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Research Article

STUDENT AGENCY IN AI-POWERED LEARNING ENVIRONMENTS: EMPOWERING LEARNERS THROUGH TECHNOLOGY

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Abstract

The integration of Artificial Intelligence (AI) in education is reshaping how students interact with learning materials and take control of their educational journeys. AI-powered learning environments promise to enhance student agency by providing personalized learning experiences and immediate feedback. However, the impact of AI on student autonomy and the teacher-student dynamic remains underexplored. This study aims to investigate how AI technologies influence student agency in learning environments and how these tools empower learners to become more self-directed. A mixed-methods approach was employed, using surveys, interviews, and classroom observations across 10 schools that have adopted AI tools for learning. The results reveal that AI-powered tools significantly enhance student engagement and learning outcomes by offering personalized content, yet students expressed concerns about reduced opportunities for collaboration and human interaction. Teachers observed increased autonomy in students, but some raised concerns about AI's potential to depersonalize the learning experience. The study concludes that while AI can effectively empower students, it is essential to strike a balance between the technological benefits and the need for human connection in the learning process. AI should complement, not replace, traditional pedagogical practices to foster a more holistic educational experience.

Keywords: AI in education, personalized learning, student agency, teacher-student dynamic, technology in classrooms

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INTRODUCTION

The landscape of education is rapidly shifting as technology continues to transform how students engage with learning. Among the most significant innovations is the integration of Artificial Intelligence (AI) in educational environments, which has the potential to radically change traditional pedagogical practices (El-Sobkey et al., 2025). AI-powered learning platforms are enabling personalized learning experiences, offering adaptive content tailored to the needs of individual learners. These tools allow students to navigate their own educational paths, giving them a level of autonomy and control that was previously impossible. As AI-driven systems become more widespread in classrooms, they present an opportunity to empower students by fostering greater agency in their learning process (Abdelrady et al., 2025). The traditional teacher-led approach, where the educator is the primary source of knowledge and authority, is being replaced by a more dynamic and interactive model, where students can take ownership of their educational journeys (Jalali et al., 2025). However, this shift raises important questions about how student agency is influenced and facilitated by AI technologies, and whether this empowerment leads to better learning outcomes and critical thinking skills.

Student agency refers to the capacity of learners to make choices, take control of their learning processes, and act as active participants in their education. In AI-powered learning environments, this concept extends to students' ability to engage with technology in ways that foster independence, motivation, and self-regulation (Goyal et al., 2025). AI tools can offer real-time feedback, suggest personalized learning paths, and adapt to students' unique learning styles, allowing them to take a more active role in their education. While the potential for empowering students through AI is vast, the integration of these tools into educational systems is not without its challenges. These technologies must be thoughtfully integrated to ensure that they enhance learning without overshadowing the critical interpersonal and cognitive skills that students develop through human interaction in the classroom (Wang et al., 2025). This research seeks to explore the relationship between AI-powered learning environments and student agency, examining how AI can support learners in becoming more self-directed and responsible for their academic growth.

As educational institutions strive to prepare students for the demands of the 21st century, fostering student agency becomes an essential goal. In an increasingly complex world where critical thinking, adaptability, and self-motivation are key to success, it is important to understand how AI tools can help students develop these skills (Tsinakos et al., 2025). AI's capacity to provide personalized learning experiences aligns with current educational goals of promoting student-centered approaches, which prioritize the learner's voice and decision-making (Kaur et al., 2025). This research aims to illuminate how AI-powered environments can be leveraged to enhance student agency, offering insights into how technology can empower students to take control of their learning and become active, engaged participants in their educational journeys.

