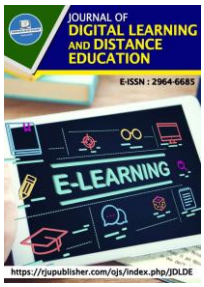

JOURNAL OF DIGITAL LEARNING AND DISTANCE EDUCATION (JDLDE)

ISSN: 2964-6685

https://www.rjupublisher.com/ojs/index.php/JDLDE

Impact of Digital Learning Tools on Student Engagement and Achievement

Afam UZORKA[a*], Omotoyosi Aishat ODEBIYI[b]

[a]*Department of Art and Sciences, College of Education, Open, and Distance Learning, Kampala International University, Kampala, Uganda.*
[b]*Department of History and Strategic Studies, University of Lagos, Akoka, Nigeria.*

*Corresponding author: afamuzorka@gmail.com

Abstract

The integration of digital learning tools in higher education has transformed online learning, enhancing student engagement and academic performance. This study investigates the impact of digital learning tools such as Learning Management Systems (LMS), interactive simulations, and gamified content on student engagement and achievement in online courses. A qualitative research design was employed, involving semi-structured interviews with 52 lecturers from 12 Universities in Uganda. Thematic analysis revealed six key findings: Digital tools enhance student engagement through interactivity, they help bridge the gap between theory and practice, they positively impact academic achievement, they facilitate communication between students and lecturers, Gamification increases student motivation, and they promote student autonomy in learning. The study concludes that digital tools significantly improve online education, but challenges such as limited internet access and digital literacy remain. It recommends improving digital infrastructure, providing faculty training, and integrating interactive digital tools to enhance student engagement and learning outcomes.

Keywords**:** Digital Learning, Student Engagement, Online Education, Higher Education, Uganda

Acknowledgments: The research team would like to thank the University of Uganda for allowing this research**.**

For citation:
Uzorka, A & Odebiyi, O. A. (2025). Impact of Digital Learning Tools on Student Engagement and Achievement. *Journal of Digital Learning and Distance Education, 4*(1), 1436-1445. https://doi.org/10.56778/jdlde.v4i1.511.

Introduction

The rapid evolution of digital technology has reshaped the landscape of higher education, introducing new methods for delivering instruction and supporting student learning. Digital learning tools such as Learning Management Systems (LMS), interactive simulations, and gamified content are now widely used to promote active learning, collaboration, and personalised educational experiences (Coelho, Pires, & Martins, 2024; Langat, 2025; Uzorka, Odebiyi, & Kalabuki, 2025). These tools have been particularly effective in enhancing student engagement and academic

achievement in many developed regions, where digital infrastructure is robust and access is widespread (Uzorka & Kalabuki, 2024; Wang, Zuo, He, & Wang, 2025; Wong, Lee, Chan, Tan, Huang, & Lee, 2025).

However, in developing countries, including Uganda, the integration of digital learning tools presents both opportunities and significant challenges. Ugandan universities frequently struggle with large class sizes, limited physical resources, poor internet connectivity, and inadequate digital literacy among students and faculty (Olaniyan & Fakuade, 2023). Despite these barriers, the shift toward online education, accelerated by global trends and local needs, has led to the increased adoption of digital tools to support teaching and learning.

While existing research has highlighted the general benefits of digital learning, much of this work is concentrated in contexts where technological adoption is already advanced and focuses predominantly on student experiences or global trends. There remains a gap in understanding how these tools function in less technologically developed settings. Specifically, there is limited empirical evidence on how digital learning tools affect student engagement and academic performance in Ugandan universities, particularly from the perspective of lecturers who play a central role in implementing digital pedagogy. This study seeks to address this gap through the following research question: How do digital learning tools influence student engagement and academic achievement in online courses in Ugandan universities?

