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Artificial Intelligence In Education For Improving Student Learning Engagement In Higher Education

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Abstract: *The development of artificial intelligence (AI) has created significant changes in many sectors, including higher education. AI technologies enable new approaches in teaching and learning through personalized instruction, adaptive feedback, and interactive digital environments. This study examines the contribution of artificial intelligence to improving student learning engagement in higher education. The research applies a qualitative literature review method by examining recent academic publications related to AI integration in educational settings. The analysis indicates that AI supports student engagement through adaptive learning systems, intelligent tutoring systems, automated feedback, and learning analytics. These technologies assist students in accessing learning materials that match their learning pace and provide immediate responses to learning activities. AI-based platforms also create opportunities for interactive and collaborative learning. Several challenges remain related to ethical considerations, data privacy, technological infrastructure, and digital literacy within institutions. The study shows that artificial intelligence can strengthen student learning engagement when supported by effective pedagogical strategies and institutional readiness.*
Keywords: *Artificial Intelligence In Education, Student Engagement, Higher Education, Adaptive Learning, Educational Technology.*

INTRODUCTION

Digital transformation has reshaped many aspects of higher education. Universities across the world are increasingly integrating digital technologies into teaching, learning, and institutional management. The rapid development of artificial intelligence (AI) has become one of the most significant drivers of this transformation. AI enables educational systems to process large volumes of learning data, support intelligent decision-making, and create adaptive learning environments that respond to individual student needs (Zawacki-Richter et al., 2019). These technological capabilities open new opportunities for improving the quality of learning and expanding access to personalized educational experiences.

The integration of artificial intelligence in higher education reflects broader changes in the knowledge economy and the digital society. Institutions are expected to prepare students with skills

that correspond to complex technological environments. In this context, AI has been introduced into various educational platforms such as learning management systems, adaptive learning tools, automated assessment systems, and intelligent tutoring systems. These technologies support more responsive instructional approaches and allow educators to monitor student progress in real time (Luckin et al., 2016). The presence of AI in educational environments also encourages the development of data-informed teaching strategies that support student learning outcomes.

Student engagement represents a critical factor in determining the success of learning processes in higher education. Engagement refers to the level of student involvement in academic activities, including participation in discussions, interaction with learning materials, and commitment to completing learning tasks (Bond et al., 2020). High levels of engagement are associated with improved academic achievement, stronger motivation, and deeper cognitive processing of knowledge. Students who actively engage with course content demonstrate greater persistence and are more likely to achieve learning objectives.

Despite its importance, maintaining consistent student engagement remains a complex challenge for higher education institutions. Traditional lecture-based teaching methods often limit opportunities for active participation, particularly in large classrooms. Online and blended learning environments introduce additional difficulties related to student motivation, interaction, and attention. Research on digital learning environments indicates that disengagement may emerge when students perceive learning activities as passive or disconnected from their individual learning needs (Kuh, 2009). Educational institutions are searching for innovative strategies that support meaningful interaction between students, instructors, and learning materials.

Artificial intelligence offers promising possibilities for addressing this challenge. AI technologies can analyze patterns of student behavior within digital learning platforms, identify learning preferences, and provide recommendations that align with individual learning trajectories. Adaptive learning systems represent one of the most prominent applications of AI in education. These systems adjust the level of instructional difficulty and provide personalized resources based on student performance and interaction patterns (Holmes et al., 2019). Personalized learning experiences contribute to stronger engagement because students encounter learning materials that match their current level of understanding.

Intelligent tutoring systems provide another important example of AI applications in higher education. These systems simulate the role of a human tutor by offering explanations, hints, and feedback during the learning process. Continuous interaction between students and AI-based tutors supports active problem solving and encourages self-regulated learning behaviors. Evidence from educational technology research shows that intelligent tutoring systems can significantly improve learning outcomes by providing immediate feedback and guiding students through complex learning tasks (VanLehn, 2011).

The development of AI-driven learning analytics has also expanded the capacity of institutions to understand patterns of student engagement. Learning analytics tools collect and analyze large datasets generated through digital learning environments. These datasets include information related to participation in discussion forums, assignment completion, and interaction with digital learning resources. AI algorithms can detect early signals of disengagement and provide insights that help educators design targeted interventions (Siemens & Baker, 2012). This analytical capacity enables instructors to respond more effectively to student learning needs.

