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The Effect of Artificial Intelligence Integration on Student Engagement in Online Learning

Suriza Noor Fahmi Hashim[1], Nor Suhaila Binti Samsuri[2]

[1]Faculty of Business and Accountancy, Universiti Poly-Tech Malaysia
56100 Kuala Lumpur, Malaysia
[2]Faculty of Business, Kolej Vokasional Shah Alam
40000 Shah Alam, Selangor, Malaysia
Corresponding Author*: suriza@uptm.edu.my

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ABSTRACT

This concept paper examines the integration of Artificial Intelligence (AI) in educational practices to enhance student engagement in higher education. The rapid digital transformation of education, accelerated by the COVID-19 pandemic, has highlighted the growing importance of AI-driven technologies in teaching and learning. AI offers significant potential through personalised learning experiences, instant feedback mechanisms, automated administrative support, and improved interactive learning environments. However, successful implementation requires careful planning, ethical considerations, and evidence-based research. This paper aims to explore how AI can improve students' behavioural, cognitive, and emotional engagement. By reviewing recent literature and proposing a mixed-method research approach, the study seeks to identify the opportunities, challenges, and effective strategies for leveraging AI to create more engaging, inclusive, and effective educational environments.

Keywords: *Artificial Intelligence (AI), Student Engagement, AI in Education, Blended Learning, Online Learning, Educational Technology*

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INTRODUCTION

The evolution of educational technology has revolutionised how learning is delivered and experienced (Singh, 2023). One of the most transformative technologies in this field is Artificial Intelligence (AI). AI, defined as the ability of machines to mimic human cognitive functions such as learning, reasoning, and problem-solving, has found increasing applications in education (Sajja et al., 2024). From virtual tutors to intelligent content delivery systems, AI is reshaping the academic landscape by enabling adaptive and personalised learning environments (Guettala et al., 2024; Kaswan et al., 2024).

Student engagement—a multifaceted construct involving behavioral participation, emotional investment, and cognitive attention—is crucial for academic success (Nguyen et al., 2024). However, maintaining engagement in online and hybrid learning environments remains a persistent challenge. Recent studies suggest that AI has the potential to address these challenges by creating adaptive, personalized, and interactive learning experiences that enhance learner participation and motivation (Yu & Yao, 2024; Salem, 2024). AI-powered systems such as intelligent tutoring systems, predictive analytics, and personalised learning platforms have demonstrated positive effects on student engagement and academic achievement in higher education institutions (Bhatia et al., 2024; Naseer et al., 2024).

This paper proposes a study to investigate the role of AI in fostering student engagement, focusing on its practical applications, perceived impact, and the barriers to its implementation in higher education institutions. The study also aims to contribute to the growing body of literature examining how AI-enabled educational technologies can support more effective and inclusive learning experiences (Merino-Campos, 2025; Long et al., 2026).

LITERATURE REVIEW

Recent research highlights the growing interest in AI as a tool for improving teaching and learning outcomes. Holmes et al. (2019) note that AI supports adaptive learning systems that tailor content to individual learning paces and styles, thereby enhancing engagement. These systems use algorithms to analyse student behaviour and adjust content delivery accordingly.

Itzhak Einenthaler and Yau (2020) review the use of learning analytics and AI for predicting student performance and engagement. They emphasise the role of data in informing timely interventions, particularly in identifying at-risk students who may benefit from personalised support. These data-driven approaches have been increasingly integrated into Learning Management Systems (LMS), enabling real-time dashboards that visualise learning patterns and guide instructional strategies.

Alimisis (2023) discusses integrating robotics and AI-driven platforms to create immersive, participatory learning environments, which are especially effective for STEM subjects. These technologies support project-based learning, simulation, and interactive experimentation, which can significantly boost students' emotional and behavioural engagement by making learning more tangible and dynamic.
Zawacki-Richter et al. (2019) conducted a systematic review of AI applications in higher education. They categorised them into four major domains: automation of administrative tasks, support for instructional design, facilitation of adaptive learning, and provision of student support services such as AI tutors and chatbots. Their study found that while AI integration is on the rise, empirical evidence on its impact on student engagement is still limited and context-specific.