By focusing on lecturers' experiences and insights, this research offers a context-specific understanding of the opportunities and challenges associated with digital learning tools in Uganda's higher education system. The objective of the study was to explore the impact of digital learning tools on student engagement and academic achievement in online courses, as perceived by university lecturers, to inform more effective digital pedagogical practices and policy decisions.

Literature Review

Student engagement is a critical factor in learning outcomes, and digital tools have been shown to enhance engagement through interactivity and personalised learning experiences. Studies indicate that interactive learning environments, including multimedia content, discussion forums, and real-time quizzes, help sustain students' interest and encourage active participation (Han, 2025; Lasekan, Pachava, Godoy Pena, Golla, & Raje, 2024; McGivney, 2025). Learning Management Systems (LMS), such as Moodle and Blackboard, provide structured platforms where students can engage with course materials at their own pace, fostering both cognitive and emotional engagement (Barbieri, 2025; Kigundu, 2025; Saknee, 2024). A study by Haerawan, Cale, & Barroso (2024) found that students in online courses reported higher levels of engagement when instructors incorporated interactive elements such as polls, video discussions, and collaborative assignments. Similarly, a meta-analysis by Sailer, Maier, Berger, Kastorff, & Stegmann, (2024) confirmed that online learning tools enhance engagement by providing real-time feedback and fostering student-centred learning.

Several studies highlight the positive correlation between digital learning tools and academic performance. Digital platforms allow students to access on-demand learning materials, recorded lectures, and self-paced exercises, which contribute to better understanding and retention of knowledge (Chaudhary, Mahato, & Adhikari, 2025; Mirza[1] & Borana, 2025; Uzorka, 2024). Gamification, adaptive learning systems, and formative assessments have also been shown to improve student learning outcomes (Li, Fryer, & Chu, 2025; Pitthan & Witte, 2025; Zhang & Huang, 2024). Research by Herout (2024) on self-regulated learning found that students who use digital tools for self-assessment and practice tend to perform better in their coursework. Furthermore, Singh, Singh, Tuli, & Mantri, (2024) found that digital simulations help bridge the gap between theoretical knowledge and real-world application, particularly in STEM and medical courses.

Integrating game-like elements such as leaderboards, achievement badges, and reward points has gained attention as a strategy for enhancing student motivation and engagement. Research shows that gamified learning environments increase student participation and encourage competition,

leading to better learning outcomes (Cai, Zhang, Liu, & Zhan, 2025; Nguyen-Viet, Nguyen-Duy, & Nguyen-Viet, 2025; Subiyantoro et al., 2024). Ortiz-Rojas et al. (2025) found that students enrolled in gamified courses reported higher motivation levels, greater task completion rates, and improved problem-solving skills compared to those in traditional learning environments. Similarly, a study by Hamid and Barzenji (2024) confirmed that gamification is particularly effective in maintaining student engagement in long-term online courses.

Effective communication between lecturers and students is crucial for learning success, and digital tools have been instrumental in breaking communication barriers in online education. Studies show that tools like discussion forums, instant messaging, and video conferencing improve instructor-student interactions, fostering a collaborative learning environment (Suen & Hung, 2025; Zamiri & Esmaeili, 2024). A study by Shen et al. (2024) found that students in courses with active discussion boards and real-time instructor feedback exhibited higher engagement and better performance than those in courses with limited communication. Furthermore, Ncube and Ngulube (2025) confirmed that asynchronous communication tools (emails, discussion boards) are particularly useful for students who prefer self-paced learning, while synchronous tools (video calls, chat rooms) enhance real-time clarification of concepts.

Self-directed learning is a key component of online education, where students take responsibility for their own learning pace and progress. Research indicates that digital tools enhance autonomy by providing flexible learning resources and self-assessment opportunities (Porubin, 2024; Thilagam, Islam, Vijayakumar, & Hameed, 2025; Zhao, Li, Ma, Xu, & Zhang, 2025). Features such as progress-tracking dashboards, self-paced modules, and adaptive learning pathways help students develop better time management and independent study habits (Sengupta, Bardhan, Das, & Chakrabarti, 2025). A study by Li & Abdullah (2025) found that students who regularly use online learning platforms develop stronger self-regulation skills, leading to improved academic performance. Additionally, Liu (2025) emphasised that self-paced digital courses are particularly beneficial for students balancing academic and personal commitments.