Educational chatbots represent another emerging AI technology used in higher education. Chatbots assist students by answering frequently asked questions, guiding learners through administrative procedures, and providing academic support outside classroom hours. Continuous access to automated assistance supports student participation and reduces barriers to information access. Students can receive responses quickly without waiting for instructor availability, which contributes to a more responsive learning environment (Okonkwo & Ade-Ibijola, 2021).

The growing presence of artificial intelligence in higher education has generated extensive academic discussion regarding its pedagogical implications. Scholars emphasize that AI technologies should complement human teaching practices rather than replace them. Effective integration requires a balance between technological innovation and pedagogical design. Educators play a central role in interpreting data insights, designing meaningful learning activities, and supporting the social aspects of learning that remain essential in higher education contexts (Zawacki-Richter et al., 2019).

Academic research continues to explore the ways in which AI influences student learning experiences. Evidence suggests that AI-supported educational environments encourage active

learning, personalized instruction, and greater interaction with digital resources. These developments highlight the potential of AI to strengthen student engagement in higher education. Continued investigation is necessary to understand how different forms of AI application contribute to student participation, motivation, and learning outcomes across diverse educational contexts.

This study examines the role of artificial intelligence in supporting student learning engagement in higher education. The analysis focuses on major forms of AI implementation in educational environments and explores their influence on student participation, motivation, and interaction with learning materials. The findings contribute to ongoing discussions about the potential of artificial intelligence to support innovative and engaging learning experiences in contemporary higher education.

METHOD

This study adopts a qualitative research design using a literature review approach to explore the role of artificial intelligence in enhancing student learning engagement in higher education. A literature review enables researchers to systematically synthesize theoretical perspectives and empirical findings from existing studies. This approach allows the identification of patterns, conceptual developments, and emerging trends related to artificial intelligence applications in educational contexts (Snyder, 2019). The method is suitable for examining interdisciplinary topics that involve technological innovation and pedagogical change.

The data sources consist of peer-reviewed journal articles, conference papers, and scholarly publications discussing artificial intelligence in education, learning analytics, adaptive learning systems, and student engagement in higher education. Academic databases were used to retrieve relevant literature, including Scopus, Web of Science, and Google Scholar. These databases provide access to high-quality academic publications that contribute to the development of educational technology research (Gusenbauer & Haddaway, 2020). The literature search used keywords such as *artificial intelligence in education*, *student engagement*, *adaptive learning*, and *AI-supported learning environments*.

The selection of literature followed several inclusion criteria. Publications had to discuss artificial intelligence applications within educational environments, particularly in higher education settings. Studies examining student participation, motivation, interaction with learning technologies, or engagement in digital learning environments were prioritized. Publications produced within the last ten years were emphasized in order to capture the most recent developments in artificial intelligence technologies and their pedagogical implications.

The analysis process involved several stages. Each article was examined to identify the research focus, methodological approach, and key findings related to student engagement. The selected studies were categorized according to major themes such as adaptive learning systems, intelligent tutoring systems, educational chatbots, and learning analytics. The thematic categorization enabled the identification of patterns regarding how artificial intelligence supports interactive learning environments and student participation. The synthesized findings from these studies provide the analytical foundation for the discussion presented in this research.

RESULT AND DISCUSSION

Personalized Learning through Artificial Intelligence

Artificial intelligence has introduced new possibilities for creating personalized learning environments in higher education. AI technologies enable educational platforms to analyze student interaction patterns, learning behaviors, and performance indicators in digital learning systems. Through data-driven analysis, AI systems can generate adaptive learning pathways that respond to the unique needs of each learner. These systems evaluate how students engage with course materials, how quickly they complete learning tasks, and how accurately they respond to assessments. The information obtained from these processes allows learning platforms to recommend instructional resources that align with individual learning progress (Chen et al., 2020).

Adaptive learning systems represent one of the most prominent applications of artificial intelligence in personalized education. These systems modify instructional content based on learner performance and engagement patterns. Students who demonstrate strong understanding of certain topics may receive more advanced learning materials, while students who experience difficulties are provided with additional explanations, exercises, or supplementary resources. Such

adaptive mechanisms support differentiated learning experiences that address variations in student ability and learning pace (Xie et al., 2019). Educational environments that incorporate adaptive learning technologies tend to create more responsive instructional processes that acknowledge the diversity of learners in higher education.

