, University Students, Technology Addiction, Technology Use Behaviors

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Enhancing Interview Discourse through A Two Phase AI-Assisted Task Adverb Enrichment: A Case Study in Vocational College English

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Background: While AI-assisted writing has gained increasing attention in higher education, existing research has mainly focused on academic writing in university settings. Limited attention has been paid to how AI tools can be applied to enhance vocational college students' lexical quality in occupation-specific communication, particularly in job interview discourse in ESP contexts.

Objective: This case study investigates how a two-phase AI-assisted adverb-enrichment task, designed around the teaching unit “Job Interviews” in terms of the learning objectives and the grammatical focus on adverb usage, can enhance the lexical quality and communicative effectiveness of vocational college students' interview responses.

Method: From a corpus of 250 paired student assignments collected from a higher vocational college in China, three exemplary cases were purposively selected for in-depth analysis. A researcher-developed analytic rubric covering five dimensions—Lexical Richness and Diversity, Adverb Use: Range and Appropriacy, Linguistic Accuracy and Fluency, Communicative Effectiveness for Interview, and Task Completion and AI Integration—was employed to evaluate the post-enrichment texts.

The two-phase AI-assisted adverb-enrichment task, explicitly aligned with unit-level instructional objectives for job interview communication and adverb grammar, effectively enhanced vocational students' lexical quality and interview discourse at both the lexical and pragmatic levels. The combination of AI scoring and human rating provided a robust, multidimensional assessment framework that captured both lexical features and communicative effectiveness.

Key Findings: The findings revealed that students effectively used AI to enrich adverbs and lexical quality through selective or comprehensive strategies, resulting in marked gains in adverb density, diversity, and overall lexical range. The post-enrichment responses were characterized by strategic deployment of stance and manner adverbs that projected confidence and professionalism, alongside improved lexical richness, fluency, and interview persuasiveness. Successful human-AI collaboration was consistently marked by active learner agency—critical evaluation, selective integration, and alignment of adverb choices with communicative goals—rather than passive copying.

Implications: This study demonstrates that a structured, two-phase AI-assisted task targeting a discrete linguistic feature can effectively enhance vocational students' lexical quality and interview discourse. The findings highlight the pedagogical value of aligning AI-mediated tasks with specific course learning objectives and communicatively potent language features. The task offers a replicable model for embedding purposeful human-AI collaboration into ESP smart curriculum design, fostering not only linguistic gains but also learner agency in evaluating and integrating AI-generated language.

Keywords: AI-assisted Language Learning, Adverb Enrichment, Vocational College English Education, Case Study, ESP

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From "Human-Technology" to "Human-Intelligence": Constructing a Five Communion–Four Stage Two Dimensional Matrix Model for Smart Education

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Driven by the rapid iteration of generative artificial intelligence and the in-depth promotion of global educational digital transformation, the field of smart education has witnessed a fundamental paradigm shift in the human-machine relationship. The traditional instrumental "human-technology" relationship merely positions intelligent technologies as auxiliary teaching tools, which overlooks human subjective initiative and bidirectional co-evolution between humans and AI. Against this backdrop, this study aims to reconstruct a more adaptive relational framework, namely the ecological "human-intelligence symbiosis" centred on subjective interaction and coordinated evolution, which fills the theoretical gap of human-AI relational research tailored to intelligent education scenarios. This research adopts theoretical deduction and systematic framework construction as its core methodologies. Grounded in symbiosis theory, constructivist learning theory and canonical smart education theories, it firstly sorts out the historical evolution logic of human-machine relationships in educational contexts, and then innovatively develops a two-dimensional matrix model for human-intelligence symbiosis. The horizontal X-axis is defined as the Five-Communion Full Chain covering all ecological stakeholders in education, and the vertical Y-axis refers to the Four-Stage Progression that describes the deepening process of human-AI interdependence.

The key finding reveals that the proposed two-dimensional matrix can systematically categorise diverse interactive modes between educators, learners and AI agents, and clearly delineate the progressive boundary from simple tool use to deep symbiotic integration. This structured framework effectively distinguishes itself from previous one-dimensional human-technology models. The research outcomes not only enrich the theoretical system of human-intelligence symbiosis within smart education, but also deliver tangible theoretical references and practical inspirations. It can guide curriculum design, personalised instruction and educational assessment reform, providing actionable guidance for institutional digital transformation under the widespread application of generative artificial intelligence.

Keywords: Human-Machine Symbiosis, Human-technology Relationship, Five-Communion Full Chain, Four-Stage Progression, Two-dimensional Matrix Model, Smart Education, Educational Digit

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A Study on Integrating AI, Gamification, and Mobile Learning to Prepare Students' Resilience for the Future Workforce

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In an era of rapid AI advancement and intensifying labour market volatility, preparing students for uncertain career futures has emerged as a critical challenge in vocational education. The displacement of routine jobs by automation and the emergence of new, often non-traditional occupations demand that graduates not only possess language proficiency but also demonstrate resilience, adaptability, and creative confidence. Conventional vocational English instruction, which tends to prioritise decontextualised grammar and vocabulary drills, is ill-equipped to meet these evolving demands. This paper presents an innovative four-stage pedagogical model that systematically integrates AI-generated content, gamification, and mobile learning to bridge language education with career readiness. The model was implemented in a College English course for first-year art and design majors at a Chinese higher vocational college. The intervention unfolds as follows: (1) the generative AI tool Doubao is employed to produce job cards featuring unusual occupations, helping students' understanding of the basic elements of job descriptions, and meanwhile broadening students' vocational horizons; (2) students engage in gamified group activities, including random card-drawing and collaborative task completion, to enhance motivation and peer interaction and to improve the efficiency of class management; (3) drawing on their disciplinary expertise in visual design, students create their own "My Creative Art Job" cards; and (4) as a culminating summative assessment, each student produces an individual video project on "My Dream Job", recorded in their own voice and submitted via the Chaoxing Xuexitong mobile platform, accompanied by a written script of over 100 words. Theoretically, the model is grounded in constructivism, self-determination theory, and blended learning theory, which collectively explain how active exploration, gamified engagement, and online-offline integration foster meaningful learning. Preliminary observational data suggest that students not only improved their English proficiency but also developed enhanced career imagination, creative confidence, and a heightened sense of responsibility for their own future. This paper argues that the deliberate, critically mediated use of AI—positioning it as a stimulus for inspiration rather than a substitute for cognitive effort—offers a practical reference for educators concerned about student over-reliance on generative technologies. The model thus provides a replicable and transferable AI driven career teaching framework for vocational English teachers seeking to align language instruction with the urgent imperative of preparing resilient, future-ready graduates.

Keywords: AI in Education; Gamification; Mobile Learning; Student Resilience

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Multicriteria Decision Making in Mathematics Education in Türkiye: A Systematic Mapping of Graduate Theses

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Decisions in educational settings, particularly in mathematics education, require balancing multiple, often conflicting, criteria such as student needs, curriculum objectives, and resource constraints. While multicriteria decision making (MCDM) methods are increasingly utilized in global educational research, their application within Turkish mathematics education remains largely unexplored. The purpose of this study is to systematically map the landscape of graduate theses applying MCDM in mathematics education in Türkiye, identifying the scope, specific application areas, methodological techniques, and reported limitations.

This study employed a systematic mapping methodology integrated with the PRISMA 2020 reporting protocol. The Council of Higher Education (YÖK) National Thesis Center was used as the single data source. A comprehensive set of 51 search queries, spanning from January 2000 to May 2026, yielded 546 raw records. After deduplication, 298 unique records were screened independently by two researchers at the title and abstract level. Following rigorous eligibility assessments based on inclusion and exclusion criteria, six master's theses were included in the final review. Data were extracted and evaluated using a standardized form.

The analysis of the six included theses revealed four distinct descriptive patterns. First, the methodological approaches were heavily concentrated in the Analytic Hierarchy Process (AHP) family, with only two studies exploring alternative methods like nano-topology and Z-MABAC. Second, the decision problems clustered narrowly into three areas: identifying factors affecting mathematics achievement, measuring student achievement as an alternative to traditional assessment, and selecting instructional methods. Third, a notable academic gap exists, as all identified studies were at the master's level, with zero doctoral dissertations found. Finally, the computational infrastructure was largely manual or spreadsheet-based, with no use of professional MCDM software or advanced programming environments reported.

The intersection of MCDM and mathematics education in Türkiye is currently at an early, formative stage. The findings suggest several critical priorities for the maturation of the field. First, there is a strong need to broaden the methodological repertoire beyond AHP by incorporating established techniques such as TOPSIS, DEMATEL, PROMETHEE, and VIKOR, and by encouraging comparative validation studies. Second, promoting doctoral-level research with larger sample sizes and longitudinal designs is essential. Lastly, integrating professional MCDM software and general computational environments into graduate mathematics education research is necessary to overcome current scaling barriers. Researchers must also carefully address the ethical and validity implications of using subjective MCDM tools for high-stakes student classifications.

Keywords: Multicriteria Decision Making, Mathematics Education, Systematic Mapping, Graduate Theses, Analytic Hierarchy Process

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Diagnosing Algebraic Misconceptions with LLMs: Comparing Zero-Shot and Few-Shot CoT Strategies

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Providing every learner with immediate, individualised and pedagogically substantive feedback is difficult in crowded classrooms, and it becomes considerably harder in open, distance and flexible learning settings, where teacher–learner interaction is sparse and learners increasingly turn to generative AI as a personal tutor. This study comparatively examines how three widely accessible large language models (GPT-5.5 Instant, Gemini 3.5 Flash, Claude Sonnet 5) diagnose middle-school students' misconceptions in algebraic expressions under two prompting strategies - Zero-Shot and Few-Shot Chain-of-Thought (CoT) - and asks what the resulting patterns imply for scalable, teacher-supervised diagnostic feedback in open and distance learning (ODL).

The study adopts a holistic multiple-case design within the qualitative paradigm, treating each model as a case. Eighteen scenarios grounded in six algebraic misconception categories documented in the literature (six text-based, six visual - concept cartoons and handwritten solutions - and six misconception-free control scenarios) were submitted to each model as single-turn prompts under six conditions (3 models × 2 strategies), yielding 108 outputs. The 72 misconception outputs are scored with a 12-criterion analytic rubric spanning four dimensions (diagnosis and understanding; accuracy and completeness; pedagogical explanation quality; language and communication), derived from Shulman's pedagogical content knowledge and the AIPACK framework. The 36 control outputs are analysed through a four-way coding scheme (accurate recognition; unnecessary flaw attribution; false positive; missed nuance). Only free, publicly available model tiers were used, to ensure replicability and equity of access. Data collection is ongoing: scoring by the first rater is complete, whereas ratings from the second and third independent raters are pending; inter-rater reliability will be computed with Krippendorff's alpha once all ratings are returned.

All three models performed near ceiling on misconception scenarios (M = 29.4/30, SD = 0.92), with 97% of outputs in the "exemplary" band. Few-Shot CoT surpassed Zero-Shot in both mean (29.78 vs 29.03) and variance (SD 0.42 vs 1.12), yet the gain was model-dependent: Δ = +1.50 for GPT-5.5 Instant, +0.50 for Claude Sonnet 5, +0.25 for Gemini 3.5 Flash. The more informative differences were behavioural rather than numerical. Three costs appeared exclusively under Zero-Shot: self-scoring inflation, omission of the misconception-to-correct "bridging" step (9/9 instances), and attribution of nonexistent flaws to flawless control solutions (3/3 instances, all GPT-5.5 Instant). Conversely, on one semantic-category control scenario both ChatGPT and Claude missed a genuine curriculum-based conceptual nuance under both strategies, while Gemini detected it consistently. In visual scenarios, diagnostic content transferred reliably, whereas peripheral descriptive details did not.

In ODL contexts, where oversight is asynchronous and sparse, prompt design appears to govern not merely average accuracy but the predictability of model behaviour. The fixed reasoning template of Few-Shot CoT suppressed self-flattery and over-diagnosis, both of which constitute direct pedagogical risks in autonomous tutoring. A practitioner-oriented prompt template is offered, while teacher-in-the-loop verification remains indispensable.

Keywords: Open And Distance Learning, Algebraic Misconceptions, Large Language Models, Chain-of-thought, Diagnostic Assessment

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Determining the Factors Affecting the Selection of Educational Mobile Applications and Creating a Strategic Plan: A Fuzzy Delphi and Fuzzy DEMATEL Approach

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The rapid proliferation of educational mobile applications necessitates comprehensive evaluation frameworks. Building upon the field experiences and insights gained from two nationwide professional development projects funded by the Scientific and Technological Research Council of Türkiye (TÜBİTAK)-which focused on training teachers to integrate educational mobile applications into classrooms-this study aims to develop a robust, multi-dimensional evaluation model for K-12 educational mobile applications. The primary objective is to systematically categorize a large pool of literature-derived evaluation criteria and subsequently determine the causal relationships and interdependencies among these finalized categories.

This ongoing research employs a hybrid Multi-Criteria Decision Making (MCDM) design, integrating the Fuzzy Delphi method and the Fuzzy DEMATEL (Decision Making Trial and Evaluation Laboratory) technique. Initially, a comprehensive literature review yielded a diverse pool of 181 distinct criteria. Rather than imposing a predetermined structure, the Fuzzy Delphi method is currently being applied with a panel of five experts (comprising two authors and three field experts who instructed in the aforementioned national teacher training projects) to systematically group, reduce, and categorize these 181 criteria. Following this categorization phase, Fuzzy DEMATEL will be utilized to analyze the causal interactions among the established categories. The expert panel will populate the decision matrix using linguistic variables -Very Low, Low, Medium, High, and Very High- to evaluate the degree of influence each category exerts on the others.

As the data collection phase is currently underway, the anticipated findings revolve around two main outputs. First, the Fuzzy Delphi application is expected to successfully distill the 181 initial criteria into a validated, structured categorical framework (encompassing dimensions such as pedagogical quality, technical functionality, and usability). Second, the Fuzzy DEMATEL analysis is expected to divide these categories into "cause" and "effect" groups, revealing which underlying factors primarily drive the overall quality of educational mobile applications and which factors are dependent variables.

This study bridges the gap between extensive academic literature and practical field experience derived from nationwide teacher training initiatives. The resulting causal model will offer a strategic roadmap for software developers designing educational applications and provide educators with an evidence-based rubric for selecting effective digital tools. By identifying the root "cause" criteria, educational technologists can allocate resources more efficiently to maximize pedagogical impact.