The literature review highlights the significant role of digital learning tools in enhancing engagement, academic performance, motivation, communication, and self-directed learning. However, existing research is largely focused on developed countries, with limited attention to how lecturers in developing contexts, such as Uganda, experience and implement these tools. This study seeks to address this gap by exploring lecturers' insights into the effectiveness, challenges, and impact of digital learning tools in Ugandan universities. The findings will contribute to the development of strategies and policies for better digital integration in higher education institutions.

Methodology

This study employed a qualitative research design to explore the impact of digital learning tools on student engagement and academic achievement in online courses. A phenomenological approach was used to understand lecturers' lived experiences and perceptions regarding various digital tools, such as learning management systems, interactive simulations, and gamified content. Data was collected through semi-structured interviews to allow participants to express their insights freely while enabling researchers to explore emerging themes in depth.

The study involved 52 lecturers from 12 universities in Uganda. Participants were selected based on their experience with online teaching and familiarity with digital learning tools. Their perspectives provided valuable insights into how these tools influence student engagement and academic achievement. Table 1 presents the demographic characteristics of the participants in the study. Out of the 52 participants, 30 (57.69%) were males and 22 (42.31%) were females, all aged 25 to 55 years. The majority of participants, 36 (69.23%), held PhD degrees. Regarding online teaching experience, 10 (19.23%) had less than 5 years of experience, 31 (59.62%) had between 5 and 10 years, and 11 (21.15%) had between 11 and 15 years. A purposive sampling technique was employed to select participants who had firsthand experience with digital learning tools in an online teaching

environment. The selection criteria included: Experience in using digital platforms for teaching, Involvement in online course delivery at a Ugandan university, and Willingness to share insights on student engagement and academic performance.

Table 1. Demographic characteristics of participants

Variables	Male Frequency (%)	Female Frequency (%)	Total Frequency (%)
Gender	30 (57.69)	22 (42.31)	52 (100)
Age (Years)			
25–34	06 (54.55)	05 (45.45)	11 (21.15)
35-44	14 (58.33)	10 (41.67)	24 (46.15)
45–55	10 (58.82)	07 (41.18)	17 (32.70)
Educational Qualification			
Master	06 (37.50)	10 (62.50)	16 (30.77)
PhD	24 (66.67)	12 (33.33)	36 (69.23)
Online teaching experience (Years)			
Under 5 years	04 (40.00)	06 (60.00)	10 (19.23)
5–10 years	19 (61.29)	12 (38.71)	31 (59.62)
11–15 years	07 (63.64)	04 (36.36)	11 (21.15)

Data was collected through semi-structured interviews conducted via online video conferencing platforms. The interviews focused on how digital tools influenced student engagement, motivation, academic performance, and communication between students and lecturers. Each interview lasted between 30 to 60 minutes and was recorded with the participants' consent. The interview guide included open-ended questions addressing the following areas:

- The effectiveness of digital learning tools in promoting student engagement.
- The role of interactivity and gamification in enhancing learning experiences.
- Challenges faced in implementing digital tools for teaching.
- Perceived impact on student performance and autonomy in learning.

Follow-up questions were asked where necessary to gain deeper insights into participants' responses.

Interviews were transcribed verbatim and analysed using thematic analysis. The process involved:

1. Familiarisation with the data through repeated reading of transcripts.
2. Initial coding to identify key concepts and patterns.
3. Grouping codes into themes based on emerging insights.
4. Reviewing and refining themes to ensure they accurately represent the data.