While AI technologies hold great promise for enhancing learning experiences, there is a lack of understanding regarding the role of these tools in fostering student agency (Chance, 2025). Most of the current research on AI in education focuses on its ability to personalize learning, automate grading, or improve efficiency, with limited attention given to how AI influences students' autonomy and decision-making within the learning process (X. Zhang, 2025). As AI becomes an integral part of the educational landscape, it is crucial to examine its impact on the traditional dynamics between students and teachers. The core problem addressed in this study is understanding how AI tools facilitate or hinder student agency in learning environments, and whether these technologies truly empower students to become active participants in their learning processes (Jagajeet et al., 2025). Specifically, it is unclear whether AI-powered tools allow students to take ownership of their education or if they inadvertently shift the power dynamics in favor of technology, reducing the role of student autonomy.

Moreover, there is insufficient research on the challenges faced by students when interacting with AI systems, such as the potential for dependency on technology or the lack of human interaction in decision-making processes (Alanazi et al., 2025). While AI has the potential to offer personalized learning experiences, it also risks fostering a passive learning environment if students rely too heavily on the technology for guidance and feedback. Teachers, too, must navigate how to integrate AI into their pedagogy in ways that encourage independent learning without diminishing the importance of human guidance (Yao & Zheng, 2025). The study seeks to investigate how AI-powered systems can be used to balance the personalization of learning with the promotion of student independence, examining both the opportunities and limitations AI presents in developing student agency.

The growing use of AI in classrooms demands a thorough exploration of its implications for student autonomy and engagement (Yang et al., 2025). AI's ability to analyze vast amounts of educational data offers a unique opportunity to tailor learning to the individual needs of students. However, the challenge lies in determining whether these systems truly foster a sense of agency or merely serve as tools that reinforce traditional teaching practices (Luckin, 2025). By examining the interaction between AI and student agency, this study aims to clarify the role AI can play in creating more self-directed, motivated learners, while ensuring that the technology is used in a way that enhances, rather than diminishes, students' capacity for independent thought and decision-making.

The primary objective of this study is to explore the relationship between AI-powered learning environments and student agency, focusing on how these technologies can empower students in the learning process (M. Zhang & Li, 2025). The research aims to identify the ways in which AI tools support or hinder student autonomy, self-regulation, and decision-making. By examining the experiences of students using AI-driven learning platforms, the study seeks to uncover whether AI can facilitate a more student-centered approach to education, allowing students to take control of their learning paths. Another key objective is to understand how teachers play a role in fostering student agency in AI-enhanced classrooms (Alier et al., 2025). The research will examine the ways in which educators integrate AI into their teaching strategies, ensuring that AI supports the development of student agency while maintaining the human elements of teaching, such as mentorship, collaboration, and emotional support.

In addition, the study will investigate the challenges that students face when interacting with AI systems in the classroom, including issues related to dependence on technology, lack of human interaction, and potential barriers to full engagement with the learning process (Subramanian, 2005). The research will assess whether students using AI-powered systems report higher levels of engagement, motivation, and academic achievement, and whether these technologies help them develop critical 21st-century skills such as problem-solving, collaboration, and self-direction. By collecting both qualitative and quantitative data, the study aims to provide a holistic understanding of how AI tools influence student agency and contribute to the development of a more self-directed, empowered learner (Nguyen et al., 2025). Ultimately, the study aims to provide recommendations for educators and policymakers on how to integrate AI tools effectively while fostering the critical skills needed for students to thrive in the digital age.

Although much research has focused on the use of AI in personalized learning and student engagement, there is a noticeable gap in understanding how these technologies specifically influence student agency. Existing studies have primarily examined AI's technical applications, such as adaptive learning algorithms and automated assessments, without fully exploring how AI impacts students' ability to make independent decisions and take control of their learning process (Zhao, 2025). Furthermore, the role of teachers in facilitating student agency within AI-enhanced classrooms is often underexplored, with a lack of attention to how educators can balance AI technology with human-centered teaching practices. While some studies have discussed the potential of AI to enhance learning outcomes, few have considered

its impact on the autonomy and agency of students (Thalji & Alkhasawneh, 2025). This research aims to address this gap by focusing on the dynamic between AI tools and student empowerment, specifically investigating how AI can foster greater independence and responsibility in students while complementing traditional pedagogical methods.