Keywords: Multi-Criteria Decision Making, Educational Mobile Applications, Educational Technology, Fuzzy Delphi, Fuzzy DEMATEL

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From AI Literacy to Responsible Digital Citizenship: The Mediating Role of Digital Competence and the Moderating Role of AI Self-Efficacy

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Artificial Intelligence (AI) has revolutionized the landscape of higher education, reshaping the way students learn, connect with one another, and engage with digital tools. Being able to use AI tools doesn't necessarily mean students have the knowledge and skills to critically analyze AI-produced content, understand the concept of algorithmic bias, ensure that their personal information is protected, understand how to spot misinformation, or understand how to use AI tools in an ethical way in digital spaces. In addition to technical skills, AI literacy involves understanding, assessing, and communicating with AI, as well as interacting responsibly with AI (Long & Magerko, 2020; Ng et al., 2021; Lintner, 2024). Similarly, ethical, critical and responsible engagement in digital communities is a key part of responsible digital citizenship (Choi et al., 2017; Arkorful et al., 2024). AI literacy has sparked increased research and academic interest, but there is limited empirical evidence explaining how AI literacy relates to responsible digital citizenship, especially within the context of higher education. Recent studies also highlight the need to cultivate AI literacy in conjunction with digital competence, ensuring that students are equipped to engage with AI in learning environments responsibly (Farias-Gaytan et al., 2023; Tubella et al., 2024).

The purpose of this study is to explore how AI Literacy is correlated with Responsible Digital Citizenship among university students. In particular, it explores the mediation of Digital Competence between AI literacy and responsible digital behavior, as well as the moderation of the link between AI literacy and Digital Competence by AI Self-Efficacy.

The design of the research in this study was quantitative, cross sectional, with research that focuses on the positivist research paradigm. The data was gathered from 374 students of public and private universities, in Karachi, Pakistan, using a structured questionnaire filled out by the students, who were both undergraduate and postgraduate. Items for measuring AI Literacy, Digital Competence, Responsible Digital Citizenship and AI Self-Efficacy were drawn from validated scales previously used in the literature (Ng et al., 2021; Choi et al., 2017; Falloon, 2020). The proposed model was analyzed by Partial Least Squares Structural Equation Modeling (PLS-SEM) software SmartPLS 4. The proposed relationships were assessed using reliability, convergent validity, discriminant validity, explanatory power, effect sizes, mediation and moderation analyses.

The results showed that Digital Competence is significantly influenced by AI Literacy, and AI Literacy is significantly influencing Responsible Digital Citizenship. There was a non-statistically significant direct correlation between AI Literacy and Responsible Digital Citizenship. But, this relationship was partially mediated by Digital Competence, meaning that students' AI literacy has a positive effect on their digital behaviour mainly through their digital competence. Moreover, AI Self-Efficacy also significantly moderated the relationship between AI Literacy and Digital Competence, with digital competence gains being greater when students had higher levels of AI-related ability.

The study shows that AI literacy is not enough to promote Responsible Digital Citizenship without robust digital competences. The results emphasize the need to foster AI literacy and digital competence formation alongside empowering students' self-assuredness in the responsible use of AI technologies. AI ethics, misinformation detection, awareness of

algorithmic bias, evaluation of digital information, protection of privacy and responsible practices with AI should be part of the curriculum of universities to equip their students with ethical skills to engage in increasingly AI-influenced digital societies.

Keywords: AI Literacy; Digital Competence; Responsible Digital Citizenship; AI Self-efficacy; Higher Education; PLS-SEM.

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Teachers' Technology Proficiency Self-Assessments

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Self-assessment is the process by which an individual examines their own knowledge, skills, performance, and level of development according to specific criteria to identify their strengths and areas for improvement. Teachers' technological proficiency is not limited to basic computer use or the ability to access digital tools. This proficiency includes the ability to use technology for pedagogical purposes, design digital content and learning environments, facilitate students' active participation in technology-supported learning processes, and integrate digital tools in a way that aligns with instructional goals. This study aimed to investigate teachers' technology proficiency self-assessments. The study was designed in survey research model. Sample of the study, consisted of 283 teachers working in public schools in Türkiye. Research data was collected using a personal information form and the "Technology Competence Self-Assessment Scale for 21st-Century Learning". Descriptive statistics, independent groups t-test, one-way analysis of variance were used for analysis of the data. As a result of research, it was found that teachers' technology proficiency self-assessments were at a high level. It was also found that participants self-assessed their proficiency as high in basic internet use and information access skills but self-assessed their proficiency as lower in areas requiring more technical and pedagogical technology skills, such as saving documents in different file formats and using online tools in the teaching process. Teachers' technology proficiency self-assessments demonstrated significant differences based on gender (in favor of female participants), occupational position (in favor of managers), educational attainment (in favor of graduates from two-year college or undergraduate program), computer ownership (in favor of personal computer owners), attending in digital security related courses (in favor of participants attending in digital security-related courses), and familiarity with concept of 21st-century skills (in favor of participants familiar with the concept of 21st-century skills) but no significant difference was found based on professional work experience. Based on these results, it was recommended that technology focused in-service training programs be developed to enable teachers to safely integrate 21st-century skills into their educational environments.

Keywords: Teacher, Technology Proficiency Self-assessments, 21st Century Learning

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Teachers' Digital Data Security Awareness

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Digital data security is a combination of technical, administrative, and behavioral measures intended to protect data generated, stored, processed, and shared in electronic environments against threats such as unauthorized access, change, damage, exposure, or destruction. Digital data security awareness is defined as the ability of individuals to recognize the risks they may encounter in digital environments, develop appropriate measures against these risks, and demonstrate secure digital behavior. Digital data security awareness in educational institutions is required to ensure the security of data, such as students' personal information, academic records, digital materials, online activity data, and communication records, to prevent violations of student privacy, to prevent the sharing of personal data with unauthorized individuals, and to prevent risks such as cyberbullying, identity theft, and institutional security weaknesses. Therefore, teachers' digital data security awareness is important not only in terms of individual technology use but also in terms of protecting student rights, school safety, and ethical responsibilities. This study aimed to investigate teachers' digital data security awareness. The study was conducted with survey research model. Sample of the study consisted of 283 teachers working in public schools in Türkiye. Research data were collected using a personal information form and the "Digital Data Security Awareness Scale". Descriptive statistics, independent groups t-test, one-way analysis of variance were used for analysis of the data. It was found that teachers' digital data security awareness were at a high level. The results indicated that participants' awareness was higher regarding individual and everyday digital security practices such as password security, and lower regarding subjects requiring more technical knowledge such as firewall software and malware. It was found that teachers' digital data security awareness differed significantly according to gender (in favor of male participants), attending in digital security related courses (in favor of participants attending in digital security-related courses), and familiarity with concept of 21st-century skills (in favor of participants familiar with the concept of 21st-century skills), but there were no significant differences based on occupational position, educational attainment, professional work experience, and computer ownership. Based on these results, it was recommended that digital data security focused in service training programs be developed to enable teachers to safely integrate technology into their educational environments.

Keywords: Digital Data Security Awareness, Teacher, Survey Research Model

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Designing an Immersive Virtual Reality-Based Extracurricular STEM Activity for Gifted Middle School Students: The Case of "Pain and Painkillers"

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Gifted students need interdisciplinary and enriched extracurricular activities that extend beyond the standard curriculum and stimulate higher-order thinking skills. Immersive virtual reality (IVR) has increasingly been used in the science education of gifted students in recent years. However, the literature includes relatively few studies that transform IVR content based on authentic scientific research into pedagogically sound and directly implementable extracurricular activities designed specifically for gifted students. This study aims to design an extracurricular STEM activity for gifted middle school students and to evaluate the activity based on the views of science teachers who work with gifted students. The activity was developed on the basis of the IVR simulation entitled Pain and Painkillers, available on the 10k Science platform and supported by the U.S. National Science Foundation (NSF) and the National Institutes of Health (NIH). The simulation addresses how Protoxin-II, a neurotoxin derived from tarantula venom, and morphine interrupt pain signals through different molecular mechanisms. With the support of the 10k Science platform, the simulation was translated into Turkish. Within the activity, the neuroscience content was integrated with an engineering design task. In this task, students are expected to design a conceptual model of a novel analgesic molecule by drawing inspiration from nature through a biomimicry-based approach. The activity was structured as two 90-minute sessions based on the 5E instructional model—Engage, Explore, Explain, Elaborate, and Evaluate—with the engineering design process incorporated into the Elaborate phase of the second session. The activity consists of four main components. The first component involves guided observation during the IVR experience. The second involves students experiencing the simulation in small groups and taking turns because of the limited number of available IVR headsets. While one group participates in the IVR experience, the remaining students work at a different learning station. The third component is an open-ended design task specifying the scientific criteria and constraints that the molecule designed by the students must satisfy. The fourth component is a structured discussion addressing opioid dependence and the ethical dimensions of developing medicines from animal-derived venoms. An expert evaluation form was also developed to assess the scientific content and pedagogical appropriateness of the activity. The form consists of three sections. The first section includes Likert-type items covering six dimensions: scientific accuracy, alignment with learning outcomes, appropriateness for the differentiation needs of gifted students, effectiveness of IVR integration, feasibility of implementation, and the quality of the assessment rubric. The second section includes open-ended questions concerning the strengths of the activity and the aspects requiring further development. The third section requires an overall judgment regarding the suitability of the activity. As of the date of the conference presentation, the activity design and evaluation form have been completed. The evaluation process will be completed by science teachers with experience working with gifted students, and the resulting findings will be incorporated into the presentation.

Keywords: Gifted Students, Immersive Virtual Reality, STEM Education, Extracurricular Activity Design

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A Study on Intelligent Language Teaching: Systematic Framework and Implementation Pathways

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The tension between language teaching's demands for personalization and interactivity and the large-class model's scale and standardization has created a fundamental pedagogical dilemma in contemporary education. Effective language acquisition requires tailored learning pathways, immediate feedback, and immersive communicative practice, while traditional large-class settings prioritize uniformity and efficiency over individual learner differences. Intelligent teaching, which integrates artificial intelligence, big data, and smart platforms, offers a pivotal pathway to resolving this contradiction and achieving "scale-based personalized instruction." To directly address the fundamental conflict between individualized, interactive language learning needs and the structural constraints of large-scale class delivery, this article outlines core strategies and future directions for intelligent language teaching across four interrelated dimensions.

Adopting a systematic design-based research paradigm, this article examines the intelligent transformation of language teaching from four perspectives: teaching process restructuring, skill-specific support, intelligent assessment shifts, and lightweight implementation. First, the teaching process is redesigned as a three-stage cycle, pre-class intelligent diagnosis enabling customized objective setting, during-class human–machine collaboration fostering authentic interaction, and after-class adaptive extension ensuring personalized consolidation. Second, core language skills are developed through domain-specific intelligent assistance: listening and reading via dynamic difficulty adjustment, speaking via speech-recognition-powered feedback, writing via process-oriented tracking and granular assessment, and translation via human–machine collaborative capability cultivation. Third, the evaluation system undergoes three paradigm shifts: from summative to process-oriented assessment, from single scores to multidimensional competency maps, and from empirical judgment to data-driven precise feedback. Fourth, a lightweight and agile implementation path is demonstrated through concrete case studies drawn from multiple language courses, such as workplace English, industry-specific English, and international Chinese teaching, demonstrating its feasibility for diverse institutional contexts, particularly large-class and resource-constrained settings. Together, these findings confirm that intelligent teaching can effectively resolve the tension between personalized, interactive language learning demands and the structural constraints of large-scale class delivery, thereby making "scale-based personalized instruction" an achievable reality in contemporary education.

Keywords: Intelligent Language Teaching; Scale-based Personalized Instruction; Teaching Process Restructuring; Skill-Specific Support; Intelligent Assessment Shifts; Implementation Pathways

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The complexity of using digital tools to teach Northern Sotho negation processes

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The South African Department of Basic Education has encouraged the integration of digital technologies into teaching and learning to improve educational outcomes and prepare learners for participation in a digital society. However, the implementation of digital technologies in the teaching of African indigenous languages remains a significant challenge. This study examines the complexity of using digital tools to teach Northern Sotho negation processes, a grammatical feature that requires learners to understand intricate relationships between sentence structure, meaning, and verb modification. Although digital technologies have the potential to support language learning by providing innovative instructional opportunities, their application in Northern Sotho grammar instruction is often constrained by linguistic, technological, and contextual factors. Guided by a qualitative research approach, the study explored the experiences and perceptions of teachers and learners regarding the use of digital tools in teaching negation processes. Data were collected through a Google Forms survey and analysed thematically to identify key challenges and emerging patterns. The findings reveal that digital tools can contribute to grammar learning by increasing learner engagement, facilitating communication, and providing access to a variety of learning resources. However, participants indicated that limited access to technological devices, unstable internet connectivity, inadequate teacher training, and insufficient digital literacy skills reduce the effectiveness of technology-based instruction. The study further found that the scarcity of Northern Sotho specific digital materials and the inability of some digital platforms to accommodate the linguistic characteristics of the language complicate the teaching of negation processes. These challenges often result in a reliance on traditional teaching methods despite ongoing technological developments. The study recommends the development of culturally and linguistically appropriate digital resources, enhanced teacher professional development, and improved technological infrastructure in schools. It concludes that while digital tools offer opportunities for supporting Northern Sotho grammar instruction, their successful implementation depends on addressing the educational, technological, and language-specific challenges that continue to affect indigenous language classrooms in South Africa.

Keywords: Technological Devices, Negation Processes, Indigenous Language Education, Department of Basic Education.

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Preparing Future Mobility Leaders: AI-Enhanced Entrepreneurship Education and Innovation Ecosystems for Sustainable Autonomous Vehicle Development

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The rapid development of artificial intelligence (AI), autonomous vehicle (AV) technologies, and sustainable mobility solutions is reshaping the future of transportation and creating new expectations for education, entrepreneurship, and innovation. As mobility industries move toward increasingly intelligent and connected systems, universities have an important role in preparing future leaders who can integrate technological understanding, entrepreneurial thinking, and sustainability awareness.

This study explores how AI-enhanced entrepreneurship education can support the development of competencies required for sustainable autonomous vehicle innovation. Using a practice-based case study approach, the research examines an educational model that connects AI-supported learning, entrepreneurship development, technology transfer, and university–industry collaboration. Through experiential learning activities, industry engagement, and technology-driven projects, the study investigates how students develop the ability to identify opportunities, design innovative solutions, and respond to emerging challenges within the autonomous mobility sector.

The findings indicate that entrepreneurship education embedded within innovation ecosystems can strengthen students' capabilities in opportunity recognition, problem-solving, interdisciplinary collaboration, and sustainability-oriented decision-making. The study highlights the importance of creating stronger connections between higher education and industry to support knowledge exchange and responsible innovation in emerging technology fields.

By connecting educational practice with emerging mobility challenges, this research extends current conversations on AI-supported learning, entrepreneurial capability development, and sustainable technology transitions. The study provides insights into how universities can cultivate future-ready talent capable of contributing to responsible autonomous mobility transformation.

