



International Journal of Strategic Information Systems and Knowledge Applications

Vol. 1, No. 1, January 2026 pp. 7-16

Journal Page is available at <https://internationaljournal.lppmunsaka.ac.id/index.php/jsiska>



E-Learning Platforms Development in Higher Education: A Conceptual Overview

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Abstract

The development of e-learning platforms in higher education has emerged as a critical response to the evolving demands of digital transformation in academic institutions. This conceptual overview explores the foundational elements that support the successful implementation of e-learning, including technological infrastructure, pedagogical strategies, institutional readiness, and user engagement. Drawing from interdisciplinary research, this paper outlines a framework that integrates educational technology theories and practical application models to optimize the learning experience in digital environments. The study emphasizes the need for adaptive platforms that accommodate diverse learning styles, support interactivity, and ensure accessibility for all students. Furthermore, it highlights the importance of continuous evaluation and quality assurance in maintaining the relevance and effectiveness of e-learning platforms.

Keywords: *E-learning, Higher Education, Digital Transformation, Educational Technology, Online Learning Platforms, Pedagogy, User Engagement, Institutional Readiness*

Introduction

The integration of e-learning platforms into higher education has become a ubiquitous trend, fundamentally reshaping the landscape of teaching and learning (Farid et al., 2015). This transformation extends beyond mere content delivery, influencing student engagement, pedagogical approaches, and the overall educational experience (Prosen & Ličen, 2025). The evolution of e-learning is deeply intertwined with the emergence of Web 2.0 technologies, which have catalyzed significant shifts in course delivery and pedagogical practices within universities across the globe (Hamadi et al., 2021). New technologies have reshaped how activities are conducted across various human endeavors, with colleges and universities in developed and developing nations leveraging information and communication technologies to positively impact teaching and learning strategies (Çavuş et al., 2021). The proliferation of digital resources, coupled with advancements in computing devices and software, has facilitated the seamless integration of technology into classroom settings (Kong, 2021). This transition addresses the demand for advanced technology systems, the increasing number of tech-savvy students, economic considerations, and the recruitment of international students (McColgan, 2012).

Despite the widespread adoption of e-learning, challenges persist, including the imperative to mitigate inequalities that may be exacerbated by the digital divide (Akar et al., 2022). Furthermore, the effectiveness of e-learning platforms hinges on their ability to foster student engagement, promote active learning, and provide personalized feedback, necessitating careful design and implementation (Uhomobhi & Ross, 2013). While e-learning holds immense promise for expanding access to education and enhancing learning outcomes, its successful

implementation requires addressing these challenges and aligning pedagogical approaches with the affordances of digital technologies. Higher education institutions face the ongoing challenge of adapting to this evolving paradigm, striving to offer learners the flexibility of accessing education anytime and from anywhere ([Farid et al., 2015](#)). The education sector is in perpetual motion, with digital transformation serving as a catalyst for enhanced pedagogy and novel learning experiences for students ([Zain, 2020](#)). The integration of digital tools has opened new avenues for educational institutions to enhance instructional strategies, cultivate digital literacy, and equip students with the requisite skills for success in the modern era ([Aldhafeeri & Alotaibi, 2022](#); [Ukpe, 2023](#)). In addition to the ubiquitous challenge in ensuring digital literacy, there remains significant disparities in access to technology and digital infrastructure, which can exacerbate existing inequalities in educational opportunities.

This paper aims to provide a comprehensive conceptual overview of the development of e-learning platforms in higher education, encompassing their evolution, key features, pedagogical implications, challenges, and future directions. It encompasses historical analysis, technology reviews, case studies, stakeholder surveys, and ethical and social implications, employing predictive modeling and trend analysis to project the future trajectory of digital transformation in higher education ([Qolamani & Mohammed, 2023](#)). The paper also explores the role of digital transformation in higher education, examining how leadership and student engagement contribute to students' work engagement ([Niță & Gutu, 2023](#)). The paper will delve into the critical aspects of designing effective e-learning environments, emphasizing the importance of user-centered design principles and the integration of multimedia content to enhance engagement and knowledge retention.