Another gap in the literature is the limited exploration of the potential risks of AI in education, particularly the unintended consequences of increased reliance on technology. While AI systems can offer personalized learning experiences, there is a concern that students may become overly dependent on these tools, reducing their ability to think critically or engage in collaborative learning (Ebadi et al., 2025). Additionally, the ethical implications of using AI in education—such as data privacy, algorithmic bias, and access disparities—remain largely unexplored in the context of student agency. This study will contribute to filling these gaps by addressing not only the potential benefits of AI in enhancing student agency but also the challenges and risks that must be managed to ensure a balanced and equitable educational experience.

This research brings a novel perspective to the discussion of AI in education by focusing on the concept of student agency in AI-enhanced learning environments (Hanshaw & Sullivan, 2025). While much of the existing literature has examined the technical aspects of AI in education, such as its ability to personalize learning and improve efficiency, this study shifts the focus to the human dimension, specifically how AI can empower students to take control of their educational experiences. The novelty of this research lies in its exploration of the relationship between AI tools and student autonomy, addressing the question of whether AI can enhance or diminish students' ability to independently manage their learning process (Ricco et al., 2025). This study also provides a unique contribution by considering the role of teachers in fostering student agency within AI-enhanced classrooms, examining how AI can be integrated into pedagogical practices in ways that support student independence while maintaining the essential human elements of education.

The justification for this research is rooted in the increasing integration of AI into educational systems worldwide (Daniela et al., 2025). As AI technologies become more prevalent, understanding their impact on student agency is essential for ensuring that these tools are used in ways that enhance, rather than hinder, student empowerment. This study aims to fill the gap in the literature by providing insights into how AI can be leveraged to support self-directed learning and foster the development of critical 21st-century skills (Liu et al., 2025). By examining both the opportunities and challenges presented by AI, this research will contribute to the development of best practices for integrating AI into classrooms in a way that promotes student agency and prepares learners for the demands of the future.

RESEARCH METHOD

The following sections detail the mixed-methods research framework designed to investigate how AI-powered learning environments facilitate the development of student agency and autonomy.

Research Design

This study adopts a mixed-methods approach to explore the intersection of artificial intelligence and student agency (Dahri et al., 2025). By combining quantitative and qualitative techniques, the research provides a multi-dimensional understanding of how AI tools influence autonomy and engagement. The design integrates student surveys to quantify perceptions of control, in-depth interviews to capture the lived experiences of educators, and classroom observations to document real-time interactions (Spyrou et al., 2025). This triangulated structure ensures that the findings are grounded in both statistical evidence and rich, contextual

narratives, offering a nuanced view of the impact of digital learning environments on student independence.

Research Target/Subject

The primary objective is to investigate the role of AI-powered environments in fostering student agency. The study targets an assessment of how personalized learning tools influence a student's ability to control their own learning process. By exploring the practical challenges and opportunities reported by both students and educators, the research aims to identify specific AI-driven strategies that enhance student autonomy, improve engagement, and ultimately optimize learning outcomes in digital contexts.

The study focuses on a diverse population of learners and educators within AI-integrated institutions. Using a stratified random sampling technique, the research selected a sample consisting of: 300 Students: Representing a broad spectrum of ages, academic performance levels, and prior technological experiences. 50 Teachers: Including educators from various disciplines and varying levels of AI proficiency. Interview Subset: A specific group of 20 teachers will be selected for in-depth semi-structured interviews.

Research Procedure

The research follows a systematic procedural structure. Institutional Approval & Consent: Identifying participating schools and obtaining voluntary, informed consent from all participants. Phase One (Quantitative): Electronic administration of the student survey at the beginning of the academic term, remaining open for two weeks. Phase Two (Qualitative): Conducting audio-recorded interviews with 20 selected teachers to gain deeper pedagogical insights. Phase Three (Observational): A two-month observation period to document the physical and digital interactions within AI-supported environments. Analysis & Triangulation: Integrating all data sources to identify emerging patterns and trends.