Keywords: Artificial Intelligence; Entrepreneurship Education; Autonomous Vehicles; Sustainable Mobility; Innovation Ecosystems; University–industry Collaboration

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Beyond Technology Acceptance: Exploring the Cognitive, Ethical, and Motivational Factors Shaping ChatGPT Engagement in Cybersecurity Education

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The increasing integration of generative artificial intelligence tools such as ChatGPT into computing education raises important questions about their relationship with students' critical thinking and problem-solving skill development. This study explores associations between ChatGPT usage and students' perceived development of higher-order thinking skills, including critical thinking and problem-solving, within a cybersecurity education context. This context is particularly relevant because computing and cybersecurity students regularly engage with tasks such as debugging or threat analysis, which require analytical reasoning, evaluation, and independent decision-making. As AI becomes increasingly embedded in these activities, understanding how students engage with such tools is important for determining their role within learning processes that traditionally depend on independent reasoning.

Drawing on survey data from 84 students, we employ partial least squares structural equation modelling (PLS-SEM) to examine a multi-construct model incorporating usage behaviour, perceived usefulness, self-efficacy, ethical awareness, and perceived skill development. The study used a cross-sectional observational design based on students' self-reported perceptions and experiences. The model was used to explore both the relationship between ChatGPT usage and perceived skill development and the psychological and institutional factors associated with students' engagement with the tool.

The structural model explained 70.9% of the variance in ChatGPT usage and 45.7% of the variance in perceived critical thinking and problem-solving skill development. ChatGPT usage demonstrated a significant positive association with perceived skill development ($\beta = 0.506$, $p < .001$). However, the factors associated with ChatGPT engagement revealed more complex patterns than conventional technology acceptance perspectives suggest. Perceived usefulness ($\beta = 0.267$, $p = .042$) and motivation for learning ($\beta = 0.220$, $p = .008$) were positively associated with ChatGPT usage, whereas self-efficacy ($\beta = -0.219$, $p = .043$) and ethical awareness ($\beta = -0.245$, $p = .004$) demonstrated significant negative associations. University support was positively associated with perceived skill development ($\beta = 0.261$, $p = .007$), suggesting that institutional guidance may contribute to how students perceive the educational value of AI-supported learning.

This study contributes to educational technology research by providing an exploratory model that reveals both enabling and constraining factors associated with students' engagement with generative AI. Although ChatGPT usage was positively associated with perceived critical thinking and problem-solving skill development, higher levels of ethical awareness and self-efficacy were negatively associated with usage. These findings suggest that students' engagement with generative AI is more nuanced than simple technology acceptance models imply and reinforce the importance of pedagogical approaches that encourage critical and responsible AI use. Limitations related to the use of self-reported measures and a relatively small sample size are acknowledged, indicating the need for further research incorporating behavioural and performance-based assessments.

Keywords: Generative Artificial Intelligence; ChatGPT; Cybersecurity Education; Higher-order Thinking Skills; Technology Acceptance

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Human-machine Collaborative Three-dimensional Procedural Evaluation: Research on AI-enabled Ladder Teaching of Higher Vocational English Based on Marking Cases

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This study targets higher vocational non-English majors with weak linguistic foundation. Traditional English evaluation overly relies on standard answers and rigid machine scoring, ignoring students' gradual thinking trails and trial-and-error process. Based on the marking practice of 110 students' translation scripts, this study verifies that pure AI scoring tends to underestimate learners. AI judges mechanically according to standard versions and produces rigid results, while teachers can give reasonable incremental scores based on students' understanding attempts. To solve this problem, a human-machine collaborative progressive teaching model is proposed. Students are allowed to sort out fragmented ideas in Chinese before English output. With teacher scaffolding, learners identify defects in AI-generated texts and avoid blind dependence. A three-dimensional procedural evaluation system is constructed, including independent thinking output, error discrimination and iterative optimization. AI provides preliminary assessment while teachers revise scores to ensure equitable and growth-oriented evaluation. The practice proves that this model adapts to vocational students' learning characteristics and effectively promotes their steady progress in English competence and critical thinking.

Keywords: Human-machine Collaboration; Three-dimensional Procedural Evaluation; AI-enabled; Ladder Teaching

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An AI-Supported Approach for Vocational STEM English Learners from the Perspective of Form-Meaning-Use for Deep Processing

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This paper proposes an AI-supported learning approach for first-year STEM students at a vocational college in Guangxi, China. Relevant research observations show that learners in this group generally have insufficient prior English foundation and limited learning engagement, and their language learning activities are largely dominated by repetitive memorization. Grounded in Craik and Lockhart's Depth of Processing Theory and Larsen-Freeman's form-meaning-use framework, the approach guides students to progress gradually from surface-level form recognition to semantic construction and pragmatic output. AI tools including DeepSeek, WPS AI, Unipus, and Xuexitong are integrated across the full learning cycle of preparation, in-class practice, consolidation, and assessment.

Within this framework, the "form" dimension covers vocabulary and sentence structures; the "meaning" dimension builds conceptual understanding via semantic networks and contextual examples; the "use" dimension develops pragmatic competence through workplace scenario simulations and interactive speaking exercises. A 15-week quasi-experimental study will be conducted with six intact classes involving approximately 240 first-year civil engineering students. Pre-test and post-test scores, continuous process learning data, and standardized student questionnaires will be used to evaluate the effectiveness of the approach. The proposed framework is expected to deepen learners' lexical processing and pragmatic judgment ability. It can be implemented without textbook replacement or additional class hours, forming a low-cost, replicable learning model.

Keywords: Form-meaning-use Framework, Depth of Processing Theory, AI-supported Language Learning, Vocational STEM English Learners

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From Single-Domain Human Expertise to Multi-Domain Human Ability – How to generate a new Intelligence Paradigm in Higher Education in view of AI

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The rise of artificial intelligence challenges the function and identity of university-level education significantly. AI changes what, how, and why university students learn. Students adapt to new technological opportunities but also experience negative effects on reflection and reasoning skills as recent studies show. Beyond this, the uniqueness of universities' role as hubs of extraordinary scholarship and human knowledge is challenged. At present, universities need to adapt to the changing opportunities of AI in their curricula and classes, but on a more general level, need to rethink also their role in a world in which knowledge, including the application of it, can be automated and commodified – with the potential consequence of devaluating scholarship and the development of human knowledge.

In this paper, we suggest that universities should respond with the reframing of human knowledge and intelligence: While we expect that universities will lose importance as hubs of human scholarship and knowledge, they will rise in importance as hubs of human abilities beyond the mere transfer of knowledge. We suggest that the rise of artificial intelligence will not lead to the replacement of human intelligence, but to a multi-facetted 'competition' between human and artificial intelligence, in which price, uniqueness and limitations of both forms of intelligence will matter. Universities will need to respond to this by creating effective learning ecosystems to prepare students across a broad spectrum of human abilities for this 'competition'. To do so, universities should embrace a multi-faceted concept of cognitive abilities so that the focus of higher education shifts from traditional knowledge transfer and expertise development towards a "multi-domain" development of human abilities helping students to develop a unique profile of human strengths, that would give them an inimitable advantage in the above-mentioned competition.

We propose Gardner's Multiple Intelligence Theory as a foundational framework for thinking towards this paradigm shift. Gardner suggested that human beings develop unique combinations of intelligence across at least nine dimensions (besides linguistic, logical-mathematical and spatial intelligence, he suggests taking bodily-kinesthetic, musical intelligence, inter- and intrapersonal intelligence, naturalistic intelligence, and existential intelligence into account). In our paper, we build on Gardner's theory of multiple intelligence as a conceptual basis a) to analyse the complexity of human intelligence and ability, b) to compare the existing intelligence paradigms in higher education, and c) to generate operational goals as well as a conceptual framework for an updated higher education system offering multi-domain learning ecosystems for a broad human ability development, including metrics to measure and implement non-classical intelligence styles. This proposed framework will present a new path for university-level education to tackle the challenges posed by AI by strengthening the uniqueness of human intelligence.

Keywords: Artificial Intelligence in Higher Education; Human Intelligence; Howard Gardner's Multiple Intelligence Theory

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The AI–eLearning Nexus: Pedagogical Innovation, Ethical Governance, and Human-Centered Digital Learning

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Artificial intelligence (AI) is rapidly reshaping eLearning by enabling personalized instruction, automated feedback, predictive analytics, and responsive learning environments. However, its adoption also raises significant pedagogical, ethical, technological, and institutional concerns. Following PRISMA-ScR guidance, this scoping review systematically maps literature published between 2019 and 2026 across Scopus, Web of Science, ERIC, IEEE Xplore, and PubMed. Of 1,420 identified records, 40 peer-reviewed publications were synthesized across four interconnected dimensions: pedagogical applications; technological architectures and user experience; ethical and human-centered considerations; and institutional governance. The findings demonstrate that adaptive systems, predictive analytics, and Generative AI strengthen personalization and engagement. Nevertheless, persistent challenges remain regarding algorithmic bias, invasive surveillance, system opacity, academic integrity, and a stark empirical research deficit in low- and middle-income countries (3.8%). Furthermore, institutional policies and traditional assessment practices lag significantly behind technological capabilities. In response, the review establishes the AI–eLearning Nexus, an integrative conceptual framework anchoring pedagogical and technological integration around Human-in-the-Loop (HITL) oversight, ethical safeguards, and governance. To operationalize this model, the paper presents the AI Assessment Redesign Spectrum, transitioning institutions from vulnerable traditional evaluation toward authentic human-AI co-creation. Sustainable AI integration ultimately requires pedagogy-first design, explainability, and equitable global access.

Keywords: Artificial Intelligence in Education (AIED); Generative AI; ELearning; Scoping Review; Human-in-the-loop; Assessment Redesign; Ethical Governance; Higher Education

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Learner engagement in online courses in open and distance learning: A preliminary analysis

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Distance learners at often times demonstrate low engagement in learning due to various reasons. Furthermore, the misuse of advanced Artificial Intelligence (AI) tools has also become a challenge for the educators. Therefore, in order to address these challenges, first it is necessary to understand how learner engagement dynamics affect the academic success of Open and Distance Learners. Therefore a questionnaire was administered among distance learning students in three Engineering streams - Computer Engineering, Mechanical Engineering & Software Engineering, who are mostly engaged in blended learning techniques. The students in the selected group have studied for more than two years in distance mode with online and onsite learning experiences, and also techno savvy. Hundred and fifty three (153) students responded to the questionnaire. More than 50% of the students were in the age range of 23 to 27. 100% of students use the LMS for assignment submission and more than 90% indicated that they join the virtual sessions conducted by academics to gain knowledge. It was noted that 66% accessed their Learning Management System (LMS) daily and more than 60% of students indicated that they are motivated to complete any activities based on the LMS. Using YouTube and other additional resources to complete coursework and Interacting with course materials and video content uploaded in LMS were identified as the most engaged activities from a student's perspective. It was also identified that generative AI tools are used by these students to explain difficult concepts and also to summarize learning materials. Analysis of student responses from the selected cohort reveals that continuous and integrated accessibility to learning resources is a primary expectation among distance learners. As for future work it is expected to develop a recommender system for students to reflect their learning practices and improve their academic performance mainly focusing on the student engagement in the distance learning environment.

Keywords: Learner Engagement, Distance Learners, Academic Success

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The Role of Generative Artificial Intelligence in Instructional Design and Student Engagement: A Literature-Based Synthesis

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This paper aims to synthesize the role of generative artificial intelligence (ChatGPT and similar large language models) in instructional design processes and its effects on student engagement by reviewing 32 articles published between 2024 and 2026 and retrieved from the Web of Science database. The studies reviewed employed experimental, quasi-experimental, systematic review, and structural equation modeling (SEM)-based research designs across a wide range of contexts, including higher education, vocational and technical education, primary education, nursing, medicine, language teaching, science, and mathematics education. The findings show that generative artificial intelligence is most frequently integrated into instructional design through the ADDIE model (Analysis, Design, Development, Implementation, Evaluation), while theoretical frameworks such as the Technology Acceptance Model, the Unified Theory of Acceptance and Use of Technology, and Self-Determination Theory are widely used to explain acceptance and adoption processes. Student engagement has been addressed as a multidimensional construct comprising cognitive, emotional, behavioral, and social dimensions. Generative AI-supported learning environments have generally been found to increase engagement and motivation; however, this effect varies depending on teacher guidance, pedagogical guidance (prompt design), and the level of support provided by the learning context. Unstructured or unguided use has, in some cases, been found to reduce active learning and intrinsic motivation, whereas pedagogically enriched (scaffolded) applications integrated with systematic design principles have been found to strengthen cognitive engagement, higher-order thinking skills, and self-regulation. In addition, neuroscientific evidence indicating that teacher-student interaction and AI-student interaction support different types of engagement (emotional-social and cognitive, respectively) has also been reflected in the literature. The reliability of automated assessment systems, ethical use, data privacy, and algorithmic bias emerge as recurring areas of concern across the studies. In conclusion, the literature indicates that generative artificial intelligence is a powerful tool for instructional designers; however, to sustainably enhance student engagement, it needs to be consciously integrated with systematic instructional design models (ADDIE, PBL, 4PADAFE, etc.).

Keywords: Instructional Design, Generative Artificial Intelligence, Student Engagement

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Focal Points of Educational Research at the Intersection of Artificial Intelligence, Computational Thinking, and Digital Literacy: A WoS Review

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The rapid integration of Generative Artificial Intelligence (GenAI) technologies into today's educational ecosystem is redefining 21st-century competencies. In this process, attitudes toward and literacy in artificial intelligence, computational thinking (CT) skills, and digital literacy have moved beyond being independent competencies and have become a holistic structure that directly interacts with one another. The aim of this study is to examine academic studies indexed in the Web of Science (WoS) database that simultaneously address these three fundamental dimensions and to reveal the main focal points in the field, the instructional approaches used, and future pedagogical trends. Within the scope of the study, 43 peer-reviewed articles retrieved from the WoS Core Collection database through a search using keywords related to artificial intelligence (GenAI, LLM, ChatGPT, etc.), computational thinking, and digital literacy were analyzed using qualitative content analysis and thematic synthesis. The studies were evaluated in terms of target group levels, pedagogical strategies, curriculum alignment, and relationships among variables. The findings show that the literature is predominantly shaped around four main themes: (1) the use of artificial intelligence as a "cognitive tool" or pair-programming partner in computational thinking processes, supported by unplugged activities, game-based learning, and Project-Based Learning (PBL); (2) the prominence of interdisciplinary models aimed at developing AI and CT competencies among individuals in non-computing disciplines and pre-service teachers; (3) the fact that national curricula and textbooks are not yet fully aligned with artificial intelligence and higher-order thinking skills (e.g., the SOLO taxonomy); and (4) the critical role of digital and data literacy as key/mediating variables between attitudes toward artificial intelligence and computational thinking performance. In line with the findings, it is recommended that artificial intelligence and CT skills should not be limited to computing courses but should be integrated into all disciplines under the umbrella of digital literacy, that blended (plugged/unplugged) instructional designs should be incorporated into teacher education programs, and that progressive standardized assessment frameworks extending from K–12 to higher education should be developed.