Aoun et al. (2022) explore the ethical implications of AI in education, raising concerns about data privacy, algorithmic bias, and the need for transparency. They argue for human-in-the-loop designs that combine technological precision with human oversight to ensure fairness and trust. Ethical AI deployment is especially critical in maintaining student confidence and participation in technology-mediated learning environments.

Gamification, adaptive assessments, intelligent chatbots, and AI-assisted discussion forums are among the most cited innovations enhancing engagement. For instance, AI can prompt questions during discussion sessions, guide group interactions, and deliver scaffolded content that aligns with individual learning goals. This has been shown to increase cognitive engagement by promoting deeper inquiry and reflection (OECD, 2021).

However, successful implementation depends heavily on external factors such as teacher readiness, institutional infrastructure, curriculum flexibility, and students' digital literacy. Teachers must be trained not only to use AI tools but to interpret AI-generated data to inform their pedagogy. Institutions need to establish digital governance frameworks that govern data use, ensure compliance with ethical standards, and promote equitable access to AI technologies.

AI and Student Engagement

Student engagement encompasses behavioural, emotional, and cognitive dimensions. AI has been shown to positively influence all three. Behavioural engagement improves with interactive tools such as gamified learning apps and AI-based quizzes, while emotional engagement benefits from AI's ability to provide instant feedback and encouragement. Cognitive engagement is deepened by personalised learning pathways tailored to individual student progress.

Holmes et al. (2019) argue that AI can support differentiated instruction by customising content to match learner profiles. Such personalisation helps maintain student interest and ensures that learners stay challenged without being overwhelmed. Similarly, Baker and Inventado (2014) emphasise the role of educational data mining and learning analytics in identifying at-risk students and enabling timely interventions.

AI Tools in Use

Recent studies show that Artificial Intelligence (AI) is increasingly used in education to improve student engagement and personalise learning experiences in online and blended learning environments (Bhatia et al., 2024). One major AI application is chatbots and virtual assistants, which provide instant responses to student questions, assist with course navigation, and reduce communication delays (Chiriboga et al., 2025). Researchers argue that these tools improve learner satisfaction and promote continuous interaction in digital classrooms (Archita & Saravanan, 2025).

Another important AI tool discussed in the literature is learning analytics systems. These systems analyse student data such as participation, assessment scores, and learning behaviour to identify learning patterns and support data-driven teaching decisions (Sajja et al., 2025). Studies indicate that learning analytics dashboards encourage student self-monitoring and allow instructors to provide early interventions for struggling learners (Afolabi et al., 2025).

Adaptive learning platforms are also widely recognised for their role in personalised education. These systems use AI algorithms to adjust learning content and difficulty levels according to students' performance and needs (Yuensook & Jantakoon, 2025). Research suggests that adaptive learning improves motivation, engagement, and learning outcomes by allowing students to learn at their own pace (Godwin Olaoye et al., 2024).

In addition, automated feedback systems provide immediate feedback on assignments and assessments, helping students quickly identify and correct mistakes (Nhan, 2025). According to Katalinic et al. (2026), timely AI-generated feedback enhances learner engagement and supports continuous improvement in online education. Overall, the literature suggests that AI technologies improve accessibility, personalisation, and student engagement, although implementation and digital literacy challenges remain significant concerns.

Challenges

Despite its benefits, the integration of Artificial Intelligence (AI) in education presents several challenges. Ethical concerns such as data privacy, surveillance, and algorithmic bias remain significant issues in AI-driven learning systems (Luckin et al., 2016; Dhiman et al., 2025). Researchers also warn that excessive reliance on AI tools may reduce students' self-regulated learning and critical thinking skills.

Another major challenge is the digital divide. Unequal access to reliable internet connections, digital devices, and technological resources limits the effectiveness of AI in education, particularly for students in rural and low-income communities (Matjie et al., 2026; Ahmed, 2024). Without equal access to technology, AI may widen existing educational inequalities rather than reduce them.