Literature Review

E-learning platforms have become indispensable tools, particularly highlighted by the recent surge in adoption driven by global events, underscoring their crucial role in maintaining educational continuity ([Abbad, 2021](#); [Jain et al., 2024](#)). The contemporary educational landscape is marked by the imperative for institutions to embrace innovative pedagogical practices and adapt their approaches to knowledge dissemination ([Bernaola et al., 2020](#)). Modern technologies have become a cornerstone for distance education, fostering feasibility and interactivity between instructors and learners while cultivating an effective learning community ([Bervell et al., 2021](#)). The shift towards technology-enhanced learning environments is fueled by the evolving expectations of students and the continuous emergence of novel technologies, like social media, which collectively drive innovation in higher education ([Gan et al., 2015](#)). E-learning has the potential to diversify classes, trainings, and courses conducted in the traditional, stationary mode associated with lecture halls ([Schulz, 2023](#)). The adoption of e-learning is not merely a technological upgrade but a paradigm shift that necessitates a reevaluation of traditional teaching models. It emphasizes the construction and sharing of knowledge through collaboration between students in an open and informal social environment ([Hashim & Osman, 2021](#)).

Learning Management Systems have become central to education, facilitating both academic and corporate distance learning ([Shurygin et al., 2021](#)). The use of technology has greatly simplified and accelerated the processes of knowledge search, storage, retrieval, transmission, gathering, dissemination, and reception ([Nelson, 2010](#)). The implementation of e-learning systems represents a significant advancement in educational technology, enhancing the quality, accessibility, and flexibility of higher education ([Kant et al., 2021](#); [Ogwu et al., 2022](#)). Moreover, they enable the tracking of student engagement and the early identification of struggling students ([Binhammad et al., 2024](#)). Personalized learning experiences and fostering improved communication between educators and students are essential components of E-learning platforms ([Furqon et al., 2023](#); [Gamage et al., 2022](#); [Sheshaayee & Bee, 2018](#)). The selection of e-learning platforms is not a simple task and requires consideration of varied

features as well as understanding the didactic context (Ballarano et al., 2016). E-learning is also being considered because it can offer interactive classes, individual teaching, and learning without leaving home, attracting students from abroad, students with disabilities, and those who cannot give up their professional work (Schulz, 2023).

Methodology

This paper adopts a multifaceted approach to provide a comprehensive and nuanced understanding of the development of e-learning platforms in higher education. A qualitative research method, involving in-depth interviews and focus group discussions, will be employed to gather rich, contextualized data from educators, students, and administrators regarding their experiences with e-learning platforms, and the results are used to determine the critical success factors (Manjeese, 2022). This methodology emphasizes a comprehensive literature review that synthesizes existing research on e-learning, digital pedagogy, and educational technology to establish a theoretical framework for understanding the evolution and impact of e-learning platforms (Siron et al., 2020). The study also includes comparative analysis of ten electronic learning management systems, considering factors such as usability, mobility, built-in course editors, video conferencing availability, core functionality, additional features, file extension support, system flexibility, mobile applications, costs, accessibility, and user-friendliness (Onwodi & Ibrahim, 2022). The study provides institutions with information to help them make well-informed decisions when choosing an LMS platform based on their specific requirements (Jain et al., 2024; Kasim & Khalid, 2016). This helps to select the appropriate Learning Management System in accordance with institutional needs, especially in light of the rise in e-learning adoption following the pandemic (Jain et al., 2024).

Results

TIPEC Framework

To create a successful integration of information and communication technologies in tertiary education, a framework known as TIPEC is used to effectively address the challenges encountered (Ukpe, 2023). TIPEC comprises Technological, Information, Pedagogical, Evaluative, and Content knowledge, which are essential for navigating the complexities of e-learning implementation.