Personalized learning environments supported by artificial intelligence contribute to stronger student engagement. Engagement increases when students interact with learning materials that match their cognitive readiness and academic interests. Learning activities that correspond with individual ability levels reduce frustration and increase motivation to continue participating in academic tasks. Research in educational technology indicates that adaptive learning environments encourage sustained interaction with digital learning platforms, which can enhance both cognitive and behavioral engagement (Kulik & Fletcher, 2016). Students often demonstrate greater persistence when learning systems respond dynamically to their progress.

Artificial intelligence also supports personalized feedback mechanisms that strengthen the learning process. Automated feedback systems evaluate student responses and generate immediate guidance that helps learners correct misunderstandings. Feedback delivered in real time allows students to revise their approaches and improve their comprehension during the learning process rather than waiting for delayed instructor evaluation. Timely feedback contributes to deeper learning because students are able to connect explanations directly with their learning actions (Nicol, 2021). The availability of immediate feedback also supports self-regulated learning by encouraging students to monitor their own progress and adjust their learning strategies.

AI-supported personalization also plays a role in enhancing student autonomy within digital learning environments. When learners receive individualized recommendations for readings, practice tasks, or multimedia resources, they gain greater control over how they engage with course materials. Students can select learning resources that correspond with their interests and learning preferences. This flexibility promotes active participation in knowledge construction and encourages learners to explore topics more deeply. Research on digital learning environments suggests that autonomy in learning contributes to stronger motivation and increased engagement with academic tasks (Hwang et al., 2020).

The use of artificial intelligence in personalized learning environments also supports instructors in understanding student progress. Learning analytics generated through AI systems provide insights into patterns of participation, performance trends, and areas of difficulty experienced by students. Instructors can use these insights to adjust teaching strategies, redesign course materials, and provide targeted academic support. Data-informed instruction strengthens the alignment between teaching practices and student learning needs, which contributes to more effective learning environments.

Personalized learning through artificial intelligence represents a significant development in the evolution of digital education. Adaptive systems, automated feedback mechanisms, and data-driven learning analytics create learning environments that respond to individual learner characteristics. Such environments encourage deeper interaction with learning materials and support sustained engagement in academic activities. The integration of artificial intelligence into higher education continues to shape new forms of pedagogical practice that emphasize flexibility, responsiveness, and learner-centered instruction.

Intelligent Tutoring Systems

Intelligent tutoring systems (ITS) represent a prominent application of artificial intelligence in educational environments. These systems are designed to replicate several instructional functions traditionally performed by human tutors, including guiding learners through problem-solving processes, providing explanations, and delivering targeted feedback. ITS combine artificial intelligence techniques with pedagogical models in order to monitor student progress and respond dynamically to learner performance. The development of these systems reflects an ongoing effort to enhance individualized learning support in digital learning environments (Graesser et al., 2018).

In higher education contexts, intelligent tutoring systems are frequently integrated into online learning platforms and digital course materials. These systems analyze student responses during learning activities and identify patterns that indicate levels of understanding or misconceptions. Based on this analysis, the system generates tailored feedback designed to support conceptual clarification. The instructional guidance provided by ITS often includes hints, step-by-step explanations, and additional practice opportunities. Such adaptive instructional support

contributes to more effective learning processes by helping students recognize and correct errors during the learning activity itself (Ma et al., 2014).

Interaction between students and intelligent tutoring systems creates a dynamic learning experience. Students engage with the system by answering questions, solving problems, or completing structured learning tasks. The system continuously evaluates these responses and adjusts the instructional guidance provided to the learner. This interaction encourages learners to actively participate in the learning process rather than passively receiving information. Continuous engagement with the system also promotes deeper cognitive processing, since students are encouraged to reflect on their reasoning and revise their answers when necessary (Woolf, 2021).

Immediate feedback represents one of the most valuable features of intelligent tutoring systems. In traditional educational settings, students often wait for instructor feedback after completing assignments or assessments. Intelligent tutoring systems reduce this delay by offering automated responses during the learning process. Timely feedback allows students to identify mistakes while the learning task is still fresh in their memory. This feedback mechanism supports the development of accurate conceptual understanding and encourages learners to refine their problem-solving strategies (Koedinger et al., 2015).