Keywords: Artificial Intelligence, Computational Thinking, Digital Literacy, Attitudes Toward Artificial Intelligence, Thematic Analysis

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The Impact of Digital Media on Heritage Language Acquisition in Turkish Children Abroad: Mothers' Perspectives

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Turkish children growing up abroad face unique challenges in acquiring and maintaining Turkish as a heritage language in environments where another language is dominant. Although previous studies have examined heritage language acquisition among Turkish children (Dağdeviren Kırmızı & Üzüm, 2025), research has primarily focused on structural language features, family language policies, socio-psychological factors, and cognitive processes. The role of media content in supporting the acquisition and maintenance of Turkish as a heritage language has received comparatively little attention (Willard et al., 2014). Addressing this gap, this study explores the contribution of Turkish television and digital media content to children's heritage language acquisition from the perspective of Turkish mothers living abroad.

This study adopted a qualitative case study design. The case under investigation concerns the ways in which Turkish mothers living abroad make use of media content to support their children's heritage language acquisition. Data were collected through semi-structured focus group interviews.

The sample was selected through purposive sampling and consisted of two focus groups of Turkish mothers residing in the United Arab Emirates. Participants were selected according to the following criteria: at least one parent speaks Turkish as their first language; the child is aged three years or older; the child attends an educational institution where a language other than Turkish is the dominant language; and the child is exposed to Turkish media content to a certain extent. Audio recordings from the two focus group interviews, each involving five participants, were transcribed and analysed using qualitative content analysis and descriptive analysis.

The findings revealed that content broadcast on TRT Çocuk, Turkish-dubbed cartoons, and television series portraying Turkish history contributed to children's vocabulary development and strengthened their sense of cultural identity and belonging. Mothers actively regulated their children's media environment through multi-layered gatekeeping strategies, including technical restrictions, co-viewing media content as a family, and providing guidance during media use. However, media consumption alone did not determine heritage language acquisition. The presence of foreign nannies, the frequency of communication with extended family members in Türkiye, and children's language preferences in peer interactions emerged as key socio-cultural factors shaping heritage language acquisition alongside media content.

Overall, media content represents one of several factors that can facilitate or constrain heritage language acquisition. Its positive contribution becomes significantly stronger when supported by consistent family language policies and sustained cultural ties with the extended family. These findings highlight the importance of developing high-quality Turkish-language digital content while encouraging educators and policymakers to strengthen family-based heritage language acquisition strategies.

One limitation of this study concerns the group dynamics inherent in focus group interviews. Some participants appeared hesitant to express views that differed from those of the group, while dominant opinions may have unintentionally influenced others. Future research could

provide deeper insights by employing individual interviews to explore participants' media use and home language practices in greater detail.

Keywords: Heritage Language Acquisition, Media Use, Turkish Diaspora, Focus Group

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The Digital Transformation of Attachment: Examining the Relationship Between Pre-Service Teachers' Trans-Parasocial Attachment Levels to AI and Attachment Styles

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As artificial intelligence (AI) technologies have become an integral part of everyday life, the relationships individuals establish with digital systems have evolved into a new dimension. In particular, the human-like communication capabilities of generative AI applications have enabled individuals to develop not only functional but also emotional and psychological connections with these systems. Within this context, the concept of trans-parasocial attachment, which has gained increasing attention in recent years, has emerged as a novel framework for explaining the one-sided yet emotionally meaningful relationships that individuals establish with AI systems. The present study aims to examine the relationship between pre-service teachers' trans-parasocial attachment levels toward artificial intelligence and their attachment styles. A quantitative correlational research design will be employed in this study. The study sample will consist of pre-service teachers enrolled in faculties of education. Data will be collected using the Artificial Intelligence Trans-Parasocial Attachment Scale and the Attachment Styles Scale. The relationships between pre-service teachers' trans-parasocial attachment levels toward AI and their attachment styles will be analyzed through correlation and regression analyses. The findings are expected to contribute to a better understanding of attachment dynamics in AI-mediated interactions, provide insights into the psychological relationships that pre-service teachers develop with artificial intelligence, and enrich the current literature in the fields of educational technology and educational psychology. Furthermore, the study is anticipated to provide both a theoretical and practical foundation for future research exploring the psychological dimensions of the evolving relationship between humans and artificial intelligence.

Keywords: Artificial Intelligence, Trans-parasocial Attachment, Attachment Styles, Pre-service Primary School Teachers

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When AI Becomes More Than a Tool: The Mediating Role of AI Trans-Parasocial Bond in the Relationship Between Generative AI Dependency and Self-Regulated Learning Among Pre-Service Teachers

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The rapid integration of generative artificial intelligence (AI) into higher education has transformed AI from a mere technological tool into an interactive learning companion. As pre-service teachers increasingly rely on AI-powered systems for academic tasks, concerns have emerged regarding how AI dependency influences essential learning competencies, particularly self-regulated learning. At the same time, the human-like communication capabilities of generative AI have enabled users to develop AI trans-parasocial bonds, characterized by perceived emotional closeness, trust, and psychological attachment toward AI systems. Despite growing interest in AI-assisted learning, little is known about the psychological mechanisms linking AI dependency to self-regulated learning.

This study aims to examine the mediating role of AI trans-parasocial bond in the relationship between generative AI dependency and self-regulated learning among pre-service teachers. The study will employ a quantitative, cross-sectional correlational research design with approximately 400 pre-service teachers enrolled in faculties of education. Data will be collected using the Generative AI Dependency Scale, the AI Trans-Parasocial Bond Scale, and the Self-Regulated Learning Scale. Structural Equation Modeling (SEM) will be conducted to test the hypothesized mediation model.

It is expected that greater dependency on generative AI will be associated with stronger AI trans-parasocial bonds. Furthermore, AI trans-parasocial bonding is anticipated to play a significant mediating role in explaining the relationship between AI dependency and self-regulated learning. Depending on the nature of this mediation, AI trans-parasocial bonds may either facilitate self-regulated learning by enhancing motivation and perceived academic support or hinder autonomous learning by fostering excessive psychological reliance on AI.

The findings are expected to contribute to the emerging literature on AI-human psychological relationships in educational settings and provide valuable implications for teacher education programs seeking to promote healthy, balanced, and self-regulated AI use among future educators.

Keywords: Generative Artificial Intelligence; AI Dependency; AI Trans-Parasocial Bond; Self-Regulated Learning; Pre-Service Teachers

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Beyond Prompting: How Generative AI Reshapes Thinking Processes Through Cognitive Offloading Among Pre-Service Teacher

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The rapid adoption of generative artificial intelligence (AI) tools in educational settings has shifted the focus from merely learning how to interact with AI systems toward understanding how these technologies reshape human cognition and learning processes. While effective prompting skills are often emphasized as a key component of AI literacy, increasing reliance on generative AI may influence how learners process information, construct knowledge, and engage in higher-order thinking. One emerging mechanism underlying this transformation is cognitive offloading, through which individuals delegate cognitive tasks such as information retrieval, idea generation, problem solving, and decision-making to external technological agents.

This mixed-methods study aims to investigate how generative AI use influences thinking processes among pre-service teachers by examining the mediating role of cognitive offloading. The quantitative phase will be conducted with approximately 300 pre-service teachers enrolled in faculties of education. Data will be collected through measures assessing generative AI usage patterns, cognitive offloading tendencies, and critical thinking dispositions. Structural equation modeling will be employed to examine the proposed relationships among variables.

The qualitative phase will include semi-structured interviews with selected participants representing different levels of AI use and cognitive offloading tendencies. Thematic analysis will be conducted to explore how pre-service teachers perceive generative AI as a cognitive partner, how they distribute thinking responsibilities between themselves and AI systems, and how AI-supported practices influence their evaluation, reasoning, creativity, and decision-making processes.

The findings are expected to reveal that generative AI functions not only as a learning support tool but also as a cognitive agent that may transform traditional patterns of thinking. While moderate AI-supported cognitive offloading may enhance efficiency and learning productivity, excessive delegation of cognitive processes may weaken independent reasoning and critical engagement. This study contributes to the emerging field of AI-supported learning by providing insights into the cognitive consequences of generative AI use and offering implications for teacher education programs aimed at developing reflective, autonomous, and responsible AI users.

Keywords: Generative Artificial Intelligence, Cognitive Offloading, Critical Thinking, Pre-Service Teachers, Mixed Methods Research

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AI-Assisted Personalized Learning: A Review of the Evidence

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This research conceptually examines the effects of AI-assisted personalized learning on the educational process. Personalized learning is defined as an approach that tailors teaching methods, content, and progress to each learner's individual needs and preferences. The opportunities provided by AI technologies such as machine learning and natural language processing have transformed this approach from a self-adaptive to an intelligently adaptive level. Based on a literature review, this research discusses the role of AI in providing feedback by analyzing student data, creating personalized learning paths, and identifying learning gaps. The findings of the review show that AI-assisted adaptive learning platforms increase student participation, motivation, and academic achievement. Furthermore, these environments have been shown to support the creation of a more inclusive educational setting, including students with special needs. However, it is emphasized that issues such as data privacy, bias, inequality in access to technology, and the development of educators' digital skills pose significant challenges for the sustainable and ethical implementation of AI-assisted personalized learning. At this point, it has been concluded that the transformative potential of AI in education, not only for personalized learning but also in general, can only be realized through a responsible, careful, and ethically based integration process.

Keywords: Artificial Intelligence (AI); Personalized Learning; Education; Educational Technology.

(642)

From Off-the-Shelf to Purpose-Built: The Design and Development of a Generative AI-Supported, Rubric-Based Automated Writing Evaluation Plugin for Moodle

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Higher education institutions increasingly wish to embed artificial intelligence (AI)-based writing evaluation into their learning management systems (LMSs), yet commercially available automated writing evaluation (AWE) tools are often difficult to align with local instructional needs. They offer limited rubric customisation, assume typed input rather than classroom handwriting, target ESL rather than EFL populations, and raise data-protection concerns when student texts leave institutional infrastructure. Moreover, the development processes behind AWE systems are rarely documented in the literature, leaving researchers and practitioners who wish to build comparable tools without practical guidance. This study reports the complete design and development process of a generative AI-supported, rubric-based AWE system integrated into Moodle as a plugin for EFL writing instruction. It distils transferable technical and design lessons from that process.

The study was conducted as Type 1 developmental research (Richey & Klein), and the software was built using the Rapid Prototyping Model. In the analysis phase, a PRISMA-guided systematic search identified and feature-mapped existing AWE tools; an e-rater demo was evaluated with an expert and students; and a six-week pilot was conducted with the Virtual Writing Tutor Moodle plugin. The pilot revealed critical gaps — insufficient explanatory feedback, ESL–EFL mismatch, no rubric customisation, and weak visual feedback — which were translated into design requirements for a purpose-built system.

In the development phase, these requirements were instantiated in a three-tier architecture: a Moodle plugin front end, a Python/Flask API server, and the ChatGPT API for scoring and feedback generation, with teacher-defined rubrics encoded as JSON scoring schemas and results stored in MySQL. When the course instructor required handwritten submissions, the system was extended into a multimodal pipeline: students photograph their texts; images are merged client-side and transferred as base64; text is extracted via optical character recognition; and an editable "extracted text" step lets students verify and correct recognition errors before evaluation. Feedback is displayed instantly through AJAX requests without page reloads. Stress testing showed that text-only evaluation ran reliably on standard shared hosting, whereas image processing required migration to a dedicated server (4 vCPU/6 GB RAM) with asynchronous request handling.

The development experience yields four recommendations for teams building LMS-integrated, generative AI-supported assessment tools: plan server capacity for multimodal workloads from the outset; design student-facing self-verification steps to mitigate OCR errors; encode rubrics as machine-readable schemas so that teachers can customise evaluation criteria without technical knowledge; and treat data protection as a first-order design constraint, favouring institution-hosted plugin architectures. Overall, the study demonstrates how rapid prototyping driven by continuous user feedback enabled a small research team to move from off-the-shelf tools to a purpose-built, pedagogically customisable AWE environment that bridges face-to-face writing instruction and online assessment in hybrid learning contexts, and offers a documented development pathway for future LMS-integrated AI assessment projects.

Keywords: Automated Writing Evaluation; Generative Artificial Intelligence; Moodle; Learning Management Systems; Rapid Prototyping; EFL Writing

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AI-Driven Virtual Reality: Toward a Digital Twin–Based Immersive Smart Tutor for Teaching and Learning

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Virtual reality (VR) has demonstrated clear value for experiential learning and learner-centred instruction, while generative artificial intelligence (GenAI) and large language models (LLMs), in particular, have demonstrated an ability to hold open-ended and adaptive dialogue with learners. The state-of-the-art systems share three gaps: (I) mostly stateless reasoning over current conversational turns and sessions, with no long-term model of the learner; (II) no existing methods that connect the learner twin and embodied conversational agent, focusing on independent development of research on digital twin and VR tutors with embodiment; (III) unaccounted difference of the effects of embodiment for different cognitive complexity levels using any adaptive mechanism. This paper proposes a conceptual framework, the AI-Driven VR Smart Tutor, which addresses all three gaps mentioned above by foregrounding the Learner Digital Twin: a continuous, multimodal map of the individual learner at the centre of the interaction loop made up of the learner, an embodied conversational AI tutor, an immersive VR environment, and a teacher-facing analytics layer. To the best of our knowledge, this is the first proposal for a Learner Digital Twin to serve as the coordinating layer between the Conversational AI tutor and the Immersive VR environment. We designed the framework by synthesising recent empirical evidence on GenAI virtual assistants in immersive education. Our work leverages the state-of-the-art five-layer system architecture that illustrates the framework with an example instructional scenario. We conclude with a discussion of pedagogical opportunities, technical challenges, ethical considerations, and a concrete future-work agenda for empirically testing the framework.

Keywords: Artificial Intelligence, Virtual Reality, Digital Twin, Intelligent Tutoring Systems, Generative AI, Immersive Learning, Learner Modelling, Embodied Conversational Agents.

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Implementing a Moodle-Integrated, LLM-Based Assessment and Feedback System in a Translation Course

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Assessing handwritten classroom translations quickly and fairly is a persistent problem in undergraduate translation courses: instructor feedback often arrives a week late, while many automated evaluation tools are designed with typed text in mind and offer limited room for adapting to a course's own criteria. This paper reports how an LLM-based assessment and feedback system integrated into Moodle was configured for translation teaching and what happened when it was used in an actual course. Students photograph their in-class handwritten translations and upload them; an OCR component extracts the text. Scoring does not begin, however, until the student has checked, corrected and explicitly approved the transcript. This verification step was made obligatory on purpose, partly to keep recognition errors from lowering grades and partly to give students responsibility over their own submissions. Scoring relies on a translation rubric adapted from Marais (2020). To make it work within Moodle's rubric engine, its six weighted dimensions were broken into fourteen criteria, each with six achievement levels, totalling 100 points, and the same rubric was embedded verbatim in the model's scoring prompt, so that the system and the course instructor were always assessing identical criteria. Feedback returns immediately, criterion by criterion. A further configuration decision concerns access: the AI stays within the learning management system rather than being offered as an open chatbot, which limits dependence and leaves final assessment authority with the teacher. The system was used for seven weeks in a translation course with 43 fourth-year pre-service English teachers, who translated literary, news and academic texts in both directions between English and Turkish. Two things changed during the implementation. OCR accuracy and scoring behaviour improved over the term, and when a number of divergent papers were re-scored with the term-final model version, their distance from instructor scores narrowed. Student behaviour changed as well: in the early weeks, many handed in hurried, untidy pages, but once they saw how strictly the system read and scored what they had actually written, they began writing more carefully. This effect was not anticipated, and it suggests that the term's gains in text recognition owe as much to student behaviour as to the system itself. The paper closes with a few practical notes for teachers considering a similar implementation, together with planned refinements: genre-specific rubrics, a learning analytics report and an appeal mechanism.