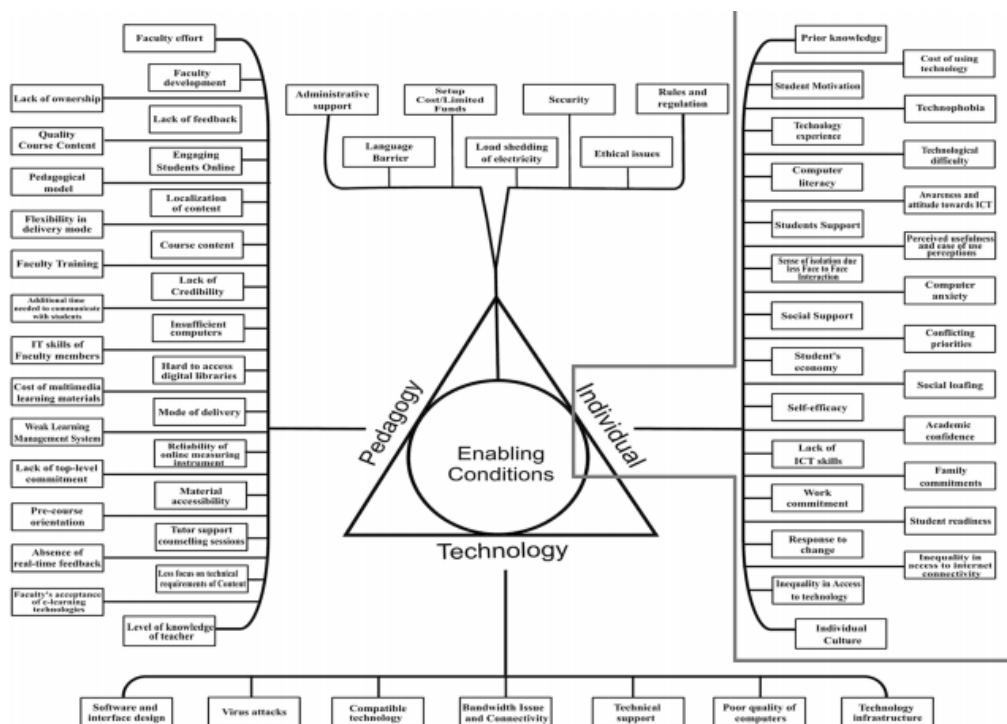


Figure 1. TIPEC Framework
Source: Basir, M., Ali, S. and Gulliver, S.R. (2021)

The Technological aspect involves selecting the appropriate technology, such as learning management systems, video conferencing tools, and digital content creation software (Caldag et al., 2021). The success of e-learning platforms hinges on their ability to offer intuitive interfaces, seamless navigation, and compatibility across various devices. Institutions should prioritize platforms that offer robust technical support, regular updates, and scalability to accommodate future growth. This factor comprises the effective use of technology in teaching practices. The incorporation of digital tools in teaching practices and recognizing their ability to improve student learning are essential to improving tertiary education (Habibi et al., 2020).

Information literacy involves effectively using online sources and technologies to research information. It's important to teach students how to assess the credibility and relevance of online information so they can navigate the vast digital landscape effectively (Guillén-Gámez et al., 2021). Incorporating information literacy into e-learning platforms equips students with the skills to discern credible sources from misinformation, fostering critical thinking and academic integrity. The incorporation of digital tools in teaching practices and recognizing their ability to improve student learning are essential to improving tertiary education.

Pedagogical Knowledge refers to how technology is used in teaching and learning by considering different teaching approaches. Understanding how to best use digital tools to promote student participation, cooperation, and customized learning experiences is essential for instructors. Integrating innovative strategies that enhance engagement and facilitate deeper understanding of course content is essential.

Evaluative Knowledge is a step in which one must evaluate different approaches to teaching and learning using technology to find the most suitable method to achieve their desired outcomes. Educators need to be adept at using data analytics tools to assess student performance, identify learning gaps, and tailor instruction accordingly.

Content Knowledge involves creating and curating digital learning resources that are current, accurate, and aligned with learning outcomes.

Digital Competence in Higher Education

Digital competence is essential in today's higher education because college students are the generation that grew up with computer networks (Zhao et al., 2021). It involves using digital technologies responsibly, critically, and safely for various activities like learning and work (Mejías-Acosta et al., 2024). Educators need to be digitally competent to effectively use technology in their teaching practices, including selecting appropriate digital resources, designing engaging learning experiences, and promoting active student participation (Prosen & Ličen, 2025). Digital competence encompasses the skills, knowledge, and attitudes necessary for teachers to navigate the digital world effectively (Batanero et al., 2021). Educators face numerous challenges in developing students' digital competence, including staying updated with technological advancements, integrating technology into the curriculum, and addressing students' diverse learning needs (Chen et al., 2024). However, universities transform from teacher-centered to active learning models through digital technologies which require digital competence (Ángel et al., 2022). The term competence is widely used by educators today and is the foundation of any education cycle that is based on the skills that individuals need to acquire (García et al., 2020). Additionally, prospective teachers who are already familiar with technology should be able to use these tools in their classrooms, while current teachers should also improve their skills to meet new teaching standards (Zhao et al., 2021). To fully embrace digital transformation, higher education institutions should prioritize digital competence among students and teachers, making sure they are ready to succeed in the digital era (Chernenko, 2021; Niță & Gutu, 2023). The integration of new technologies into

teaching practices helps teachers in civil engineering to improve the learning process ([Surya & Mulyanti, 2020](#)). Digital literacy is a system of knowledge, skills, and attitudes that are necessary for a modern person to live in a digital society, and for a teacher to work successfully in a digital educational space ([Vaskov et al., 2021](#)).