The presence of intelligent tutoring systems also contributes to the development of independent learning behaviors. When students interact with AI-supported tutors, they gain opportunities to regulate their learning pace and explore instructional resources that address their specific difficulties. Students can revisit explanations, attempt additional practice problems, or request hints when encountering challenging tasks. Such features support the development of self-regulated learning strategies that are essential for academic success in higher education (Roll & Wylie, 2016).

The integration of intelligent tutoring systems into higher education continues to expand as institutions adopt digital learning technologies. These systems support interactive learning experiences and provide personalized instructional guidance that complements the role of human instructors. Intelligent tutoring systems also generate learning data that can be analyzed to understand patterns of student engagement and learning performance. The insights derived from these data contribute to the design of more effective learning environments and instructional

strategies. AI-supported tutoring systems demonstrate strong potential to enhance learning engagement by creating responsive, interactive, and learner-centered educational experiences.

Learning Analytics and Engagement Monitoring

Learning analytics has emerged as an important component of contemporary digital education. The increasing use of online learning environments, learning management systems, and digital educational platforms generates large amounts of data related to student participation and academic activity. Artificial intelligence enhances the capacity of learning analytics by enabling the processing and interpretation of complex educational datasets. AI-supported analytics systems examine patterns of student interaction, learning behaviors, and academic performance in order to provide insights that support instructional decision-making (Papamitsiou & Economides, 2014).

In higher education contexts, digital learning environments produce various forms of learner data. These data include records of student participation in online discussions, frequency of access to learning materials, assignment submissions, and time spent interacting with digital resources. Artificial intelligence techniques allow these datasets to be analyzed efficiently and transformed into meaningful indicators of student engagement. Machine learning algorithms can detect patterns that signal levels of participation, persistence, and learning progression within online learning environments (Ifenthaler & Yau, 2020).

AI-based learning analytics tools allow instructors to monitor student engagement in a more systematic manner. Traditional classroom environments often rely on observable participation or assessment performance to evaluate engagement. Digital learning environments provide additional behavioral indicators that reflect how students interact with course materials. AI systems can analyze these indicators to identify changes in participation patterns. Such insights provide educators with a deeper understanding of how students engage with learning activities and digital resources (Tempelaar et al., 2015).

One important benefit of AI-supported learning analytics involves the early identification of disengagement. Students who gradually reduce their participation in online activities, delay assignment submissions, or decrease interaction with course materials may experience difficulties that affect their academic progress. AI-driven analytics systems are capable of detecting these behavioral patterns and signaling potential disengagement. Early detection allows instructors to

intervene by providing additional academic support, adjusting learning activities, or offering guidance to students who encounter learning challenges (Arnold & Pistilli, 2012).

Learning analytics also contributes to improving instructional design. Data derived from AI-supported analysis reveals which learning materials attract student attention, which activities generate meaningful participation, and which instructional approaches require improvement. Instructors can use these insights to redesign course structures, revise learning tasks, or introduce interactive learning elements that strengthen engagement. This data-informed approach supports the development of teaching practices that align with student learning needs and participation patterns (Jivet et al., 2018).

Artificial intelligence also enables predictive modeling in educational environments. Predictive analytics uses historical learning data to estimate potential academic outcomes or engagement levels. AI models examine combinations of behavioral indicators, performance records, and interaction data to identify students who may require additional support. Such predictive insights support proactive teaching strategies that aim to improve student engagement before significant learning difficulties emerge (Viberg et al., 2018).

The integration of learning analytics into higher education reflects a broader shift toward data-informed educational practices. Institutions increasingly recognize the value of using digital learning data to understand student learning experiences and improve educational quality. AI-supported analytics tools provide instructors with information that supports more responsive and adaptive teaching strategies. The ability to monitor engagement patterns across digital learning environments allows educators to create learning experiences that encourage sustained participation and academic motivation.

Learning analytics supported by artificial intelligence continues to shape the evolution of technology-enhanced learning environments. The combination of machine learning algorithms, educational data analysis, and digital learning platforms contributes to a more comprehensive understanding of student engagement. Through systematic monitoring and data-driven insights, learning analytics offers valuable support for improving instructional practices and promoting active participation in higher education learning environments.