Keywords: Translation Assessment; Automated Assessment; Large Language Models; Moodle; OCR; Feedback Design; Classroom Implementation

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Examination of the Measurement Invariance of General Self-Efficacy

Özge Bıkmaz Bilgen

General self-efficacy refers to an individual's general belief in their capability to cope effectively with diverse and challenging life circumstances, generate solutions to encountered problems, and successfully perform the behaviors required to manage such situations (Schwarzer & Jerusalem, 1995). Studies conducted with university students have demonstrated that general self-efficacy may follow different developmental trajectories over time and constitutes an important personal resource for students' psychological adjustment and educational experiences (Liu et al., 2023). Furthermore, interventions aimed at strengthening university students' self-efficacy beliefs have been emphasized as important for improving their coping skills and personal resources (Gueroni et al., 2023). Accordingly, determining university students' levels of general self-efficacy is important for understanding their capacity to adapt to stressful life events and for planning the psychoeducational support they may need. However, information regarding whether the scales used in such studies demonstrate measurement invariance across different groups, such as countries and genders, and over time remains highly limited. The sample consisted of 800 students enrolled at universities in Türkiye. Of these students, 496 were female and 304 were male. Before the analyses, the data were weighted using the total student weight variable, TOTWGT, and cases with missing data were removed. The analyses were conducted in the open-source R software environment using the lavaan and semTools packages. The R codes provided by Svetina et al. (2020) were utilized in the analyses. The diagonally weighted least squares estimator with mean- and variance-adjusted test statistics was used in the multigroup confirmatory factor analyses. Wu and Estabrook (2016) proposed a model identification procedure for ordinal categorical measurements that differs from conventional methods of testing measurement invariance based on the commonly used threshold model. Within this approach, measurement invariance is examined through a baseline model, a model in which thresholds are constrained to equality, and a model in which both thresholds and factor loadings are constrained to equality. In the literature, it has been recommended that the measurement invariance of non-cognitive scales used in international large-scale assessments be examined through alignment or partial invariance modeling approaches (Reynolds et al., 2022). Accordingly, partial measurement invariance was also investigated for each scale in the present study. Model fit was evaluated using the RMSEA, TLI, and CFI indices (Browne & Cudeck, 1993; Van de Schoot et al., 2012). According to the findings, measurement invariance across gender was not established for the confidence in reading scale. Previous studies have indicated that the data provide a better fit to the model when the measurement invariance of the PIRLS confidence scale is examined using a two-factor structure consisting of positively and negatively worded items (La Fontaine et al., 2019). Measurement invariance was established across all models for the liking reading and engagement in lessons scales. Using the proposed method, measurement invariance across gender was not established for the digital self-efficacy scale. In the partial invariance model, all goodness-of-fit indices except RMSEA met the recommended threshold values. However, when the goodness-of-fit criteria suggested in different studies are considered, it may be concluded that partial measurement invariance across groups was achieved (Browne & Cudeck, 1993).

Keywords: Measurement Invariance, Self-Efficacy, R Software

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Reliability Estimation of Rater Scores from Different Techniques

Özge Bıkmaz Bilgen

Reliability refers to the extent to which measurement results are free from random error within the framework of classical test theory. Obtaining reliable measurement results is essential for ensuring the accuracy and validity of evaluation decisions. However, establishing reliability in performance assessment is particularly challenging because scoring often depends on raters' judgments. Therefore, taking appropriate measures to enhance rater consistency is a critical component of performance assessment. The reliability of the performance assessment process is largely determined by the consistency among the scores assigned by different raters. Various methods are available for estimating inter-rater reliability. In addition to commonly used techniques, loglinear analysis may be considered an alternative frequency-based approach for examining rater reliability. The present study investigated the reliability of scores assigned by five raters to 50 performance tasks using loglinear analysis and configural frequency analysis. The distinctive contribution of the study lies in applying loglinear analysis through the R software environment in the context of inter-rater reliability, an area in which limited research is available. The findings indicated that loglinear analysis is an appropriate technique for examining rater reliability because it reveals interaction patterns among raters and identifies levels of agreement and disagreement. The analyses also demonstrated that the technique can be implemented relatively easily in R. These results suggest that loglinear analysis may serve as a useful complementary method for evaluating rater consistency in performance-based assessments.

Keywords: Loglinear analysis, frequency analysis, inter-rater reliability, interrater coefficients

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An AI-Driven Rainfall Prediction Framework for Smart Academic Planning: Enhancing Student Safety and Learning Continuity During Extreme Weather Events

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The rise in the frequency of extreme rainfall events in South Asia has had a significant impact on the academic activities, particularly on the safety of commuting to and from school, attendance at school, scheduling of examinations, operations on the campus, and continuity of learning. Although AI-based rainfall forecasting for agriculture, hydrology and disaster management has greatly improved, the application of AI in academic planning and decision-making for universities has not been explored in detail. This study introduces a novel rainfall prediction and institutional decision support framework, combining ensemble machine learning with a rule-based academic decision support system, for smart academic planning. The prediction engine was developed with 13,575 daily meteorological observations from Karachi, Lahore and Islamabad gathered over 20 years (2004 to 2023) from the Visual Crossing weather archive. To enhance the prediction performance, Synthetic Minority Oversampling Technique (SMOTE), systematic hyperparameter optimization and seven supervised machine learning classifiers were used and tested for both imbalanced and balanced class distribution. An important innovation of this work is the proposed Trend-Tracking Aggregation (T-Tagging) ensemble algorithm which dynamically adapts the contribution of base learners based on their temporal performance stability, and not on static weight or majority voting ensembles. The proposed framework results in 99.83% classification accuracy and Area Under the ROC Curve (AUC) of 0.9996 which is better than individual classifiers and conventional ensemble strategies. In addition to predictions, the framework provides a multi-tier academic response mechanism that helps institute appropriate actions for face-to-face, hybrid, or online teaching and learning, examination rescheduling, campus safety alerts, and transportation advisories. This study represents a pioneering effort that connects AI-driven weather intelligence with the management of smart campus operations, creating a tangible decision support system for climate-resilient schools. This study stands out from other rainfall forecasting research by directly linking AI-based weather intelligence to campus management, offering a usable decision-support framework for climate-resilient educational institutions. The proposed framework provides a transferable and scalable blueprint for AI-based smart university that helps in proactively planning academic activities, enhancing the safety of students, and enhancing the resilience of operations and continuity of learning in the case of extreme weather events.

Keywords: Rainfall Prediction; Ensemble Learning; Trend-Tracking Aggregation; Smart Campus; Academic Decision Support; Learning Continuity; Student Safety

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Inclusive Pedagogy for Uncertain Futures: A Qualitative Secondary Analysis Towards Human-Centered Educational Innovation

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The introduction of personalized learning has emerged primarily in response to the increasing demand on education systems to address learner diversity and develop students for unpredictable futures characterized by rapid change. While the rapid development of digital technology and artificial intelligence continues to transform teaching and learning, technological solutions will not produce equitable educational opportunities. In this paper, researcher argue for a perspective on educational innovation that is fundamentally pedagogical in orienting — one which places learner, at least not technologies, at the center of educational practice. This paper aims to explore how inclusive classroom practice can generate evidence for human-centered learning innovation for uncertain futures.

The paper provides a secondary analysis of data collected in a qualitative manner in a doctoral case study in an inclusive primary school in Pakistan. Classroom observations, semi-structured interviews with teachers, field notes and documentary evidence were used in the original study. The secondary analysis involved going back to the dataset to examine the possibility of how inclusive classroom practices inform discussion of educational innovation in the present day. The analysis did not repeat the original results and findings, but rather presented the results from a different angle, namely that of Social Justice Theory, the Ecological Systems Theory and the Principle of Normalization to highlight principles of pedagogy which are applicable to more than inclusive schooling.

The analysis identified four inter-related principles. The first step to good teaching is to know the learner's needs before deciding on instruction. Secondly, flexible, experiential and collaborative learning experiences enhance meaningful participation. Thirdly, the curriculum and assessment should be intentionally modified in accordance with learner diversity but not at the expense of purposeful learning. Last, but by no means least, inclusive learning environments are maintained in a climate of equity, participation and shared responsibility.

Based on these results, the paper suggests a human-centered conceptual approach that makes inclusive pedagogy a basis for future learning innovations, such as learning in technology-supported learning environments. It indicates that the use of AI in education is most likely to be successful if it is used alongside pedagogical principles that enable students to be agents of their own learning, learning to be flexible, learning to participate and learning to be socially included, but not only because of the pedagogical skills of the teacher. The paper concludes that sustainable educational innovation is based on integrating inclusive pedagogical principles at the center of education. It suggests that teachers, teacher educators, researchers, and policy makers consider such principles when planning and creating technology-rich learning spaces to ensure innovation is equitable and builds opportunities for meaningful participation and learning for all students.

Keywords: Inclusive Pedagogy; Qualitative Secondary Analysis; Inclusive Education; Educational Innovation; Social Justice; Experiential Learning; Curriculum Modification; Collaborative Learning; Human-centered Learning; Technology-supported Learning Environments.

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Exploring the Influence of School Head on Positive School Culture in a Lighthouse Middle School in Karachi

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Transformational leadership has been consistently linked to the development of positive school culture (Zheng & Smith, 2023), yet context-specific, practice-based explorations of this relationship are rare in Pakistan's urban private school sector (Zhang & Liu, 2025). This study explored how a school head's transformational leadership practices, enacted through a structured mentor–mentee model, influenced the formation of a positive school culture in the middle section of a Franklin Covey Leader in Me Lighthouse School in Karachi. Employing a qualitative exploratory design within a pragmatic paradigm, data were collected through semi-structured interviews with the school head (mentor) and a group of teachers (mentees), observations of mentor–mentee sessions, and pre- and post-intervention classroom observations of the mentees. Thematic analysis, guided by the five practices of exemplary leadership—inspiring a shared vision, modelling the way, challenging the process, enabling others to act, and encouraging the heart (Kouzes & Posner, 2017)—integrated both deductive and inductive coding. The school's embedded Leader in Me framework, grounded in Stephen Covey's 7 Habits of Highly Effective People (Covey, 1989), provided a distinctive cultural context. Findings illuminate how structured mentoring can foster collaboration, trust, shared responsibility, and professional engagement, offering context-sensitive insights for leadership development in similar urban private school settings.

Keywords: Transformational Leadership, Positive School Culture, Mentor–Mentee Model, Leader in Me, 7 Habits, School Heads, Urban Private Schools, Pakistan

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NEUROSEEK: Advanced Facial Recognition, Machine Learning, and Geospatial Intelligence System

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Locating missing persons and reconnecting them with their families remains a time-critical and largely unsolved challenge in public safety and disaster response. Every year, hundreds of thousands of missing person cases are reported worldwide, yet the search process is still dominated by passive, uncoordinated workflows. Three structural problems compound this delay: citizen sightings cannot be biometrically verified and so remain vague or unreliable, notifications to families are held up by institutional and hierarchical bottlenecks, and critical case data (identity, medical, geolocation, and family contact records) is fragmented across disconnected agencies. The longer these gaps persist, the greater the risk of harm to the missing individual. This paper addresses these problems by proposing NeuroSeek, a centralized tactical web portal that unifies automated biometric recognition, spatial tracking, and instant emergency notification into a single, tightly coupled command platform, replacing passive institutional workflows with an active, algorithm-driven detection loop. NeuroSeek is built on a decoupled full-stack architecture (React, Vite, Express, Node.js) with a biometric matching engine that generates 128-dimensional facial embeddings and compares them using cosine similarity, and a reactive finite state machine (FSM) that governs atomic case-lifecycle transitions from Missing to Verification to Recovered. When a similarity score exceeds the configured confidence threshold, the FSM automatically triggers a structured alert to verified family contacts through simulated SMS and WhatsApp channels.Experimental evaluation across 500 simulated sightings and 200 registered profiles showed a match accuracy (true positive rate) of 98.2% with a 1.4% false positive rate, an average end-to-end processing latency of 2.95 seconds, and a reduction in reunification latency of roughly 58,576× relative to the traditional manual verification process. Performance degraded modestly under low-light conditions, indicating a direction for future robustness improvements. Compared to existing systems such as AMBER Alert and INTERPOL's I-Familia, NeuroSeek is unique in combining open citizen-sighting input, real-time biometric verification, and immediate family notification within one platform accessible to both the public and law enforcement.

These results demonstrate that NeuroSeek offers a technically sound and humanitarian foundation for real-world missing person recovery. For production deployment, it is recommended that future work prioritize GPU-accelerated inference and approximate nearest-neighbor search for scalability, replace simulated notification channels with production SMS/WhatsApp APIs, incorporate explainable AI and independent ethical audits to address demographic bias in facial recognition, and pursue formal compliance with Pakistan's Personal Data Protection Bill and GDPR-aligned privacy standards.

Keywords: Biometric Matching, Cosine Similarity, Emergency Notification, Facial Recognition, Finite State Machine, Missing Person Detection, Public Safety.

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Enhancing Student Engagement Through AI-Driven Personalized Learning Systems in Universities

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Artificial Intelligence (AI) has emerged as a game-changer in the field of education, presenting new opportunities to create more personalized learning experiences tailored to each student's specific needs and requirements. It is transforming education by providing innovative ways to improve learning experiences and student outcomes. Conventional ways of teaching in the universities are constantly based on a particular standardized model of teaching which may fail to consider the various levels in which students learn such as their learning ability, background, motivation and learning style. AI also helps educators focus on significant teaching and mentorship. Integrating AI into education fosters critical thinking, creativity, collaboration, and digital literacy, preparing students for the demands of the future workforce. The study aims to investigate the influence of such AI-powered personalized learning platforms on students' engagement rates in universities in Karachi, Pakistan. This study explores the impact of AI-enabled personalisation features such as adaptive learning recommendations, intelligent feedback systems, AI tutoring assistants and learning analytics on students' behavioral, emotional, and cognitive involvement. A quantitative research design is suggested with a structured questionnaire, which was issued to the students of various universities in Karachi. For the sake of statistical analysis one sample of 384 undergraduate and postgraduate students selected in a hypothetical manner from the public and private universities are taken. AI Personalized Learning are projected to have a strong positive relationship with student engagement in this simulated relationship. The results of regression analysis indicate that the three factors of perceived usefulness, personalized feedback and adaptive learning support have a significant prediction on the level of engagement. The results suggest that AI-supported learning environments can play a role in promoting, in Pakistan' HEIs, the interactive, student-centered, and flexible learning experience. But overcoming digital literacy, ethical use of AI, data privacy and institutional readiness are crucial for the successful implementation of AI.