Discussion

E-learning platforms in higher education are evolving as technology advances, meeting the changing needs of students and faculty. These platforms are essential for fostering digital literacy, which involves the capacity to utilize, comprehend, and assess information from diverse sources ([Liu et al., 2025](#)). It is described as the attitudes, knowledge, and skills that enable individuals to effectively use digital tools ([M.S. et al., 2025](#)). Educators need to possess digital competencies, including the ability to find and evaluate information critically in digital environments ([Vaskov et al., 2021](#)). Modern e-learning systems provide a variety of resources and instruments that improve educational experiences and promote student success ([Dewi, 2022](#)). These encompass multimedia content, interactive simulations, and adaptive learning platforms that adjust to each student's unique requirements and learning styles ([-, 2023](#)). Higher education teachers' digital competencies are essential for creating learning environments and tasks that facilitate the development of students' digital skills necessary for the workforce ([Tondeur et al., 2023](#)). The integration of digital literacy into teacher training programs is essential for preparing teachers to use technology effectively in their teaching methods ([Ángel et al., 2022](#)). Moreover, as digital technologies become increasingly prevalent, educators must develop digital skills to effectively use these tools in their teaching practices ([Antoniuk & Zasiadivko, 2023](#)). The rapid development of technology and the digital environment has created a scenario where younger employees often have advanced digital skills that may be unfamiliar to some senior workers ([Galanti et al., 2024](#)). To address this, organizations should implement thorough training programs that are customized to meet the needs of workers from various age groups and levels of technological expertise ([Galanti et al., 2024](#)). Overall, digital literacy is regarded as a crucial skill for the 21st century, enabling individuals to fully engage in society, education, and the workforce ([Alnuaim, 2024; Mejías-Acosta et al., 2024](#)).

The integration of social media tools within e-learning systems offers unparalleled opportunities to enhance student engagement and create more flexible learning environments ([Almusheifri, 2020](#)). The adoption of sophisticated data analytics tools enables educators to gain deeper insights into student learning patterns and personalize the learning experience accordingly. Platforms such as Moodle, Blackboard, Canvas, and iSpring Learn offer a range of features, each with its own strengths and weaknesses ([Onwodi & Ibrahim, 2022](#)). The need to teach students the correct rules for using technology is very important. All equipment should be adjusted to the age of the student and used appropriately to ensure their safety ([Garlińska et al., 2023](#)). LMS systems have simplified the creation of digital learning environments and facilitated the virtual implementation of educational programs ([Korikov & Levin, 2021](#)). It facilitates the interaction of both students and teachers with learning content, such as course descriptions, schedules, educational resources, and communication tools ([Onwodi & Ibrahim, 2022](#)). These systems are useful for students, teachers, and administrators because they make communication, learning, and administration easier.

Conclusion

E-learning platforms are essential for higher education because they give students more access, let them personalize their learning, and improve their digital skills ([Zou et al., 2025](#)). As educational technologies develop, these platforms must adjust to students' changing needs and make sure learning is still interesting and successful ([Ruiz-Rojas et al., 2024](#)). Furthermore, educational institutions should create virtual learning environments that encourage students to work together ([Camilleri & Camilleri, 2022](#)). Digital learning platforms are seen to boost

learning, make subjects more interesting, and improve skills in problem-solving, communication, and research (Alieto et al., 2024). Institutions need to invest in training so that both teachers and students can fully use digital resources.

F-It is important to recognize the limitations of the study, especially in terms of the constraints that may impact its external validity. It is important to note that technology offers a powerful way to fully involve students in language learning activities, representing information in new ways (Fatimah et al., 2022).

G-In future studies, researchers could explore the effectiveness of different e-learning approaches and technologies in different cultural contexts. Future studies should address the need for digital skills among teachers, focusing on how to integrate digital literacy into teaching methods. Additional research is needed to clarify the role of user preferences in online learning (Ilin, 2021).