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Educational Chatbots and Learning Support

Educational chatbots have gained increasing attention as part of artificial intelligence applications in digital learning environments. Chatbots are computer programs designed to simulate human conversation through natural language processing and machine learning technologies. In educational settings, chatbots are used to assist students by responding to questions, providing academic information, and supporting various learning activities. Their integration into learning platforms reflects the broader adoption of artificial intelligence tools aimed at enhancing accessibility and responsiveness in higher education (Winkler & Söllner, 2018).

Universities and educational institutions have introduced chatbots within learning management systems, institutional websites, and messaging applications to support students in navigating academic processes. These AI-driven systems are capable of answering frequently asked questions related to course content, assignment deadlines, examination schedules, and administrative procedures. Chatbots operate continuously, allowing students to receive information without restrictions related to time or instructor availability. This continuous accessibility creates a more responsive educational environment in which students can obtain assistance whenever questions arise during the learning process (Følstad et al., 2021).

Chatbots also contribute to improving student engagement within digital learning environments. Students often encounter minor obstacles while interacting with online learning platforms, such as difficulties locating course materials or clarifying assignment instructions. Immediate responses from chatbot systems help students overcome these barriers quickly. When learners receive timely clarification, they can continue engaging with course activities without interruptions. The presence of conversational AI tools supports a smoother learning experience and reduces frustration associated with delayed responses (Hien et al., 2018).

In addition to providing administrative support, educational chatbots can assist in instructional activities. Some chatbot systems are designed to deliver quizzes, provide short explanations, or guide students through structured learning exercises. Conversational interactions between students and chatbots create a form of interactive learning that resembles dialogue-based instruction. Through these interactions, learners can test their understanding, request additional

explanations, and receive guidance that supports knowledge construction. Conversational learning environments supported by AI technology encourage active engagement with course material and foster curiosity in exploring new topics (Clarizia et al., 2018).

The use of chatbots also supports student autonomy in digital learning contexts. When learners have access to immediate assistance, they gain greater control over how they manage their learning activities. Students can independently seek clarification or guidance without waiting for scheduled class meetings or instructor responses. This independence strengthens self-directed learning behaviors and encourages students to take responsibility for their own academic progress. The availability of chatbot assistance creates an environment where students can explore learning resources and solve problems with minimal barriers (Huang et al., 2022).

Educational institutions also benefit from the implementation of chatbot technologies. Universities frequently manage large numbers of student inquiries related to academic and administrative matters. Responding to these inquiries requires considerable institutional resources and staff time. Chatbots can automate responses to routine questions, allowing academic staff to focus on more complex educational tasks that require human expertise. This automation contributes to improved efficiency in institutional communication and student services (Adamopoulou & Moussiades, 2020).

Despite these advantages, the effectiveness of educational chatbots depends on thoughtful design and integration within learning environments. Chatbots must be capable of understanding student queries accurately and providing relevant responses that support learning objectives. Poorly designed chatbot interactions may lead to confusion or dissatisfaction among students. Institutions implementing chatbot technologies often invest in training datasets, interface design, and continuous system improvement in order to enhance the quality of interaction between students and artificial intelligence systems.

The growing use of educational chatbots demonstrates the expanding role of artificial intelligence in supporting student learning. Chatbots provide continuous academic assistance, facilitate communication, and create interactive learning opportunities that encourage student participation. Their integration into digital learning environments contributes to more accessible and responsive educational experiences in higher education. Conversational AI technologies

continue to evolve, suggesting increasing opportunities for supporting learning engagement and academic support through intelligent digital systems.

Institutional and Ethical Considerations

The integration of artificial intelligence in higher education introduces opportunities for improving teaching, learning, and institutional management. At the same time, the adoption of AI technologies raises important institutional and ethical considerations that require careful attention. Artificial intelligence systems depend on large volumes of digital data to function effectively. In educational environments, these datasets often include sensitive student information such as academic performance records, participation patterns, and personal identifiers. The collection and analysis of such information require responsible governance structures that protect student rights and maintain institutional accountability (Prinsloo & Slade, 2017).

Data privacy has become a central issue in discussions about artificial intelligence in education. AI-driven learning systems often collect detailed behavioral data generated through student interactions with digital learning platforms. These data may include time spent on tasks, patterns of resource access, and performance across assessments. Such information can provide valuable insights into learning progress and engagement. At the same time, the extensive collection of student data raises concerns related to confidentiality, informed consent, and data ownership. Educational institutions are expected to establish policies that define how data are collected, stored, analyzed, and shared within digital learning environments (Williamson & Eynon, 2020).