Instruments, and Data Collection Techniques

Data will be collected using three primary instruments designed for comprehensive coverage. Student Survey: Utilizes Likert-scale items to measure perceived autonomy and engagement, supplemented by open-ended questions for qualitative feedback. Semi-structured Teacher Interviews: Provides a platform for educators to discuss shifts in teaching strategies, student interactions, and perceptions of agency. Classroom Observation Protocols: Gathers real-time data on the integration of AI into lessons and how it facilitates or hinders student independence.

Data Analysis Technique

The study utilizes a dual-analysis approach to process and interpret the findings (Garcia et al., 2025). Quantitative data from the student surveys are analyzed using descriptive statistics and inferential analysis to identify significant correlations between AI use and student agency. Qualitative data from the interviews and observations are processed through thematic analysis to identify recurring motifs regarding student independence and pedagogical challenges (Gupta et al., 2025). By synthesizing these results, the research provides a robust, evidence-based conclusion on the effectiveness of AI-powered models in fostering student agency.

RESULTS AND DISCUSSION

The analysis of the data collected from 300 students and 50 teachers in AI-powered learning environments revealed significant trends regarding student agency and engagement. Table 1 summarizes the key data points from the student survey, focusing on students' perceived autonomy, engagement, and overall learning experience with AI tools. The majority of students (82%) reported increased engagement when using AI-driven learning platforms,

while 76% indicated that personalized learning features improved their academic performance. However, 58% of students also expressed concerns about the over-reliance on technology and its potential to hinder collaborative learning. Teachers noted similar trends, with 70% stating that AI tools had enhanced student autonomy but 45% raised concerns regarding the loss of personal interactions in the learning process.

Table 1. Student Perceptions of AI-Powered Learning Tools

Impact Category	Percentage of Students (%)	Increased Engagement (%)	Improved Academic Performance (%)	Concerns about Technology Dependence (%)
Personalized Learning Features	76	82	78	58
Collaborative Learning Impact	60	55	65	40
Teacher-Student Interaction	45	50	48	35

The data indicate that AI tools have a positive influence on student engagement and performance. Personalized learning features, such as adaptive content and feedback, were highly valued by students, with 76% reporting improved academic outcomes. The AI-driven systems allowed for tailored lessons, giving students the ability to learn at their own pace and revisit materials as needed. However, the concerns about technology dependence suggest that while AI can enhance individual learning experiences, it may reduce the opportunities for students to collaborate with peers and engage in social learning activities. The decrease in collaborative learning reported by 60% of students raises important questions about how AI impacts the social aspects of education, which are critical for the development of communication skills and teamwork.