References

- Abbad, M. (2021). Using the UTAUT model to understand students' usage of e-learning systems in developing countries. *Education and Information Technologies*, 26(6), 7205. <https://doi.org/10.1007/s10639-021-10573-5>
- Akar, H., Yilmaz-Na, E., Ayan-Civak, R., & Kandemir, A. (2022). Digitizing borderless higher education landscapes through curriculum policy change to educate global citizens. *Journal of Educational Technology Development and Exchange*, 15(2), 1. <https://doi.org/10.18785/jetde.1502.01>
- Aldhafeeri, F., & Alotaibi, A. A. (2022). Effectiveness of digital education shifting model on high school students' engagement. *Education and Information Technologies*, 27(5), 6869. <https://doi.org/10.1007/s10639-021-10879-4>
- Alieto, E. O., Abequibel, B., Estigoy, E., Balasa, K., Eijansantos, A. M., & Torres-Toukoumidis, Á. (2024). Teaching inside a digital classroom: A quantitative analysis of attitude, technological competence and access among teachers across subject disciplines. *Heliyon*, 10(2). <https://doi.org/10.1016/j.heliyon.2024.e24282>
- Almusheifri, H. Y. (2020). THE INFLUENCE OF EASE OF USE AND FACILITATING CONDITION ON INTENTION TO ACCEPT E-LEARNING PLATFORM. *International Journal of Engineering Applied Sciences and Technology*, 5(3), 45. <https://doi.org/10.33564/ijeast.2020.v05i03.008>
- Alnuaim, A. A. (2024). The Impact and Acceptance of Gamification by Learners in a Digital Literacy Course at the Undergraduate Level: Randomized Controlled Trial. *JMIR Serious Games*, 12. <https://doi.org/10.2196/52017>
- Antoniuk, L., & Zasiadivko, V. (2023). DIGITAL LITERACY AND TECHNOLOGIES FOR EDUCATION: PRINCIPLES AND TOOLS. *ГРААЛІЬ НАУКИ*, 26, 249. <https://doi.org/10.36074/grail-of-science.14.04.2023.044>
- Ballarano, A., Colace, F., Santo, M. D., & Greco, L. (2016). "The Postman Always Rings Twice": Evaluating E-Learning Platform a Decade Later. *International Journal of Emerging Technologies in Learning (iJET)*, 11(2), 35. <https://doi.org/10.3991/ijet.v11i02.5030>
- Basir, M., Ali, S. and Gulliver, S.R. (2021), "Validating learner-based e-learning barriers: developing an instrument to aid e-learning implementation management and leadership", *International Journal of Educational Management*, Vol. 35 No. 6, pp. 1277-1296.
- Batanero, J. M. F., Graván, P. R., Rueda, M. M., Meneses, E. L., & Cerero, J. F. (2021). Digital Teaching Competence in Higher Education: A Systematic Review [Review of Digital Teaching Competence in Higher Education: A Systematic Review]. *Education*