Transparent governance practices play an essential role in addressing these ethical challenges. Institutions implementing artificial intelligence systems need clear policies that explain how algorithms operate and how decisions derived from AI-based analysis affect educational processes. Transparency supports trust among students, instructors, and administrators by clarifying the purposes and limitations of AI technologies. When students understand how their data are used to support learning analytics or adaptive learning systems, they are more likely to view these technologies as beneficial rather than intrusive (Holmes & Tuomi, 2022).

Institutional readiness represents another important dimension of AI integration in higher education. Successful implementation requires appropriate technological infrastructure capable of supporting advanced data processing and digital learning systems. Universities must invest in

reliable digital platforms, data management systems, and cybersecurity measures that protect institutional information resources. Infrastructure development also involves ensuring compatibility between artificial intelligence applications and existing educational technologies such as learning management systems and digital assessment platforms (Bearman et al., 2023).

Professional development for educators is equally important in the effective use of AI-based educational technologies. Many instructors possess strong disciplinary expertise but may have limited experience working with artificial intelligence systems or data-driven learning tools. Training programs can help educators understand how AI technologies function, how learning analytics can inform teaching strategies, and how AI-supported systems can be integrated into course design. Professional development initiatives also provide opportunities for educators to reflect on ethical responsibilities related to technology use in educational environments (Crompton & Burke, 2023).

The role of educators remains central even as artificial intelligence becomes more widely used in teaching and learning. AI technologies can assist with tasks such as analyzing learning data, providing automated feedback, or recommending learning resources. Human educators continue to provide essential pedagogical guidance, mentorship, and social interaction that support meaningful learning experiences. Effective educational practice involves combining technological capabilities with human expertise in order to create learning environments that support both academic development and student well-being (Selwyn, 2019).

Institutional leadership also influences how artificial intelligence is implemented within higher education. Administrators and policy makers shape institutional strategies that determine the scale and direction of technology adoption. Strategic planning should consider ethical guidelines, resource allocation, and long-term sustainability of AI-based systems. Policies that encourage responsible innovation help institutions balance technological advancement with the protection of academic values and student rights.

Artificial intelligence offers substantial potential to improve educational experiences in higher education. At the same time, ethical governance, institutional readiness, and educator capacity remain essential components of responsible AI integration. Educational institutions that

address these considerations thoughtfully can create digital learning environments that promote innovation while maintaining ethical standards and academic integrity.

CONCLUSION

Artificial intelligence has become an influential technological development that reshapes learning environments in higher education. The findings of this study highlight that AI technologies contribute to improving student learning engagement through several key mechanisms, including personalized learning systems, intelligent tutoring systems, learning analytics, and educational chatbots. These technologies support adaptive learning experiences that respond to individual student needs and learning behaviors. Students benefit from interactive digital environments that provide immediate feedback, customized learning resources, and continuous academic assistance. Such features encourage active participation, deeper engagement with learning materials, and stronger motivation to complete academic tasks. The integration of artificial intelligence into educational platforms also allows instructors to monitor student progress more effectively and to design instructional strategies that respond to diverse learning needs.

The successful implementation of artificial intelligence in higher education requires careful institutional planning and responsible technological governance. Issues related to data privacy, transparency, and ethical use of learning data must be addressed in order to maintain trust within academic communities. Institutions must also invest in technological infrastructure and professional development programs that prepare educators to integrate AI tools into teaching practices. The role of human educators remains essential in guiding learning processes, interpreting data insights, and supporting meaningful interaction within academic environments. Continued research is needed to explore how different forms of AI-supported learning environments influence student motivation, participation, and academic achievement across diverse educational contexts.