The final themes were aligned with the study's objectives, highlighting the lecturers' perspectives on student engagement, academic performance, and digital tool effectiveness. To ensure credibility, dependability, and transferability in the research findings, the following strategies were applied: Some participants reviewed the transcripts to verify accuracy; Insights were compared across multiple participants to ensure consistency in themes; Discussions with colleagues helped refine the interpretations; Detailed explanations were provided to enhance the study's transferability. Participants provided informed consent before the interviews, ensuring they understood the study's purpose and their rights. Confidentiality was maintained by anonymising responses and securing data storage. Participants had the right to withdraw at any stage without any consequences.

Results

The findings of this study reveal six key themes that emerged from interviews with lecturers regarding the impact of digital learning tools on student engagement and academic achievement. Each theme is presented below with a narrative description, followed by representative quotes that illustrate the lecturers' perspectives. To maintain the confidentiality of names, each participant in the study was assigned a database number referred to as P 1 to P 52. When the findings reference a participant's comments, the database number (P 1 to P 52) is recorded in parentheses.

Enhanced Student Engagement through Interactivity

Many participants reported that digital learning tools, particularly interactive features such as quizzes, discussion forums, and live polls, significantly enhanced student engagement. These tools encouraged students to actively participate rather than passively consume information. Features such as real-time feedback and multimedia integration kept students interested and involved in learning activities. *"I've noticed that students are more engaged when they interact with the content. Features like quizzes and polls within the LMS keep them on their toes and encourage active participation"* (P 9). *"The ability to use videos, simulations, and animations has transformed how I teach. Students no longer just listen; they interact, ask questions, and even research further on their own"* (P 14).

Bridging the Gap between Theory and Practice

Participants highlighted that digital tools, particularly simulations and virtual labs, helped students bridge the gap between theoretical knowledge and practical application. These tools provided students with hands-on experience, allowing them to visualise abstract concepts and apply them in real-world scenarios. *"In subjects like engineering and medicine, simulations have been a game changer. Students can now practice virtually before handling real-life cases, which boosts their confidence and understanding"* (P 26). *"Before using interactive case studies, students struggled to see how theory connected to practice. Now, they engage with real-life examples, which enhances comprehension"* (P 19).

Positive Impact on Academic Achievement

Several participants observed that students who actively engaged with digital learning tools demonstrated improved academic performance. The availability of supplementary resources, self-paced learning materials, and instant feedback contributed to better understanding and retention of concepts. *"Ever since we introduced interactive content and self-assessment quizzes, the students' performance has improved significantly. They take ownership of their learning, and it reflects in their grades"* (P 41). *"Students who regularly engage with the LMS resources perform better in assessments compared to those who don't. They have access to recorded lectures, additional reading materials, and practice exercises"* (P 22).

Facilitating Communication between Students and Lecturers

Digital learning tools were found to improve communication between lecturers and students. Features such as discussion boards, chat functions, and email integrations provided students with easier access to their lecturers, reducing hesitation in seeking clarification. *"Previously, students would hesitate to ask questions in class, but now they comfortably post their concerns on discussion forums. It has created an open and continuous learning environment"* (P 51). *"With digital platforms, I can provide timely feedback and address student concerns much faster than before. It has strengthened my interaction with students"* (P 35).

Gamification and Motivation

The incorporation of gamified elements, such as badges, leaderboards, and reward points, was seen as a powerful motivator for students. Gamification made learning more enjoyable and competitive, fostering intrinsic motivation among students to complete tasks and participate in activities. *"When we introduced leaderboards and achievement badges, students became more engaged. They now challenge each other to perform better, which wasn't the case before"* (P 11). *"Gamification has helped sustain interest, especially in repetitive tasks like coding exercises. Students see learning as a fun challenge rather than a burden"* (P 31).