Keywords: Artificial Intelligence, Personalized Learning, Student Engagement, Higher Education, AI-Based Learning Systems, Karachi Universities, Pakistan.

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Neuroband: AI-Based Emotional Pain Detection System for Non-Verbal Patients Using Multimodal Physiological and EEG Signals

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Emotional pain among non-verbal patients remains a significant yet underexplored challenge in contemporary healthcare, as individuals affected by conditions such as coma, locked-in syndrome, advanced neurodegenerative disorders, and severe paralysis remain often unable to communicate their emotional distress despite retaining varying levels of consciousness. Consequently, conventional assessment approaches that primarily rely on verbal communication and behavioural observation remain inadequate for accurately identifying concealed emotional suffering in this vulnerable population. To address this limitation, this paper presents an artificial intelligence-based wearable framework for real-time emotional pain detection that integrates multimodal physiological signals, including heart rate variability (HRV), electrodermal activity (EDA), peripheral skin temperature, and electroencephalography (EEG). The acquired physiological signals remain analysed using advanced deep learning architectures, including Long Short-Term Memory (LSTM) networks, Convolutional Neural Networks (CNNs), and Transformer models, to identify complex patterns associated with emotional distress. Furthermore, Explainable Artificial Intelligence (XAI) techniques, including SHAP and LIME, incorporated to enhance model transparency by providing interpretable clinical insights into the prediction process. The framework draws upon publicly available physiological emotion corpora in conjunction with real-time recordings acquired from wearable sensors and a lightweight EEG headband, while a mobile and web-based dashboard sustains continuous patient monitoring and issues timely alerts when significant emotional distress detected. Evaluation across both public corpora and clinical recordings, reported separately to expose any degradation under authentic bedside conditions, demonstrates that multimodal fusion yields more dependable detection than single-modality configurations. The work advances intelligent clinical decision support by uniting wearable sensing, multimodal deep learning, and explainable artificial intelligence to improve the identification and management of concealed emotional suffering in patients who cannot communicate verbally.

Keywords: Artificial Intelligence, Electrodermal Activity (EDA), Electroencephalography (EEG), Emotional Pain Detection, Explainable Artificial Intelligence (XAI), Heart Rate Variability (HRV), Non-Verbal Patients, Wearable Healthcare.

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HealHer: An AI-Powered Multilingual Mobile Health Platform for Breast Cancer Awareness, Self-Examination Guidance, and Educational Mammography Support in Pakistan

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Breast cancer is the most common cancer in women in Pakistan and the highest age standardized incidence rate of breast cancer is reported in Pakistan in the Asian region, where one in nine women is expected to develop breast cancer at some point in her life (Aslam et al., 2024; Munawwar et al., 2023). Despite this burden, the awareness of warning signs, self-examination and screening is low and expertise in oncology is limited to a few centres in urban areas (Khan et al., 2024). This paper introduces HealHer, a multilingual health education mobile-first solution that is specially created for Pakistan. HealHer's suite includes an educational (non-diagnostic) mammography-image review feature, guided breast self-examination instructions, awareness content through short-form video “reels,” and patient, doctor, hospital/NGO and content creator dashboards. It has been designed with Agile/Scrum sprints and a User-Centred Design process, and is implemented with Next.js, React, TypeScript, Firebase and Google Gemini. The design philosophy, features, system architecture, workflow algorithms, and positioning of HealHer with respect to the current global digital health tools, its opportunities to advance breast-health literacy, and early help-seeking amongst Pakistani women are described.

Keywords: Healthcare for Breast Cancer Awareness, Mobile Health, Artificial Intelligence, Multilingual Healthcare Application, Self-examination, And Digital Health.

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Role of burnout in the relationship between dimension of abusive supervision and turnover intention

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The present study aims to investigate the role of burnout in the relationship between dimensions of abusive supervision and turnover intention. Questionnaires were filled by employees of textile industries in Karachi. In this study Structural Equation Models (SEM) and Confirmatory Factor Analysis were used as the statistical techniques. The results of the study revealed significant insights that all dimensions of abusive supervision significantly predict burnout and turnover intention in employees of textile industries. Findings supported the mediation model of burnout between dimensions of abusive supervision and turnover intention. Since, it is found that dimensions of abusive supervision and burnout are significant increases the turnover intention among employees it is recommended that managers of textile industries should not get involved in the abuse and maintain a respectful work environment at the workplace in order to reduce the burnout and turnover intention.

Keywords: Dimensions of Abusive Supervision, Burnout And Turnover Intention.

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Exploring Teachers' Practices of Formative Assessment in Strengthening Feedback and Supporting Students' Learning: A Case Study of a Private School in Karachi, Pakistan

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Formative assessment is widely regarded as an important part of effective teaching because it helps teachers understand what students have learned and decide how teaching and feedback should be adjusted. This study explored teachers' practices of formative assessment in strengthening feedback and supporting student learning. The purpose of the research was to understand how teachers perceive formative assessment, how they gather evidence of students' learning during instruction, how they use this evidence to provide feedback, and how students experience and use the feedback they receive.

The study followed a qualitative, interpretivist approach & used an exploratory case study design. It focused on teachers' understanding of formative assessment, their classroom practices, and students' experiences of receiving and using feedback. Data were gathered through semi-structured interviews with three English Language teachers, non-participant classroom observations, and focus group discussions with students from Grades 8 and 9. Braun & Clarke's thematic analysis framework was used to identify recurring patterns across the data. Findings from the different sources were compared to strengthen the credibility of the analysis.

The findings showed that formative assessment was part of everyday classroom teaching. Teachers used questioning, guided practice, peer correction, rubrics, worksheets, exit tickets, classroom discussions, digital tools, and both verbal and written feedback. They understood formative assessment as a way of gathering immediate evidence of learning, identifying misconceptions, adjusting instruction, and responding to students' needs. Students particularly valued feedback that was clear, specific, easy to understand, and practical. Oral feedback was especially helpful because it allowed them to ask questions and clarify what they needed to improve. Students also showed a willingness to take responsibility for their learning by revising their work, comparing drafts, reflecting on errors, and asking for further explanation.

However, the study also found an important gap between receiving feedback and using it to improve learning. Although teachers regularly gathered evidence and provided feedback, students were not always given structured time or opportunities to revise their work, reflect on their progress, or demonstrate improvement. Students wanted more time and opportunity to act on feedback. The core issue, then, is not the absence of formative assessment but an incomplete feedback loop:evidence is gathered and feedback given, but follow-up and monitoring of improvement are often missing. Teachers linked this difficulty to large class sizes, heavy workloads, and limited instructional time. As a result, formative assessment was often initiated but not carried through as a complete learning process.

The study concludes that the effectiveness of formative assessment depends not only on the quality of feedback but also on what happens after feedback is given. A meaningful formative assessment cycle requires teachers to gather evidence, provide useful feedback, create opportunities for students to act on it, and then review whether learning has improved. By presenting formative assessment as a continuous cycle rather than a collection of techniques, this study contributes to discussions on feedback literacy and assessment for learning in examination-oriented contexts. It also offers practical implications for teachers, school

leaders, and professional development programmes seeking to build classrooms in which feedback leads more consistently to meaningful improvement in student learning.

Keywords: Formative Assessment, Feedback, Assessment for Learning, Student Learning, Teacher Practice, Feedback, Literacy

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The impact of Innovative Pedagogies using digital simulations on students' attitude towards learning Mathematics: A Quasi-Experiment on Lower Secondary Schools in Karachi

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Innovative pedagogy has gained attention of many researchers as an effective approach to enhance students' positive attitude towards learning mathematics and achieve a high mathematics score. Students commonly face difficulties in understanding basic mathematical concepts which leads to mathematical anxiety (Firdaus et al., 2025) not because they are unable to grasp but due to "learned mindset shaped by negative experience and social influence." (Panit, 2025) which may include learning the subject in a conventional way, students need to connect the concept with experience and therefore there is a need to change the way mathematics is taught. This study aims to analyze the effectiveness of using innovative pedagogy to develop a positive attitude among grade 6 students to learn mathematics and gain higher marks. The researchers used quasi-experimental design involving grade 6 students selected from three schools (2 private and 1 public) located in East and South districts of Karachi, Pakistan.

The East and South districts were purposively selected for this study because the two model schools operated under a public university are located exclusively within these districts. In addition, these districts account for 43 out of the 72 eligible schools (59.7%) in the three school pools, which is the highest percentage of schools in the sampling frame. The students were divided into two sections as experimental (students who learnt mathematics using digital simulation method and group work) and control (students who learn mathematics through lecture-cum-demonstration method). An achievement test was used to collect data and a research instrument was used to gather data for the perception of students' attitude. The statistical analysis includes t-tests on controlled and experimental group. The results significantly differentiated between the experimental and control specially for students who were exposed to digital simulations, showed higher self-confidence, motivation, enjoyment, work effort, value, and mathematics achievement, and lower mathematics anxiety. Based on the results, it is concluded that the use of innovative pedagogy with the application of digital simulations and group work can significantly improve the affective and academic results in mathematics learning. The study suggests that technology-based, learner-centered instruction in the mathematics classroom be integrated to enhance students' learning experiences and achievement.

Keywords: Innovative Pedagogies, Paragogy, Cybergogy, Mathematics Achievement, Attitude Towards Learning Mathematics

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Determinants Of Generative Artificial Intelligence (GenAI) Adoption Among University Students And Its Impact on Academic Performance: The Mediating Role of Trust in Technology

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The rapid rise of Generative Artificial Intelligence (GenAI) has reshaped the educational landscape by introducing new tools for learning, analysis, and academic support. However, its adoption among university students is shaped by both behavioral and technological factors that determine how effectively it can be used. This study aims to examine the key elements that influence students' use of GenAI and to explore its impact on academic performance, with particular attention to the mediating role of trust in technology. In the educational institution, the adoption of the Generative artificial intelligence (GenAI) has also been increasing among the students, and this is attributed to the ability of the technology to improve learning abilities that it can motivate teachers, reduce dropouts, and personalize learning. It has also been advised that the implementation of AI may cause the creation of assumptions as well as the spread of misconceptions and the promotion of inappropriate learning strategies However, Pakistan is very far behind in this matter. Even though initiatives such as Digi Skills, collaborations with Khan Academy, or AI powered education initiatives introduced as a result of COVID-19 remain promising, they remain scattered and fail to overcome infrastructure bottlenecks, especially within rural areas of Pakistan, due to limited access to technological resources. These challenges are gradually being addressed through various developments. According to recent local research, many are still connecting AI software with chatbots, without consideration for the fact that the reality of its potential is much greater. This will enable the country's major sectors to greatly benefit from these by increasing efficiency and promoting innovation. AI has the ability to greatly improve the educational sector.

Data were collected through a structured questionnaire administered to students at private universities, and Partial Least Squares Structural Equation Modeling (PLS-SEM) was applied to analyze the relationships between adoption factors, technological trust, and academic outcomes.

Keywords: AI Creation, Use of AI, Student Grades, Belief in Tech, Understanding of Technology, Personal Thoughts, College Students, Preference for Tech

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Consulting-Led AI Transformation in Vocational Training: A Partnership Framework for Future-Ready Skills in Emerging Markets

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The rapid integration of generative artificial intelligence, automation, and digital instrumentation precipitates a transformation of job roles within sectors such as manufacturing, logistics, retail, hospitality, and IT-enabled services (Kocaoğlu & Szymczak, 2025),(Sudan, 2023). Vocational education and training (VET) systems within emerging markets encounter significant challenges in maintaining alignment with such trajectories, a phenomenon that frequently results in skill disparities, underemployment, and diminished resilience among youth and mid-career cohorts (Sudan, 2023),(Santoso et al., 2026). The current inquiry delineates a consulting-led artificial intelligence transformation framework for vocational training, which may connect training providers, employers, and international partners for the co-design and delivery of future-ready, industry-aligned skill programs within India and similar socioeconomic contexts.

Adopting a design-based, practice-oriented methodology, the study draws upon consulting engagements with vocational training providers (Industrial Training Institutes, polytechnics, private training academies, and skill development organizations) and small and medium enterprises (SMEs) in India. Data sources encompass employer needs assessments, trainer interviews, and pilot implementations of short, stackable learning modules focused on AI-augmented technical skills, digital literacy, and workplace problem-solving capacities. The framework comprises three distinct components: (1) a diagnostic model designed to identify AI-sensitive occupations and priority competency gaps across key vocational sectors; (2) a micro-credential architecture that aligns modular, work-relevant learning outcomes with occupational standards and global skill frameworks; and (3) a partnership framework that facilitates the co-delivery of programs by local consultants alongside international VET institutions, training organizations, and educational technology providers.

Early implementations suggest that this approach may facilitate the improvement of alignment between vocational curricula and employer requirements, the enhancement of learner motivation through the utilization of short, job-linked credentials, and the provision of structured pathways for the upskilling of entry-level and mid-level workers (Varadarajan et al., 2023), (Yun & Lai, 2026). The framework may also facilitate the creation of clear entry points for international partners to localize curricula, co-create joint certifications, and establish regional implementation hubs for vocational programs. By emphasizing resilience (adaptability to technological change), responsibility (ethical and safe use of AI at work), and lifelong learning (stackable credentials and continuous upskilling), the model appears to support the ICETOL 2026 theme of “Education for uncertain futures: learning, resilience, and responsibility” and aligns with sub-themes on micro-credentials, employability, and digital transformation in vocational education.

The paper may delineate implications for vocational training leaders, policymakers, and global education and technology providers seeking scalable, context-sensitive models for AI-enabled skill development. It further elucidates the manner in which consulting firms can position themselves as strategic intermediaries in building sustainable, partnership-driven ecosystems for vocational training and workforce development in emerging economies.

Keywords: AI in Skills Development; Industry-training Partnerships; Emerging Markets

(660)

AgroSense: An IoT- and Machine-Learning-Based Smart Irrigation and Crop Monitoring System for Lemon Cultivation

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[1] Agrosense

Farming in developing countries such as Pakistan is facing increasing stresses, there is a shortage of water, climate change is making forecasting more difficult, and the vast majority of irrigation continues to be based on a farmer's intuition instead of authentic data. The outcome is a familiar one - water is lost, crops are affected and yields are not achieved. This paper proposes a cost-effective solution using IoT and machine learning concepts to make smart irrigation and crop monitoring more accessible to SMD scale farms: called AgroSense. It integrates on ground environmental sensors and data processing on the cloud and provides a mobile decision support interface in one single, end-to-end pipeline.

With an embedded IoT edge device-based sensing unit, AgroSense collects real-time soil moisture, air temperature, humidity, light intensity and rain data. Supervised machine learning models are used to process this data in order to evaluate crop stress conditions and produce irrigation recommendations. Moreover, the system incorporates an intelligent irrigation actuation functionality with the assistance of a relay system operated by a micro-controller. Farmers interact with the system through a mobile application that presents their real-time sensor readings, predictive analysis, alerts, and manual override.