- Sciences, 11(11), 689. Multidisciplinary Digital Publishing Institute. <https://doi.org/10.3390/educsci11110689>
- Bernaola, A. R., Aldude, M., Estrada, J. D. R., Señas, V., & Andrade-Arenas, L. (2020). Analysis of the Use of Technological Tools in University Higher Education using the Soft Systems Methodology. *International Journal of Advanced Computer Science and Applications*, 11(7). <https://doi.org/10.14569/ijacsa.2020.0110754>
- Bervell, B., Umar, I. N., Kumar, J. A., Somuah, B. A., & Arkorful, V. (2021). Blended Learning Acceptance Scale (BLAS) in Distance Higher Education: Toward an Initial Development and Validation. *SAGE Open*, 11(3). <https://doi.org/10.1177/21582440211040073>
- Binhammad, M. H. Y., Othman, A., Abuljadayel, L., Mheiri, H. A., Alkaabi, M., & Almarri, M. (2024). Investigating How Generative AI Can Create Personalized Learning Materials Tailored to Individual Student Needs. *Creative Education*, 15(7), 1499. <https://doi.org/10.4236/ce.2024.157091>
- Camilleri, M. A., & Camilleri, A. C. (2022). Remote learning via video conferencing technologies: Implications for research and practice. *Technology in Society*, 68, 101881. <https://doi.org/10.1016/j.techsoc.2022.101881>
- Chen, B.-C., Wu, Y.-T., & Chuang, Y.-T. (2024). The impact of teachers' perceived competence in information and communication technology usage, and workplace anxiety on well-being, as mediated by emotional exhaustion. *Frontiers in Psychology*, 15. <https://doi.org/10.3389/fpsyg.2024.1404575>
- Chernenko, A. (2021). Information and Digital Competence as a Key Demand of Modern Ukrainian Education. *Educational Challenges*, 26(2), 38. <https://doi.org/10.34142/2709-7986.2021.26.2.04>
- Dewi, C. (2022). Digital Literacy Analysis of Elementary School Students Through Implementation of E-Learning Based Learning Management System. *Journal of Education Technology*, 6(2), 199. <https://doi.org/10.23887/jet.v6i2.44160>
- Farid, S., Ahmad, R. B., Niaz, I. A., Arif, M., Shamshirband, S., & Khattak, M. D. (2015). Identification and prioritization of critical issues for the promotion of e-learning in Pakistan. *Computers in Human Behavior*, 51, 161. <https://doi.org/10.1016/j.chb.2015.04.037>
- Fatimah, A. S., Nurfitriani, B., & Ruslan, R. (2022). Students' Perception on The Use of Canvas-Based Learning Activities in Online Classroom: Focusing on Its Benefits. *Conference on English Language Teaching*, 2, 79. <https://doi.org/10.24090/celti.v2.38>
- Furqon, M., Sinaga, P., Liliarsari, L., & Riza, L. S. (2023). The Impact of Learning Management System (LMS) Usage on Students. *TEM Journal*, 1082. <https://doi.org/10.18421/tem122-54>
- Galanti, T., Fantinelli, S., Giffi, V., & Cortini, M. (2024). Colleagues' Support and Techno-Complexity: The Importance of a Positive Aging Climate. *Informing Science The International Journal of an Emerging Transdiscipline*, 27, 11. <https://doi.org/10.28945/5383>
- Gamage, S. H. P. W., Ayres, J. R., & Behrend, M. (2022). A systematic review on trends in using Moodle for teaching and learning [Review of A systematic review on trends in using Moodle for teaching and learning]. *International Journal of STEM Education*, 9(1). Springer Science+Business Media. <https://doi.org/10.1186/s40594-021-00323-x>
- Gan, B. K. S., Menkhoff, T., & Smith, R. R. (2015). Enhancing students' learning process through interactive digital media: New opportunities for collaborative learning. *Computers in Human Behavior*, 51, 652. <https://doi.org/10.1016/j.chb.2014.12.048>

- García, F. A. M., Salguero, F. L., Sánchez, M. R. F., & Campo, J. L. C. del. (2020). Digital Technologies at the Pre-University and University Levels. *Sustainability*, 12(24), 10426. <https://doi.org/10.3390/su122410426>
- Garlińska, M., Osial, M., Proniewska, K., & Pręgoska, A. (2023). The Influence of Emerging Technologies on Distance Education. *Electronics*, 12(7), 1550. <https://doi.org/10.3390/electronics12071550>
- Guillén-Gámez, F. D., Almenara, J. C., Cejudo, M. del C. L., & Palacios-Rodríguez, A. (2021). Differential Analysis of the Years of Experience of Higher Education Teachers, their Digital Competence and use of Digital Resources: Comparative Research Methods. *Technology Knowledge and Learning*, 27(4), 1193. <https://doi.org/10.1007/s10758-021-09531-4>
- Habibi, A., Razak, R. A., Yusop, F. D., Mukminin, A., & Yaqin, L. N. (2020). Factors Affecting ICT Integration During Teaching Practices: A Multiple Case Study of Three Indonesian Universities. *The Qualitative Report*. <https://doi.org/10.46743/2160-3715/2020.4150>
- Hamadi, M., El-Den, J., Azam, S., & Sriratanaviriyakul, N. (2021). A novel framework for integrating social media as cooperative learning tool in higher education's classrooms. *Research and Practice in Technology Enhanced Learning*, 16(1). <https://doi.org/10.1186/s41039-021-00169-5>
- Hashim, N. H. C., & Osman, K. (2021). Students' Knowledge of the Readiness to Use E-Learning. *International Journal of Academic Research in Progressive Education and Development*, 10(2). <https://doi.org/10.6007/ijarped/v10-i2/10142>
- Ilin, V. (2021). The role of user preferences in engagement with online learning. *E-Learning and Digital Media*, 19(2), 189. <https://doi.org/10.1177/20427530211035514>
- Jain, S., Prabha, C., Nandan, D., & Bhosale, S. (2024). Comparative analysis of frequently used e-learning platforms. *Frontiers in Education*, 9. <https://doi.org/10.3389/educ.2024.1431531>
- Kant, N., Prasad, K. D., & Anjali, K. (2021). Selecting an appropriate learning management system in open and distance learning: a strategic approach. *AAOU Journal/AAOU Journal*, 16(1), 79. <https://doi.org/10.1108/aaouj-09-2020-0075>
- Kasim, N. N. M., & Khalid, F. (2016). Choosing the Right Learning Management System (LMS) for the Higher Education Institution Context: A Systematic Review [Review of Choosing the Right Learning Management System (LMS) for the Higher Education Institution Context: A Systematic Review]. *International Journal of Emerging Technologies in Learning (iJET)*, 11(6), 55. kassel university press. <https://doi.org/10.3991/ijet.v11i06.5644>
- Kong, S. C. (2021). Delivery and evaluation of an e-Learning framework through computer-aided analysis of learners' reflection text in a teacher development course. *Research and Practice in Technology Enhanced Learning*, 16(1). <https://doi.org/10.1186/s41039-021-00172-w>
- Korikov, A. M., & Levin, S. (2021). LSM and Digital Education Transformation. *Journal of Physics Conference Series*, 2001(1), 12035. <https://doi.org/10.1088/1742-6596/2001/1/012035>
- Liu, X., Wang, J., & Luo, Y. (2025). Acceptance and Use of Technology on Digital Learning Resource Utilization and Digital Literacy Among Chinese Engineering Students: A Longitudinal Study Based on the UTAUT2 Model. *Behavioral Sciences*, 15(6), 728. <https://doi.org/10.3390/bs15060728>
- M.S., C., Shek, D. T. L., Fan, I. Y. H., Zhu, X., & Hu, X. (2025). The Impact of Digital Safety Competence on Cognitive Competence, AI Self-Efficacy, and Character. *Applied Sciences*, 15(10), 5440. <https://doi.org/10.3390/app15105440>