Student Autonomy and Self-Directed Learning

Digital tools empowered students to take control of their learning, fostering autonomy and self-directed study habits. The flexibility of online resources allowed students to learn at their own pace and revisit materials as needed. *"With digital tools, students can manage their learning schedule. Some students prefer studying late at night, and the flexibility of online resources accommodates that"* (P 6). *"I've observed that students who actively engage with online learning tools develop better time management and independent study skills. They no longer rely entirely on classroom instruction"* (P 48).

Discussion

This study explored the impact of digital learning tools on student engagement and academic achievement through the perspectives of university lecturers in Uganda. The findings align with existing research while offering unique contributions, particularly in the context of Ugandan higher education. The study found that interactive features such as quizzes, polls, discussion forums, and multimedia content significantly enhance student engagement. These findings are consistent with previous studies that have demonstrated how interactivity increases participation and motivation in online learning environments (Han, 2025; Lasekan et al., 2024; McGivney, 2025). However, this study uniquely highlights the specific tools and features that lecturers in Uganda find most effective, such as live quizzes and real-time discussion forums. Unlike research conducted in developed countries, where students may already be accustomed to digital interactivity, lecturers in Uganda emphasised that these tools compensate for the lack of physical engagement in traditional classrooms.

Participants reported that simulations, case studies, and virtual labs effectively helped students apply theoretical knowledge in practical contexts. These findings are in line with research by Singh et al. (2024), which highlights the role of simulations in improving conceptual understanding and skill development. A unique contribution of this study is the focus on how these tools address context-specific challenges in Uganda, such as limited access to physical laboratories and practical training facilities. Participants indicated that digital tools provide an alternative to hands-on experiences that would otherwise be unavailable due to resource constraints.

This study found that students who actively engage with digital learning tools tend to perform better academically, a finding consistent with research by Chaudhary et al. (2025), who noted that online tools improve learning outcomes by providing additional practice opportunities and immediate feedback. The unique contribution of this study is that it captures lecturers' direct observations of performance improvements in a developing-country context. Unlike studies in highly digitised environments, where digital tools are supplementary, lecturers in Uganda found that these tools compensate for traditional instructional gaps such as large class sizes and limited contact hours.

The study found that digital tools improved communication between students and lecturers, particularly through discussion forums, instant messaging, and email. These findings align with those of Suen and Hung (2025), who found that asynchronous and synchronous communication tools promote deeper engagement and more frequent student-teacher interaction. A notable contribution of this study is the specific emphasis on how these tools address hierarchical barriers in Uganda, where students traditionally hesitate to approach lecturers for clarification. Digital platforms create a more

informal and accessible communication channel, encouraging students to ask questions they might avoid in face-to-face settings (Dickson & Enock, 2024; Siregar & Kasmawati, 2022).

Gamification elements such as leaderboards, badges, and reward points were found to enhance student motivation and participation, supporting findings by Cai et al. (2025), who emphasise the effectiveness of game-based learning strategies. This study demonstrates the impact of gamification in resource-limited learning environments. Participants highlighted that gamified tool make learning more engaging, especially for students who struggle with motivation in purely text-based online courses. The study found that digital learning tools promote student autonomy by allowing learners to control their pace and access resources at their convenience. This aligns with research by Zhao et al. (2025), who emphasise the role of self-regulated learning in academic success. The unique contribution of this study is its focus on the role of digital tools in addressing the challenges of large class sizes and limited instructor availability in Uganda. Participants noted that self-paced learning materials help students compensate for gaps in instructor-led sessions.

Conclusion

This study examined the impact of digital learning tools on student engagement and academic achievement in online courses, based on qualitative insights from 52 lecturers across 12 universities in Uganda. The findings highlight that digital tools enhance student engagement through interactivity, facilitate practical application of theoretical knowledge, improve academic performance, strengthen communication between students and lecturers, increase motivation through gamification, and promote student autonomy in learning. The study contributes to existing research by offering a context-specific perspective on digital learning in a developing country, emphasising how digital tools help compensate for traditional classroom limitations such as large student populations, limited laboratory access, and hierarchical communication structures. It also underscores the critical role of digital infrastructure and faculty training in ensuring the effective implementation of these tools. Digital learning tools have the potential to revolutionise higher education in Uganda, making learning more accessible, engaging, and effective. However, their success depends on institutional support, faculty preparedness, and student adaptability. By addressing challenges related to digital connectivity and instructional design, universities can fully leverage these tools to enhance the quality and effectiveness of online education in the region.