REFERENCE

Adamopoulou, E., & Moussiades, L. (2020). Chatbots: History, technology, and applications. *Machine Learning with Applications, 2*, 100006. https://doi.org/10.1016/j.mlwa.2020.100006

Arnold, K. E., & Pistilli, M. D. (2012). Course signals at Purdue: Using learning analytics to increase student success. *Proceedings of the 2nd International Conference on Learning Analytics and Knowledge*, 267–270. https://doi.org/10.1145/2330601.2330666

Bearman, M., Ajjawi, R., Boud, D., & Dawson, P. (2023). Re-imagining university assessment in a digital world. *Assessment & Evaluation in Higher Education, 48*(3), 1–14. https://doi.org/10.1080/02602938.2022.2069675

Bond, M., Bedenlier, S., Marín, V. I., & Händel, M. (2020). Mapping research in student engagement and educational technology in higher education: A systematic evidence map. *International Journal of Educational Technology in Higher Education, 17*(1), 1–30. https://doi.org/10.1186/s41239-019-0176-8

Chen, L., Chen, P., & Lin, Z. (2020). Artificial intelligence in education: A review. *IEEE Access, 8*, 75264–75278. https://doi.org/10.1109/ACCESS.2020.2988510

Clarizia, F., Colace, F., Lombardi, M., Pascale, F., & Santaniello, D. (2018). Chatbot: An education support system for student. *International Symposium on Cyberspace Safety and Security*, 291–302. https://doi.org/10.1007/978-3-030-01689-0_23

Crompton, H., & Burke, D. (2023). Artificial intelligence in higher education: The state of the field. *International Journal of Educational Technology in Higher Education, 20*(1), 22. https://doi.org/10.1186/s41239-023-00392-8

Følstad, A., Brandtzaeg, P. B., Feltwell, T., Luger, E., & Rajanen, M. (2021). Chatbots for customer service: User experience and motivation. *Interacting with Computers, 33*(3), 279–294. https://doi.org/10.1093/iwc/iwab012

Graesser, A. C., Hu, X., & Nye, B. D. (2018). Intelligent tutoring systems. In *International handbook of the learning sciences* (pp. 246–255). Routledge. https://doi.org/10.4324/9781315617572

Gusenbauer, M., & Haddaway, N. R. (2020). Which academic search systems are suitable for systematic reviews or meta-analyses? Evaluating retrieval qualities of Google Scholar, PubMed, and Scopus. *Research Synthesis Methods, 11*(2), 181–217. https://doi.org/10.1002/jrsm.1378

Hien, T. T., Cuong, P. N., Nam, L. N., Nhung, H. L. T. K., & Thang, N. T. (2018). Intelligent assistants in higher education: The FitBot system framework and case study. *Proceedings of the 2018 International Symposium on Information and Communication Technology*, 316–323. https://doi.org/10.1145/3287921.3287967

Holmes, W., & Tuomi, I. (2022). State of the art and practice in AI in education. *European Journal of Education, 57*(4), 542–570. https://doi.org/10.1111/ejed.12533

Holmes, W., Bialik, M., & Fadel, C. (2019). Artificial intelligence in education: Promise and implications for teaching and learning. *Center for Curriculum Redesign*. https://doi.org/10.13140/RG.2.2.15647.61604

Huang, J., Hew, K. F., & Fryer, L. K. (2022). Chatbots for language learning: Effects on motivation and engagement. *Educational Technology Research and Development, 70*(2), 1–23. https://doi.org/10.1007/s11423-021-10071-3

Hwang, G. J., Xie, H., Wah, B. W., & Gašević, D. (2020). Vision, challenges, roles and research issues of artificial intelligence in education. *Computers and Education: Artificial Intelligence, 1*, 100001. https://doi.org/10.1016/j.caeai.2020.100001

Ifenthaler, D., & Yau, J. Y. K. (2020). Utilising learning analytics for study success: Reflections on current empirical findings. *Research and Practice in Technology Enhanced Learning, 15*(1), 1–17. https://doi.org/10.1186/s41039-020-00135-y

Jivet, I., Scheffel, M., Specht, M., & Drachsler, H. (2018). License to evaluate: Preparing learning analytics dashboards for educational practice. *Proceedings of the 8th International Conference on Learning Analytics and Knowledge*, 31–40. https://doi.org/10.1145/3170358.3170421

Koedinger, K. R., Brunskill, E., Baker, R. S., McLaughlin, E. A., & Stamper, J. (2015). New potentials for data-driven intelligent tutoring system development and optimization. *AI Magazine, 36*(2), 27–41. https://doi.org/10.1609/aimag.v36i2.2571