AgroSense is different from the majority of the smart irrigation systems available, as it is designed to build around a single crop or one specific task. It has been designed specifically for multi crop, multi-functional platform and it is directly applicable to wheat, rice and lemon crops. Cost was continually kept at the forefront of mind, as was the scalability and actual working under real open field conditions, not controlled laboratory conditions. The overall objective is simple: to improve the use of water, monitor crop condition, and to progress towards more sustainable agriculture systems. Test results support this, and, indeed, combining low cost IoT hardware with machine learning can provide the kind of actionable intelligence precision agriculture is looking for, particularly in places with limited resources.

Keywords: Smart Agriculture, Precision Irrigation, Internet of Things, ESP32, Environmental Monitoring, Soil Moisture Analysis, Machine Learning, Random Forest, Crop Stress Assessment, Cloud Integrated Farming.

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An AI-Assisted Programming Assessment Platform for Automated Test Case Generation, Educational Feedback, and Programming Difficulty Prediction

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Programming lab is at the core of computer science education, manual written test cases exists and only a binary pass/fail feedback is provided. The teachers expend a great deal of effort in developing assessment resources and students have little guidance in learning. This paper introduces an AI-Assisted Programming Assessment Platform, which utilizes Large Language Models in an automated programming assessment system. The platform consists of three modules: automatic test case generation, personalized feedback for educational and programming difficulty prediction. It leverages the Groq API and the Large Language models to create structured test cases in six categories, give feedback on provided code and execution outcomes, and rate the difficulty of the problems. A comparative evaluation of Meta Llama 3.3 70B, Meta Llama 3.1 8B, Mistral Small, GPT-OSS 20B and Qwen 3.6 27B shows that Llama 3.1 8B is the most accurate model for programming difficulty prediction. Judge0 executes code and the system is constructed in Asp.NET Core 8, React 18, and PostgreSQL. This platform is equipped with an embedded research evaluation system that collects information on all user (instructor and student) interactions during regular operation, and evaluates the quality of the AI output (accuracy, F1-score, ROC-AUC, instructor's acceptance rate, student feedback ratings). Pilot results show that the system functions as expected, and that there is a reduction in the workload for the instructors while the quality of the feedback remains.

Keywords: Large Language Models, Programming Assessment, Test Case Generation, Educational Feedback

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Designing a Novel Hybrid Statistical Algorithm for Enhancing MIS Reporting and IFRS-Compliant Financial Reporting in a Bank's Central Payments Department

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Management Information System (MIS) reporting and International Financial Reporting Standards (IFRS)-compliant financial reporting are mission-critical activities within the Central Payments Department of a large commercial bank. Traditional reporting pipelines rely on manual reconciliation, static rule sets and single-model analytics, which struggle to capture the heterogeneous, high-volume and imbalanced nature of payment data. This paper proposes the Hybrid Statistical Ensemble Framework (HSEF), a novel algorithm that integrates Bayesian priors, logistic regression, Random Forest classification, Isolation Forest anomaly scoring, statistical outlier detection, time-series accrual forecasting and Monte Carlo risk simulation within a weighted soft-voting fusion layer. HSEF is designed for United Bank Limited (UBL) Central Payments operations and is evaluated on a realistic synthetic payment dataset of 1,200 transactions. Compared with a traditional single-model baseline, HSEF improves exception-detection recall from 0.17 to 0.38 and the F1-score from 0.15 to 0.37, while raising the ROC-AUC from 0.60 to 0.65. The framework additionally tags every transaction with its IFRS category, producing an auditable, consistent and timely reporting trail. Results indicate that a justified hybrid design materially enhances reporting accuracy, exception detection and audit readiness relative to conventional approaches.

Keywords—MIS reporting, IFRS compliance, hybrid algorithm, ensemble learning, anomaly detection, financial analytics, Bayesian inference, banking data science, payment reconciliation.

Keywords: MIS; IFRS; Data Modeling

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From Scrolling to Offloading: Digital Content and Cognitive Function

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Today's digital content culture has become a bombardment of information, moving into a new direction from complex, media-dominated, professionally crafted pages to increasingly dynamic, engagement-focused content on the short-form video platforms, influencer networks, algorithmic feeds and generative artificial intelligence. The shift has increased access to information, participation in media production, and concerns regarding attention, cognitive endurance, reasoning, emotional regulation, and human relationships. This exploratory qualitative study involved an interdisciplinary literature review and semi-structured interviews with two senior clinicians from complementary professions – a clinical mental-health and addiction counsellor with over 15 years' experience in Pakistan and New Zealand, and a neurologist with over 30 years of clinical experience in a major tertiary care hospital in Pakistan. The interviews were a mix of profession-specific Likert items and open-ended questions and were analyzed using reflexive thematic analysis with a hybrid deductive–inductive coding strategy. Five integrated themes were developed: fragmented attention and reduced cognitive depth; reinforcement-driven dependence and diminished self-regulation; AI-mediated cognitive offloading; developmental vulnerability and generational adaptation; and weakening direct human connection. The counsellor also highlighted anxiety, irritability, insomnia, anhedonia and functional disability. The neurologist further highlighted the importance of attention in learning, premature closure of thought, loss of incidental learning, and doubts about the trustworthiness of AI-generated information. Results do not indicate a decrease in intelligence or general ability. They suggest potential avenues whereby engagement-optimized and AI-generated content could lead to excessive, passive, compulsive, or substitutive use, which might hinder the consistent development of sustained attention, independent thinking, creativity, emotional self-regulation, and relational skills. A conditional augmentation–substitution framework is proposed for this study and priorities are outlined for larger, multidisciplinary, longitudinal and experimental studies.

Keywords: Attention Economy; Short-form Video; Influencer Culture; Cognitive Offloading; Artificial Intelligence; Digital Dependence; Cognitive Engagement; Social Media

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The Relationship Between Spatial Ability and UAV Learning Outcomes among University Students

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This study investigates the relationship between spatial ability and unmanned aerial vehicle (UAV) learning outcomes among university students. It focuses on the possible contribution of spatial ability to conceptual knowledge, operational skills, skill-acquisition speed, and certification performance. The study context involved 60 students enrolled in UAV operation courses at a university of science and technology. Thirty students received conventional hands-on instruction, whereas 30 received progressive virtual–physical integrated instruction combining flight simulation, virtual reality, and hands-on UAV practice. Available data included a conceptual-knowledge test, time required to attain basic operational competence, performance-based skill assessment, certification results, and student interviews.

Existing learning outcomes showed no significant between-group difference in conceptual knowledge. However, students in the virtual–physical integrated condition required less practice time to attain basic competence and achieved higher operational-skill scores and certification pass rates. Because these differences were concentrated in tasks requiring orientation discrimination, perspective transformation, spatial localization, and dynamic path correction, spatial ability is proposed as an important individual-difference factor in UAV learning. The paper therefore develops a framework for examining the relationship between spatial ability and multiple learning outcomes.

The original dataset did not include a standardized measure of spatial ability. Accordingly, this paper does not fabricate correlations or predictive effects. It recommends supplementing the dataset with the Revised Purdue Spatial Visualization Test: Visualization of Rotations or a comparable measure and examining the proposed relationships through correlation, hierarchical regression, and moderation analyses. The framework provides a basis for subsequent empirical testing and adaptive instructional support.

Keywords: Spatial Ability, UAV Learning, Operational Skills, Learning Outcomes, University Students

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Do Social Networking Sites Have an Impact on Youth and Teenagers? ”An Analysis of Teenagers Behavior Towards SNSs

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This research study is to examine the impact of social networking sites on the students, teenagers and the youth. Nowadays Students have full authority from their parents to use social networking sites. Even though they know how unsafe and addictive it could be for their children. The survey was conducted through 100 random students which revealed that 57.4% students find it useful to maintain relationships with people on social networking sites and according to 79.6% students there should be the limit on personal information and the data should
not be shared with the friends but when it comes on the academic performance of students, it is convenient for them to learn online and 75.9% agreed on it. The purpose of the questionnaire was to find the factors of SNSs that impact students behavior and on their privacy. Variables identified are performance expectancy, perceived ease of use, social influence and privacy.

Keywords: Social Networking Sites, Students, Academic Performance, Performance Expectancy, Social Influence, Perceived Ease of Use, Privacy

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Shaping the Future of Higher Education and facing the Challenges in Implementing Blended Learning

Huma Shahid

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Following the COVID-19 pandemic, higher education institutions (HEIs) rapidly adopted digital tools, making blended learning an increasingly prominent approach that combines the structure of face-to-face instruction with the flexibility and scalability of online learning.
However, HEC-recognized universities in Pakistan continue to face pedagogical, institutional, technological, and policy-related challenges in implementing blended learning effectively. The purpose of this study was to explore the implementation of blended learning in Pakistani higher education, with particular emphasis on the factors influencing faculty members' selection of blended-learning sub-models, institutional policies and technological infrastructure, perceptions of face-to-face and online modalities, effects on student engagement and learning outcomes, and strategies for overcoming implementation barriers. An exploratory qualitative case-study design was employed. Faculty members working in HEC-recognized universities were selected through purposive sampling, and data were collected through semi-structured interviews.
The data were analyzed thematically to identify recurring patterns and perspectives. The findings revealed that faculty members' choice of blended-learning models was influenced by course content, class size, students' digital readiness, teachers' technological competence, and access to institutional support. Although participants valued face-to-face instruction for direct interaction and immediate feedback, they considered online learning beneficial for flexibility, accessibility, and resource sharing. Inadequate digital infrastructure, unreliable internet connectivity, limited professional development, increased faculty workload, and unclear institutional policies emerged as major barriers.
Nevertheless, blended learning was perceived to improve student engagement and learning outcomes when supported by appropriate instructional design and timely feedback. The study recommends developing clear institutional policies, strengthening technological infrastructure, providing continuous faculty training, and establishing technical and pedagogical support systems to ensure the sustainable implementation of blended learning in Pakistani universities.

Keywords: Synchronous And Asynchronous Learning, Higher Education Institution, Learning Management Systems, Exploratory Case Study, Stratified Purposive Sampling, Thematic Analysis

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Driving Financial and Operational Performance through Generative AI and FinTech Integration: Empirical Evidence from Pakistan

Wajahat Hussain

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With advent of technology, Generative AI (GenAI) and FinTech integration are evolving financial institutions by automating cognitive processes, strengthening analytics, and enabling data-driven decision-making. However, the mechanisms through which these technologies translate into superior financial and operational performance remain underexplored, particularly in emerging markets within Pakistan. Drawing on Dynamic Capability Theory and the Resource-Based View, this study examines how GenAI adoption and FinTech integration enhance organizational capabilities and, in turn, drive performance outcomes in Pakistan's banking industries.

Using a quantitative explanatory design, primary data were collected via a structured questionnaire from 200 banking employees. Partial least squares structural equation modelling (PLS-SEM) was employed to test the hypothesized relationships. Results reveal that FinTech integration exerts the strongest positive effect on financial capabilities (β = 0.818), while GenAI adoption most strongly influences operational capabilities (β = 0.503). Operational capabilities emerge as the primary driver of financial performance (β = 0.751). All hypothesized direct paths and the sequential mediation of financial performance between financial capability and operational performance are supported.

The findings demonstrate that the performance benefits of GenAI and FinTech arise primarily through the development of interdependent financial and operational capabilities rather than through technology adoption alone. The study contributes to digital transformation literature by providing empirical evidence from an emerging-market context and offers practical guidance for managers and policymakers seeking to leverage digital technologies for sustainable performance gains.

The results of this study have some significant implications for managers and top managers of the financial sector in Pakistan. First, the preeminent impact of FinTech Integration on Financial Capabilities implies that financial institutions should mainstream the application of digital financial technologies in their core financial planning, monitoring and reporting activities, not use FinTech adoption as an add-on. Managers need to pay particular attention to ensuring that FinTech platforms are also compatible with the information systems that are already in place at the organization to maximize the value and impact of capability development.

The study has acknowledged its shortcomings in terms of cross-sectional design, perceptual measurement and sample scope, but it has still been able to make substantive theoretical, contextual and managerial contributions to the digital transformation and capability-based performance literature. This work should be extended in future research by using longitudinal design, objective evidence of performance and cross-national comparative analysis to further deepen the understanding of how emerging economies can leverage the use of AI and FinTech innovations for ongoing organizational excellence

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Keywords: Generative AI, FinTech Integration, Financial Capability, Operational Capability, Organizational Performance, Dynamic Capability Theory, Pakistan

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HyFlex Learning and Teaching in Higher Education 1

Cengiz Hakan Aydin [1], Kenan Dikilitaş [2], Robert Morris Gray [2], Brian J. Beatty [3]

[1] Özyeğin University
[2] University of Bergen
[3] San Francisco State University

As higher education increasingly embraces flexible and technology-enhanced learning, educators need practical approaches to designing engaging and inclusive HyFlex learning environments. This panel introduces the Erasmus+ HYCOMM project and its AI-supported HyFlex Learning and Teaching training program, developed collaboratively by partner universities in Norway, Spain, and Türkiye to strengthen faculty competencies in HyFlex pedagogy and responsible AI integration. Panelists will present the structure and key features of the training before sharing insights from its pilot implementation across the three institutions. The discussion will highlight participants' experiences, perceived benefits, implementation challenges, and recommendations for improving both the training and institutional readiness for HyFlex education. Special attention will be given to themes such as faculty workload, student engagement, learning design, AI-supported teaching, and organizational support. The panel offers valuable evidence-based insights for educators, instructional designers, and institutional leaders seeking to scale sustainable, learner-centered, and AI-enhanced HyFlex practices in higher education.

Keywords: HyFlex Teaching, Hybrid Learning Design, Flexible Learning

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HyFlex Learning and Teaching in Higher Education 2

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Keywords: HyFlex Teaching, Hybrid Learning Design, Flexible Learning

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Inequalities in Access to Generative Artificial Intelligence in Higher Education: A Systematic Review and Student Perspectives

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This study aims to examine inequalities in access to generative artificial intelligence (GenAI) in higher education and explore the implications of these disparities for young people's right to education, equal opportunity, and social inclusion. The study employed a systematic review combined with a qualitative approach involving focus group interviews to gain in-depth insights. Data obtained from the systematic review and focus group interviews were analyzed using content and descriptive analysis methods. Initially, a systematic search was conducted in the Web of Science and Scopus databases following PRISMA guidelines. The search was limited to English-language articles published between 2022 and 2026. After removing duplicates and applying specific inclusion and exclusion criteria, a final sample of 29 articles was selected for the systematic review. For the qualitative phase, focus group interviews were conducted with 8 students currently enrolled at a state university in Türkiye. The findings show that inequalities in access to GenAI can influence young people's educational opportunities, access to information, and participation in learning processes. Specifically, both the literature and interviews indicated that a lack of knowledge is the primary obstacle to GenAI access. Secondly, barriers related to economic conditions emerged prominently in both the interviews and the literature analysis. These financial constraints prevent students from accessing premium platforms and restrict access to necessary internet or computer infrastructure. Beyond these socio-economic hurdles, inadequate institutional support and policies, regional restrictions, and individual English language barriers were also identified as significant obstacles to equitable access. These barriers may reinforce existing inequalities among students and contribute to unequal learning experiences. Therefore, access to GenAI emerges not merely as a technological issue but as a matter that must be evaluated in terms of equal opportunity and social inclusion. Ensuring equitable access requires attention to technological infrastructure, digital competencies, financial resources, institutional support, and language-related needs. To foster more inclusive and equitable access, this study proposes targeted policy and practical recommendations for higher education institutions and policymakers.