Conflicts of Interest

The authors declare no conflict of interest.

References:

Barbieri, W. (2025). Learning Management Systems: Campus Closure and Student Engagement. In Risks and Opportunities in Using Educational Technologies (pp. 37-45). Singapore: Springer Nature Singapore. https://doi.org/10.1007/978-981-96-1595-7_4.

Cai, Z., Zhang, X., Liu, C., & Zhan, J. (2025). Effects of Digital Game-Based Learning on Student's Problem-Solving Ability: A Three-Level Meta-Analysis. Journal of Computer Assisted Learning, 41(2), e70002. https://doi.org/10.1111/jcal.70002.

Chaudhary, M. K., Mahato, S., & Adhikari, M. (2025). The effectiveness of online learning in the emerging academic environment: A Structural Equation Modelling (SEM) approach. FIIB Business Review, 14(1), 103-113. https://doi.org/10.1177/23197145231210355

Coelho, A. S., Pires, R., & Martins, O. (2024). Digital Tools In Active Learning Activities: Motivating And Engaging Higher Education Students. In Edulearn24 Proceedings (Pp. 10729-10738). Iated. https://doi.org/10.21125/edulearn.2024.1657.

Dickson, S. M., & Enock, S. B. (2024). Analysis of Covid-19 Pandemic and Migration to Distance Learning and Digital Education in Public Tertiary Institutions in Abia State. *Journal Of Digital Learning And Distance Education*, *3*(7), 1175–1181. https://doi.org/10.56778/jdlde.v3i7.369

Haerawan, H., Cale, W., & Barroso, U. (2024). The Effectiveness of Interactive Videos in Increasing Student Engagement in Online Learning. Journal of Computer Science Advancements, 2(5), 244-258. https://doi.org/10.70177/jsca.v2i5.1322.

Hamid, R., & Barzenji, Z. (2024). Evaluating the Effectiveness of Gamification in Online Education: Strategies for Promoting Active Learning and Student Retention. International Journal of Post Axial: Futuristic Teaching and Learning, 97-110. https://doi.org/10.59944/postaxial.v2i2.302

Han, X. (2025). Research on english E-learning teaching model based on digital entertainment and gamification experience: Interactive teaching experience. Entertainment Computing, 52, 100867. https://doi.org/10.1016/j.entcom.2024.100867

Herout, L. (2024). THE IMPACT OF DIGITAL SELF-ASSESSMENT TOOLS ON ACADEMIC PERFORMANCE IN HIGHER EDUCATION. In ICERI2024 Proceedings (pp. 428-434). IATED. https://doi.org/10.21125/iceri.2024.0208.

Kigundu, S. (2025). Engaging e-Learning in Higher Education: An Empirical Student Engagement Model for LMS-Mediated e-Tutorials. Journal of Medives: Journal of Mathematics Education IKIP Veteran Semarang, 9(1), 92-117. https://doi.org/10.31331/medivesveteran.v9i1.3350.

Langat, A. K. (2025). Transition From Analogue to Digital Technology: Examining Teaching, Learning, and Assessment in Higher Education in Kenya. In Artificial Intelligence, Digital Learning, and Leadership: Redefining Higher Education (pp. 89-118). IGI Global. https://doi.org/10.4018/979-8-3373-0025-2.ch004.