- Manjeese, C. (2022). Divulging the efficacy of e-learning through the eyes of university students: Lessons from a third world perspective. *Physics and Chemistry of the Earth Parts A/B/C*, 127, 103187. <https://doi.org/10.1016/j.pce.2022.103187>
- McColgan, K. (2012). Development of a multi-media book for clinical supervision training in an undergraduate nursing programme. *Journal of Nursing Education and Practice*, 3(5). <https://doi.org/10.5430/jnep.v3n5p31>
- Mejías-Acosta, A., Regnault, M. D., Vargas-Cano, E., Cobo, J., & Vidal-Silva, C. (2024). Assessment of digital competencies in higher education students: development and validation of a measurement scale. *Frontiers in Education*, 9. <https://doi.org/10.3389/educ.2024.1497376>
- Nelson, M. B. (2010). The Role of Technology in Curriculum Development and Delivery. 3, 83. <https://eric.ed.gov/?id=EJ1072801>
- Niță, V., & Guțu, I. (2023). The Role of Leadership and Digital Transformation in Higher Education Students' Work Engagement. *International Journal of Environmental Research and Public Health*, 20(6), 5124. <https://doi.org/10.3390/ijerph20065124>
- Ogwu, E. N., Emelogu, N. U., Azor, R. O., & Okwo, F. A. (2022). Educational Technology Adoption in Instructional Delivery in the New Global reality. *Education and Information Technologies*, 28(1), 1065. <https://doi.org/10.1007/s10639-022-11203-4>
- Onwodi, G., & Ibrahim, F. (2022, September 1). Technical Analysis of Learning Management Systems Towards Improving System Functionality. Tenth Pan-Commonwealth Forum on Open Learning. <https://doi.org/10.56059/pcf10.1761>
- Prosen, M., & Ličen, S. (2025). Evaluating the digital transformation in health sciences education: a thematic analysis of higher education teachers' perspectives. *BMC Medical Education*, 25(1). <https://doi.org/10.1186/s12909-025-07420-3>
- Qolamani, K. I. B., & Mohammed, M. M. (2023). The Digital Revolution in Higher Education: Transforming Teaching and Learning. *QALAMUNA Jurnal Pendidikan Sosial Dan Agama*, 15(2), 837. <https://doi.org/10.37680/qalamuna.v15i2.3905>
- Ruiz-Rojas, L. I., Salvador-Ullauri, L., & Acosta-Vargas, P. (2024). Collaborative Working and Critical Thinking: Adoption of Generative Artificial Intelligence Tools in Higher Education. *Sustainability*, 16(13), 5367. <https://doi.org/10.3390/su16135367>
- Schulz, M. (2023). E-Learning as a Development Tool. *Sustainability*, 15(20), 15012. <https://doi.org/10.3390/su152015012>
- Sheshasaayee, A., & Bee, M. N. (2018). Analyzing Online Learning Effectiveness for Knowledge Society. In *Advances in intelligent systems and computing* (p. 995). Springer Nature. https://doi.org/10.1007/978-981-10-7512-4_100
- Shurygin, V., Saenko, N., Zekiy, A. O., Klochko, E., & Kulapov, M. (2021). Learning Management Systems in Academic and Corporate Distance Education. *International Journal of Emerging Technologies in Learning (iJET)*, 16(11), 121. <https://doi.org/10.3991/ijet.v16i11.20701>
- Siron, Y., Wibowo, A., & Narmaditya, B. S. (2020). Factors affecting the adoption of e-learning in Indonesia: Lesson from Covid-19. *Journal of Technology and Science Education*, 10(2), 282. <https://doi.org/10.3926/jotse.1025>
- Srivastava, S. (2023). The Evolution of Education: Navigating 21st-Century challenges. *International Journal for Multidisciplinary Research*, 5(5). <https://doi.org/10.36948/ijfmr.2023.v05i05.6314>
- Surya, R., & Mulyanti, B. (2020). Competencies needed by civil engineering teachers in the digital era. *IOP Conference Series Materials Science and Engineering*, 830(3), 32060. <https://doi.org/10.1088/1757-899x/830/3/032060>
- Tondeur, J., Howard, S., Zanten, M. V., Gorissen, P., Neut, I. V. der, Uerz, D. C., & Kral, M. (2023). The HeDiCom framework: Higher Education teachers' digital competencies for