Teacher readiness is also a concern discussed in the literature. Effective AI implementation requires educators to possess adequate digital literacy and technological skills. However, insufficient training and resistance to technological change may prevent teachers from fully utilising AI tools to improve learning outcomes (Oyetade & Zuva, 2025).

In addition, infrastructure limitations remain a barrier, especially in developing countries. Many institutions lack the technical infrastructure, secure data systems, and high-speed internet needed to support AI-based educational technologies effectively (Assefa, 2025). These challenges highlight the need for improved infrastructure, teacher training, and ethical guidelines to ensure equitable and effective AI integration in education.

METHODOLOGY

To assess the impact of AI on student engagement, this study will adopt a mixed-methods research design that combines the breadth of quantitative analysis with the depth of qualitative exploration. This approach ensures a more comprehensive understanding of how AI tools influence student participation, motivation, and learning outcomes.

Quantitative Component: The quantitative phase will involve a sample of 200 undergraduate students drawn from three different faculties. Data will be collected using a structured questionnaire based on the Student Engagement Instrument (SEI), with adaptations to include specific items on AI usage, such as interactions with chatbots, reliance on AI grading systems, and experiences with adaptive learning platforms. The collected data will be analyzed using SPSS, applying descriptive statistics to summarize trends, and correlation and regression analyses to determine the relationships between AI tool usage and levels of student engagement.

Qualitative Component: The qualitative phase will focus on gathering insights from 12 lecturers representing various academic departments who have integrated AI into their teaching practices. Data will be collected through a semi-structured interview protocol designed to explore perceptions of AI in education, implementation experiences, and observed student responses to AI-assisted learning. The interview transcripts will be analyzed using thematic analysis in NVivo to identify recurring patterns, challenges, and opportunities associated with AI integration.

By combining statistical evidence with rich narrative insights, this mixed-method approach will provide a balanced and nuanced perspective on the role of AI in enhancing or hindering student engagement in higher education.

Research Questions

1. What types of AI tools are currently being used in teaching and learning?
2. How do students perceive the impact of AI on their learning engagement?
3. What are the key challenges educators face in integrating AI tools?
4. What strategies can enhance the ethical and practical use of AI in education?

EXPECTED FINDINGS

The findings of this study are expected to provide valuable insights into the role of AI in higher education. Specifically, the research will assess the effectiveness of different AI tools in enhancing student engagement across behavioural, emotional, and cognitive domains. It will also capture students' acceptance and satisfaction with AI-enabled learning environments, offering a clearer understanding of how such tools impact motivation and participation. Additionally, the study will highlight institutional and pedagogical barriers to AI adoption, shedding light on gaps in infrastructure, policy, and instructor readiness. Finally, it will propose best practices for aligning AI implementation with both engagement objectives and ethical standards. These insights will inform evidence-based policy recommendations and guide faculty development programs, ultimately fostering more effective and responsible AI usage in higher education settings.

CONCLUSION

Artificial Intelligence represents a powerful avenue for reimagining student engagement in the digital era. While existing literature confirms its potential, practical implementation remains uneven due to technical, ethical, and cultural challenges. This concept paper proposes a systematic investigation into how AI tools are currently utilised in higher education, their perceived benefits, and the structural support needed for effective integration. Ultimately, the goal is to provide a framework for leveraging AI to create more engaging, inclusive, and student-centred learning environments.

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CONFLICT OF INTEREST

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in the paper.

AUTHOR CONTRIBUTION STATEMENT

Author 1 contributed to the conceptualization, research design, and writing of the original draft.
Author 2 was responsible for data collection, analysis, and validation of the results.
Author 3 provided supervision, critical review, and editing of the final manuscript.
All authors have read and approved the final version of the manuscript.

ETHICS STATEMENT

This research was conducted in accordance with the ethical standards of Universiti Poly-Tech Malaysia and adhered to the principles outlined in the Declaration of Helsinki. Ethical approval was obtained from the **Review Board** under reference number 2025-12-02. All participants were informed about the purpose of the study and provided written informed consent prior to participation. Participants' privacy and confidentiality were strictly maintained, and the data collected were used solely for academic purposes.

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