Lasekan, O. A., Pachava, V., Godoy Pena, M. T., Golla, S. K., & Raje, M. S. (2024). Investigating factors influencing students' engagement in sustainable online education. Sustainability, 16(2), 689. https://doi.org/10.3390/su16020689

Li, C., Fryer, L. K., & Chu, S. K. (2025). Utilising gamified formative assessment to support English language learning in schools: a scoping review. Innovation in Language Learning and Teaching, 19(2), 188-204. https://doi.org/10.1080/17501229.2024.2352789.

Li, N., & Abdullah, M. Y. (2025). Exploring the Impact of Virtual Learning Environments on Social Interaction and Academic Performance in China. Uniglobal Journal of Social Sciences and Humanities, 4(1), 206-215. https://doi.org/10.53797/ujssh.v4i1.25.2025.

Liu, P. (2025). Optimizing Self-paced Learning in Machine Learning Education for Working Professionals: Strategies, Trends, and Insights. In International Conference on Human-Computer Interaction (pp. 120-136). Springer, Cham. https://doi.org/10.1007/978-3-031-76815-6_10.

McGivney, E. (2025). Interactivity and identity impact learners' sense of agency in virtual reality field trips. British Journal of Educational Technology, 56(1), 410-434. https://doi.org/10.1111/bjet.13513

Mirza[1], J., & Borana, K. (2025). A New Era in E-Learning. Anand, R., Jigyasu, D., & Abhishek, S. (eds) Mobile Cloud Computing, Services and Engineering, 94-113.

Ncube, M. M., & Ngulube, P. (2025). Enhancing social presence in asynchronous instruction: a focus on a higher education institution in Zimbabwe. South African Journal of Libraries and Information Science, 91(1), 1-11. https://hdl.handle.net/10520/ejc-liasa_v91_n1_a6.

Nguyen-Viet, B., Nguyen-Duy, C., & Nguyen-Viet, B. (2025). How does gamification affect learning effectiveness? The mediating roles of engagement, satisfaction, and intrinsic motivation. Interactive Learning Environments, 33(3), 2635-2653. https://doi.org/10.1080/10494820.2024.2414356.

Olaniyan, A. O. & Fakuade, O. V. (2023). Level of ICT Available and User Competency in Post-COVID Era in Ugandan Universities. African Multidisciplinary Journal of Development (AMJD), 12(2), 146-152. https://doi.org/10.59568/AMJD-2023-12-2-14

Ortiz-Rojas, M., Chiluiza, K., Valcke, M., & Bolanos-Mendoza, C. (2025). How gamification boosts learning in STEM higher education: a mixed methods study. International Journal of STEM Education, 12(1), 1. https://doi.org/10.1186/s40594-024-00521-3.

Pitthan, F., & Witte, K. D. (2025). Game over or continue? How gamification can improve completion rate in adaptive learning. Education and Information Technologies, 30(3), 2757-2786. https://doi.org/10.1007/s10639-024-12928-0.

Porubin, L. (2024). Learner autonomy and personalized learning in the 21st century. In Universitas Europaea: spre o societate a cunoașterii prin europenizare și globalizare (Vol. 2, pp. 135-139). https://doi.org/10.54481/uekbs2024.v2.45

Sailer, M., Maier, R., Berger, S., Kastorff, T., & Stegmann, K. (2024). Learning activities in technology-enhanced learning: A systematic review of meta-analyses and second-order meta-analysis in higher education. Learning and Individual Differences, 112, 102446. https://doi.org/10.1016/j.lindif.2024.102446.

Saknee, A. (2024). Predictive Relationships Between Learning Management System Engagement Measures and Academic Performance in College (Doctoral dissertation, Grand Canyon University).

Sengupta, S., Bardhan, S., Das, R., & Chakrabarti, S. (2025). LearnAlytics: The Smart Way to Analyze, Adapt, and Achieve in E-Learning. SN Computer Science, 6(1), 79. https://doi.org/10.1007/s42979-024-03535-4.