- the future. *Educational Technology Research and Development*, 71(1), 33. <https://doi.org/10.1007/s11423-023-10193-5>
- Uhomoihi, J., & Ross, M. (2013). E-Learning Development Trends in Computer and Engineering Education. *International Journal of Engineering Pedagogy (iJEP)*, 3(2), 26. <https://doi.org/10.3991/ijep.v3i2.2441>
- Ukpe, E. (2023). Information and Communication Technologies (ICTS) for E-Learning in Tertiary Education. *Open Journal of Social Sciences*, 11(12), 666. <https://doi.org/10.4236/jss.2023.1112044>
- Vaskov, M., Isakov, A., Bilovus, V., Bulavkin, A., & Mikhaylenko, N. (2021). Digital literacy of modern higher education teachers. *E3S Web of Conferences*, 273, 12035. <https://doi.org/10.1051/e3sconf/202127312035>
- Zain, S. (2020). Digital transformation trends in education. In Elsevier eBooks (p. 223). Elsevier BV. <https://doi.org/10.1016/b978-0-12-822144-0.00036-7>
- Zhao, Y., Llorente, A. M. P., & Gómez, M. C. S. (2021). Digital competence in higher education research: A systematic literature review. *Computers & Education*, 168, 104212. <https://doi.org/10.1016/j.compedu.2021.104212>
- Zou, Y. L., Kuek, F., Feng, W., & Cheng, X. (2025). Digital learning in the 21st century: trends, challenges, and innovations in technology integration. *Frontiers in Education*, 10. <https://doi.org/10.3389/feduc.2025.1562391>
- Ángel, N. G., Sánchez, J. N. G., Rubio, I. M., García-Martín, J., & Brito-Costa, S. (2022). Digital literacy in the university setting: A literature review of empirical studies between 2010 and 2021 [Review of Digital literacy in the university setting: A literature review of empirical studies between 2010 and 2021]. *Frontiers in Psychology*, 13. *Frontiers Media*. <https://doi.org/10.3389/fpsyg.2022.896800>
- Çaldağ, M. T., Gökalp, E., & Alkış, N. (2021). ICT-Based Distance Higher Education: A Necessity During the Era of COVID-19 Outbreak. In *Studies in systems, decision and control* (p. 365). Springer International Publishing. https://doi.org/10.1007/978-3-030-67716-9_23
- Çavuş, N., Mohammed, Y. B., & Yakubu, M. N. (2021). Determinants of Learning Management Systems during COVID-19 Pandemic for Sustainable Education. *Sustainability*, 13(9), 5189. <https://doi.org/10.3390/su13095189>