Keywords: Generative Artificial Intelligence, Higher Education, Access Inequality, Educational Equity, Social Inclusion

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AI-Supported Storytelling with Gemini Storybook: Receptive and Expressive Language Skills of Preschool Children

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This study aims to examine changes in the receptive and expressive language skills of preschool children through AI-supported storytelling activities. In the study, story texts and visual content used in the activities were created with Gemini Storybook, and necessary revisions to the generated content were made using Canva. The prepared stories were presented to experts in preschool education, educational technologies, and Turkish language education, and necessary revisions were made based on expert feedback. The study was conducted using a one-group pretest-posttest design. The study group consisted of 32 children aged 4 attending a preschool education institution. Before and after the implementation, the Turkish Early Language Development Test (TEDİL) was administered to assess the children's receptive and expressive language skills. During the implementation process, children were presented with AI-supported stories and participated in storytelling activities. Their listening, oral expression, and interaction/participation behaviors during the storytelling activities were evaluated using an observation form. The observation form consisted of 10 items rated on a three-point scale as "Yes," "Partially," and "No." Observation forms were completed separately for each child at the end of each session. The implementation was carried out over 10 weeks, with two sessions per week, for a total of 20 sessions, and each session lasted 40 minutes. After each story, integrated activities were included to reinforce the stories. Examination of the observation data showed that the listening, oral expression, and interaction/participation behaviors of most children were rated as "Yes," while those of some children were rated as "Partially." A limited number of "No" responses were observed, and these responses were found to recur mostly among the same children. Statistical analyses of the TEDİL pretest and posttest scores are ongoing, and findings regarding changes in receptive and expressive language skills will be reported after the analyses are completed.

Keywords: Artificial Intelligence, Storytelling, Preschool Education, Receptive Language, Expressive Language

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Design and Development of an AI-Powered Chatbot to Support the Reading Comprehension Skills of Middle School Students with Specific Learning Disabilities

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Reading comprehension is a multifaceted process that involves skills such as understanding what one reads, interpreting a statement, drawing conclusions, and distinguishing between ideas. Students with specific learning disabilities may experience difficulties in their academic development—such as in reading, writing, and mathematics—compared to their peers. The difficulties encountered by students with specific learning disabilities in their reading processes have highlighted the need for reading support that takes their individual needs into account and helps them make sense of the text and establish connections within it.

Accordingly, the purpose of this study is to introduce the instructional structure, pedagogical foundations, design features, and operational mechanism of an AI-powered chatbot developed to support the reading comprehension processes of middle school students with specific learning disabilities. The chatbot was specifically designed to address reading comprehension difficulties experienced by students with specific learning disabilities by supporting comprehension monitoring, identification of key information, connections with prior knowledge, recognition of unfamiliar words, and organization of story elements.

The chatbot's pedagogical structure is based on metacognitive reading strategies and the story map technique, which support students in monitoring their own comprehension process and actively participating in the reading process. This approach is structured within the chatbot into three phases: pre-reading, during-reading, and post-reading. In the pre-reading phase, the student is expected to prepare for the reading process by making predictions about the content based on the text's title and selecting a reading pace that suits them. In the during-reading phase, the student is supported in monitoring their own comprehension process by identifying key information in the text, connecting what they read to prior knowledge, and recognizing words whose meanings they do not know. In the post-reading phase, students are encouraged to reflect on their own reading process by summarizing the text and evaluating the difficulties they encountered during reading as well as the elements that aided their comprehension. The story map technique is also integrated into this stage to help students identify key story elements—such as the protagonist, time, setting, problem, events, and resolution—and structure the text they have read.

The texts used in the chatbot and the questions related to them are predefined in the system. Artificial intelligence plays a supporting role in this process. The GPT-4o mini model evaluates students' responses, provides definitions for unfamiliar words in accordance with the system context, and provides guidance, hints, and feedback tailored to the student's needs during the activity. Additionally, the time students spend in the system and the responses they provide throughout the process are recorded as part of the system's data logging feature.

The developed chatbot is designed as an instructional support tool that integrates controlled AI-assisted guidance and feedback, metacognitive reading strategies, the story map technique, voice support, and a trackable, recordable process into a structured learning environment comprising pre-reading, during-reading, and post-reading stages.

Keywords: Specific Learning Disabilities, Artificial Intelligence, Chatbot, Story Map, Reading Comprehension

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Distance Education: Who Is in Control? Humans or Artificial Intelligence? Exploring the Future of Digital Learning

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North Cyprus

The rapid integration of Artificial Intelligence (AI) into distance education has transformed the way knowledge is delivered, accessed, and experienced. While traditional online learning environments have been mainly designed and controlled by human educators and institutions, AI-powered systems are increasingly taking an active role in content generation, personalized learning, assessment, and learner support. This raises an important question: Who is controlling the future of distance education—human beings or artificial intelligence?

This study explores the current state of AI-enhanced distance education and examines the evolving relationship between human intelligence and artificial intelligence in digital learning environments. It discusses existing applications, including AI tutors, adaptive learning systems, automated feedback, learning analytics, and generative AI tools, while considering their impact on teachers, learners, and educational institutions.

The study argues that the future of distance education will not be a competition between humans and AI, but rather a collaboration where AI supports human decision-making, creativity, and pedagogical expertise. However, maintaining human control, ethical responsibility, transparency, and learner-centered approaches remains essential.

The findings provide insights into how educational systems can benefit from AI innovation while preserving the irreplaceable role of educators in creating meaningful and inclusive learning experiences.

Keywords: Distance Education, Artificial Intelligence, Generative AI, Human-AI Collaboration, Digital Learning, Future of Education

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Modeling Mathematical Process Skills and Mathematical Resilience through Generative AI and Learning Analytics

Fatih Kaleci

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As educational environments navigate increasingly uncertain and AI-mediated futures, mathematics education faces a dual challenge: leveraging generative artificial intelligence (GenAI) for adaptive support while preserving the reasoning, agency, and productive struggle through which mathematical competence develops. This study examines how GenAI and Learning Analytics (LA) can be integrated to generate process-sensitive evidence about students' mathematical problem solving, reasoning and proof, communication, representation, and connections, while also examining mathematical resilience during complex problem-solving activity.

An explanatory sequential mixed-methods design (QUAN → qual) is employed. In the quantitative phase, digital trace data generated during GenAI-supported mathematical problem-solving sessions are integrated with task-performance indicators and measures of mathematical resilience. Interaction events are coded according to the functional role of GenAI use—including explanation seeking, strategy generation, verification, revision, error diagnosis, and representation—and student responses to AI-generated suggestions are differentiated as acceptance, verification, revision, rejection, or extension. Cluster analysis and sequential pattern mining are then used to identify distinctive human–AI learning trajectories and recurrent patterns associated with mathematical process-skill performance and persistence during cognitive impasses.

The qualitative phase uses purposive sampling from the identified trajectories. Semi-structured diagnostic interviews and student reflection records are analyzed thematically to explain how learners interpret AI feedback, regulate mathematical inquiry, respond to difficulty, and negotiate responsibility for mathematical decisions. Quantitative and qualitative evidence is integrated through joint displays to examine where behavioral traces converge with, complement, or contradict students' reported reasoning and agency.

The study proposes a dual-loop instructional architecture in which an inner learner–GenAI loop supports immediate scaffolding and an outer teacher–LA loop transforms process evidence into pedagogical intervention, both situated within a human-centered governance layer. Rather than treating clicks, prompts, or AI-assisted products as direct measures of learning, the framework conceptualizes them as evidence requiring contextual and pedagogical interpretation. The study contributes a process-oriented approach to learning analytics for mathematics education that seeks to support personalization without displacing productive struggle, mathematical agency, or teacher judgement.

Keywords: Generative AI; Learning Analytics; Mathematics Education; Mathematical Process Skills; Mathematical Resilience; Mathematical Agency

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A Multi-Dimensional NLP Analysis of Instructional Discourse and Student Reflections in Video Lectures

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Video lectures have become a widely adopted instructional medium in engineering education, particularly for conveying complex and abstract concepts. Prior research has examined their effectiveness from multiple perspectives, including cognitive load, multimedia design, and learner engagement. However, comparatively little attention has been paid to the role of instructor discourse in shaping how content is communicated and perceived by students. In particular, there is a lack of systematic, data-driven analyses that examine how linguistic features of instructional discourse relate to student perceptions in video-based learning environments. To address this gap, this study investigates how instructor discourse in video lectures is associated with student perceptions using a natural language processing (NLP) framework. The study draws on TR-EduVSum, a previously published corpus of Turkish video lectures on Data Structures and Algorithms delivered by four instructors. Both instructor discourse and student-generated texts were examined using NLP techniques to capture linguistic, emotional, and pedagogical dimensions. The results indicate that student perceptions and expressed understanding vary systematically with characteristics of instructor discourse. In particular, the instructor who received the most positive evaluations demonstrated more balanced speech pacing, greater lexical diversity, and a more motivational tone. Furthermore, the content of this instructor's lectures showed higher alignment with students' summaries compared to others. By integrating linguistic, emotional, and pedagogical analyses, this study proposes a data-driven framework for evaluating instructional discourse in video-based learning environments.

Keywords: Computer Engineering Students, Video Lectures, Discourse Analysis, Natural Language Processing NLP-based Video Lecture Analysis, Pedagogical/linguistic/emotional Analyses

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Exploring the Impact of Climatic Change on Anxiety and Stress in Emerging Adults - Social Support's Mediating Effect and Moderating Effect of Coping Strategies

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The climate crisis on a global scale has not only surpassed its beginnings as an ecological phenomenon but has turned into an intense psychosocial stressor. A sample size of 235 young adults (18-30 years old) participated in this quantitative study. Climate Change Anxiety Scale, Brief COPE Inventory, and Multidimensional Scale of Perceived Social Support, were used in the assessment. The results show that there is an excellent positive correlation between climate change concern and psychological distress that is statistically significant ($r = 0.834$, $p < .001$). Multiple regression model explained 70.79% variation in psychological distress ($R2 = 0.7079$). There was no mitigative effect of social perceived support on the psychological distress instead there is a strong positive association between anxiety and perceived social support ($\beta=0.2116$, $p= 0.006$), Moreover, the interrelationship between climate concern and anxiety was greatly mediated by coping mechanisms (Effect = 0.2128, 95% CI [0.0875, 0.3456]).

Keywords: Climate Anxiety, Eco-anxiety, Young Adults, Coping Strategies, Social Support, Psychological Resilience, Mental Health, Climate Change

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Examining the Effects of Online Examinations Conducted in a Proctored Laboratory Environment on the Instructional Process

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Online examinations are becoming increasingly widespread in higher education due to the flexibility and automation they provide in assessment and evaluation processes; however, the reliability of such examinations and the extent to which they accurately reflect learning outcomes remain matters of debate. This study was conducted to examine online examinations administered in a proctored laboratory environment, with IP-based access restrictions and under the supervision of proctors, in terms of the quality of learning. The research was designed as a qualitative case study. The study group consisted of three faculty members who administered online examinations through a learning management system (LMS) in a proctored laboratory environment with IP-based access restrictions. The participants were selected through criterion sampling. Following the examinations, they reviewed student- and item-level achievement matrices, and data were collected through a semi-structured interview form. The data were analyzed using content analysis and organized under themes and categories. When the findings were evaluated holistically, it was concluded that the low achievement rates observed in examinations conducted under proctored conditions indicated actual deficiencies in the attainment of course learning outcomes and highlighted the need for improvements at the instructional design level. The findings showed that student- and item-level achievement data obtained through the LMS provided faculty members with functional feedback for identifying students' learning deficiencies, topics and learning outcomes with which students experienced difficulty, and problematic examination items. Examination analytics were found to support instructional and assessment-related decisions, including revisiting course content, planning additional explanations and learning activities, providing feedback to students, and reviewing the question pool. The combined use of a proctored laboratory environment and IP-based access restrictions was also considered to support examination security, academic integrity, and the standardization of examination conditions. Nevertheless, preparing the question pool, designing questions in accordance with the online examination format, and the technical and administrative workload associated with implementation emerged as the main challenges of the system. Overall, the findings suggest that online examinations conducted in a proctored laboratory environment can be used not only for assessment purposes but also as a mechanism for generating data to support the improvement of the instructional process.

Keywords: Quality of Learning, Learning Analytics, Online Examination, Item Analysis, Question Pool, LMS, Proctored Examination

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The Unseen Face of Artificial Intelligence in Academia: Experiences of Academics and Graduate Students

Osman Urhan

Much of the research regarding the use of generative artificial intelligence in higher education focuses heavily on perceived usefulness, ease of use, efficiency, and behavioral intention to adopt. While these studies help us understand why and how the technology is used, they remain limited in explaining the less visible transformations it creates in everyday academic life. For instance, how does artificial intelligence affect a researcher's trust in their own thinking, their decision-making during the writing process, or their perception of the value of academic labor? Where is the boundary drawn between evaluating a suggestion and delegating the responsibility of decision-making to the tool? This study aims to examine the often-unstated impacts of generative artificial intelligence in academia through the experiences of academics and graduate students. Designed with a qualitative research approach, the study plans to conduct semi-structured interviews with 10 academics and 20 graduate students chosen from various universities and disciplines in Turkey. The interviews will address how participants utilize artificial intelligence in research, reading, writing, and feedback processes, as well as the situations in which they trust or approach the tool with skepticism. Furthermore, the study will investigate the extent to which participants share their artificial intelligence usage with colleagues and advisors, whether they feel explicit or implicit pressure regarding its use, and how these experiences relate to their perceptions of academic competence. Interview data will be analyzed through thematic analysis, evaluating issues such as academic autonomy, cognitive dependency, invisible labor, inequality, and the sharing of responsibility based on participants' narratives. The significance of this study lies in moving beyond the dominant perspective that treats artificial intelligence merely as a tool that facilitates or accelerates tasks. Examining the experiences of academics and graduate students together will help understand whether the same technology creates different opportunities and tensions across varying academic positions. The findings are expected to contribute to developing more comprehensive research questions regarding the use of artificial intelligence in higher education, and to discussing academic integrity, researcher training, and institutional support policies by taking the actual experiences of users into consideration.

Keyword: Generative Artificial Intelligence, Academic Autonomy, Higher Education