Shen, J., Qi, H., Mei, R., & Sun, C. (2024). A comparative study on the effectiveness of online and in-class team-based learning on student performance and perceptions in virtual simulation experiments. BMC Medical Education, 24(1), 135. https://doi.org/10.1186/s12909-024-05080-3.

Singh, G., Singh, G., Tuli, N., & Mantri, A. (2024). Hyperspace AR: An augmented reality application to enhance spatial skills and conceptual knowledge of students in trigonometry. Multimedia Tools and Applications, 83(21), 60881-60902. https://doi.org/10.1007/s11042-023-17870-w.

Siregar, S. U. K. M. & Kasmawati. (2022). Analysis of The Use of Digital Learning Media Before and After Pandemic. *Journal Of Digital Learning And Distance Education*, *1*(3), 114–119. https://doi.org/10.56778/jdlde.v1i3.24.

Subiyantoro, S., Degeng, I. N. S., Kuswandi, D., & Ulfa, S. (2024). Developing gamified learning management systems to increase student engagement in online learning environments. International Journal of Information and Education Technology, 14(1), 26-33. https://doi.org/10.18178/ijiet.2024.14.1.2020

Suen, H. Y., & Hung, K. E. (2025). Enhancing learner affective engagement: The impact of instructor emotional expressions and vocal charisma in asynchronous video-based online learning. Education and Information Technologies, 30(3), 4033-4060. https://doi.org/10.1007/s10639-024-12956-w

Thilagam, P. S., Islam, M. S., Vijayakumar, S., & Hameed, N. S. (2025, February). Mobile Applications for Self-Assessment in English Language Learning: Enhancing Learner Autonomy and Reflection. In 2025 3rd International Conference on Intelligent Systems, Advanced Computing and Communication (ISACC) (pp. 422-426). IEEE. https://doi.org/10.1109/ISACC65211.2025.10969327

Uzorka, A. (2024). Perspectives on Online Education in Higher Education. International Journal of Technology in Education and Science, 8(1), 111-120. https://doi.org/10.46328/ijtes.523

Uzorka, A., & Kalabuki, K. (2024). The transformative impact of technological advancements in educational leadership on student experiences and outcomes. Education and Information Technologies, 29(16), 20883-20904. https://doi.org/10.1007/s10639-024-12714-y

Uzorka, A., Odebiyi, O. A., & Kalabuki, K. (2025). Educational leadership in the digital age: Navigating challenges and embracing opportunities. International Journal of Technology in Education and Science, 9(1), 128-141. https://doi.org/10.46328/ijtes.605

Wang, Y., Zuo, M., He, X., & Wang, Z. (2025). Exploring Students Online Learning Behavioral Engagement in University: Factors, Academic Performance and Their Relationship. Behavioral Sciences, 15(1), 78. https://doi.org/10.3390/bs15010078

Wong, A., Lee, W. L., Chan, M. S. L., Tan, Y. E., Huang, J. M. K., & Lee, Y. H. (2025). Digital learning resources and student success: Analyzing engagement and academic performance. Journal of Applied Learning and Teaching, 8(Sp. Iss. 2), 45-54. https://doi.org/10.37074/jalt.2025.8.S2.3

Zamiri, M., & Esmaeili, A. (2024). Methods and technologies for supporting knowledge sharing within learning communities: A systematic literature review. Administrative Sciences, 14(1), 17. https://doi.org/10.3390/admsci14010017

Zhang, Z., & Huang, X. (2024). Exploring the impact of the adaptive gamified assessment on learners in blended learning. Education and Information Technologies, 29(16), 21869-21889. https://doi.org/10.1007/s10639-024-12708-w

Zhao, Y., Li, Y., Ma, S., Xu, Z., & Zhang, B. (2025). A meta-analysis of the correlation between self-regulated learning strategies and academic performance in online and blended learning environments. Computers & Education, 230, 105279. https://doi.org/10.1016/j.compedu.2025.105279