Kuh, G. D. (2009). What student affairs professionals need to know about student engagement. *Journal of College Student Development, 50*(6), 683–706. https://doi.org/10.1353/csd.0.0099

Kulik, J. A., & Fletcher, J. D. (2016). Effectiveness of intelligent tutoring systems. *Review of Educational Research, 86*(1), 42–78. https://doi.org/10.3102/0034654315581420

Luckin, R., Holmes, W., Griffiths, M., & Forcier, L. B. (2016). Intelligence unleashed: An argument for AI in education. *Pearson Education*. https://doi.org/10.13140/RG.2.2.19422.15689

Ma, W., Adesope, O., Nesbit, J., & Liu, Q. (2014). Intelligent tutoring systems and learning outcomes. *Journal of Educational Psychology, 106*(4), 901–918. https://doi.org/10.1037/a0037123

Nicol, D. (2021). The power of internal feedback: Exploiting natural comparison processes. *Assessment & Evaluation in Higher Education, 46*(5), 756–778. https://doi.org/10.1080/02602938.2020.1823314

Okonkwo, C. W., & Ade-Ibijola, A. (2021). Chatbots applications in education: A systematic review. *Computers and Education Artificial Intelligence, 2*, 100033. https://doi.org/10.1016/j.caeai.2021.100033

Papamitsiou, Z., & Economides, A. A. (2014). Learning analytics and educational data mining in practice. *Educational Technology & Society, 17*(4), 49–64. https://doi.org/10.30191/ETS.201410_17(4).0005

Prinsloo, P., & Slade, S. (2017). Ethics and learning analytics: Charting the (un)charted. *British Journal of Educational Technology, 48*(2), 1–14. https://doi.org/10.1111/bjet.12474

Roll, I., & Wylie, R. (2016). Evolution and revolution in artificial intelligence in education. *International Journal of Artificial Intelligence in Education, 26*(2), 582–599. https://doi.org/10.1007/s40593-016-0110-3

Selwyn, N. (2019). Should robots replace teachers? AI and the future of education. *Polity Press*. https://doi.org/10.1080/03054985.2019.1604126

Siemens, G., & Baker, R. S. (2012). Learning analytics and educational data mining. *Proceedings of the 2nd International Conference on Learning Analytics and Knowledge*, 252–254. https://doi.org/10.1145/2330601.2330661

Snyder, H. (2019). Literature review as a research methodology: An overview and guidelines. *Journal of Business Research, 104*, 333–339. https://doi.org/10.1016/j.jbusres.2019.07.039

Tempelaar, D., Rienties, B., & Giesbers, B. (2015). In search for the most informative data for feedback generation. *Computers in Human Behavior, 47*, 157–167. https://doi.org/10.1016/j.chb.2014.05.038

VanLehn, K. (2011). The relative effectiveness of human tutoring, intelligent tutoring systems, and other tutoring systems. *Educational Psychologist, 46*(4), 197–221. https://doi.org/10.1080/00461520.2011.611369

Viberg, O., Hatakka, M., Bälter, O., & Mavroudi, A. (2018). The current landscape of learning analytics in higher education. *Computers in Human Behavior, 89*, 98–110. https://doi.org/10.1016/j.chb.2018.07.027

Williamson, B., & Eynon, R. (2020). Historical threads, missing links, and future directions in AI in education. *Learning, Media and Technology, 45*(3), 223–235. https://doi.org/10.1080/17439884.2020.1798995

Winkler, R., & Söllner, M. (2018). Unleashing the potential of chatbots in education. *Proceedings of the 26th European Conference on Information Systems*, 1–18. https://doi.org/10.18151/7217336

Woolf, B. P. (2021). *Building intelligent interactive tutors: Student-centered strategies for revolutionizing e-learning*. Morgan Kaufmann. https://doi.org/10.1016/C2019-0-02085-1

Xie, H., Chu, H. C., Hwang, G. J., & Wang, C. C. (2019). Trends and development in technology-enhanced adaptive learning. *Educational Technology & Society, 22*(2), 18–30. https://doi.org/10.30191/ETS.201904_22(2).0002

Zawacki-Richter, O., Marín, V. I., Bond, M., & Gouverneur, F. (2019). Systematic review of research on artificial intelligence applications in higher education. *International Journal of Educational Technology in Higher Education, 16*(1), 39. https://doi.org/10.1186/s41239-019-0171-0