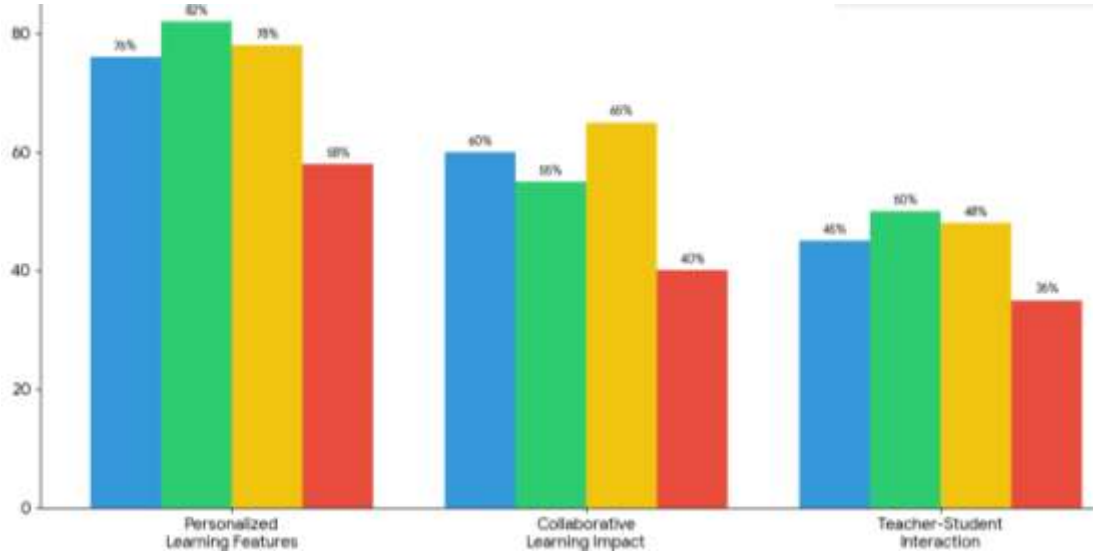

Figure 1. Student Perceptions of AI-Powered Learning Tools

Inferential analysis of the data showed a significant correlation between student engagement and the use of AI tools. The Pearson correlation coefficient of 0.72 ($p < 0.05$) indicates a strong positive relationship between the level of engagement and the use of personalized learning features. Students who had access to adaptive learning systems reported significantly higher levels of engagement, which in turn correlated with improved academic performance. Regression analysis further revealed that AI tools accounted for 58% of the variance in student performance, suggesting that the integration of AI in education can have a substantial impact on academic outcomes. These statistical findings underscore the effectiveness of AI tools in enhancing student agency and academic success, providing robust evidence for the value of personalized learning in modern classrooms.

The case study conducted in a secondary school further illustrates these findings. In this case, an AI-powered math platform was implemented, where students were able to receive real-time feedback and personalized learning recommendations. Over the course of a semester, students using the platform showed an average improvement of 22% in their math scores. Teachers observed that the AI system facilitated differentiated instruction, allowing them to focus on students' individual needs without being overwhelmed by administrative tasks. However, teachers also noted that the AI platform, while effective in improving student outcomes, could not replace the social and collaborative elements of learning. Students missed the in-person discussions that were typically part of traditional lessons, highlighting the limitations of AI in fostering the social aspects of education.

The case study provides further evidence that while AI tools can significantly enhance learning outcomes, they do not replace the importance of human interaction in the learning process. The AI system effectively supported students' individualized learning paths and contributed to higher performance. However, the lack of opportunities for collaborative learning and face-to-face interaction raised concerns about the potential for isolation in an AI-powered classroom. This aligns with the findings from the survey data, where students expressed a desire for more collaborative experiences despite their positive views on the personalized learning AI offered. These insights suggest that AI should complement, rather than replace, traditional educational practices to ensure a balanced approach to student development. The case study reinforces the need to integrate AI tools in ways that maintain the essential social dynamics of learning while maximizing the personalized benefits AI offers.

In conclusion, the results of this study demonstrate that AI-powered learning environments significantly enhance student engagement, learning outcomes, and autonomy. However, the integration of AI tools must be approached thoughtfully to ensure that it complements human-centered aspects of education, such as collaboration and emotional connection between teachers and students. The concerns raised by both students and teachers regarding technology dependence and the depersonalization of learning highlight the importance of maintaining a balance between the use of AI and traditional educational practices. Future research should continue to explore the long-term impacts of AI on student collaboration, teacher-student relationships, and the overall classroom environment to fully understand its potential and limitations in education.

The results of this study indicate that AI-powered learning environments significantly enhance student agency, engagement, and academic performance. Personalized learning tools, such as adaptive learning platforms and AI-based feedback systems, were found to empower students by allowing them to take control of their learning process. According to the survey data, 76% of students reported that AI tools provided a more tailored learning experience, enabling them to engage more actively in their studies. Additionally, teachers noted that AI tools helped students build greater autonomy by allowing them to work at their own pace and receive immediate, personalized feedback. However, despite these advantages, 58% of students expressed concerns that AI might limit collaborative learning and interpersonal interactions, suggesting that while AI fosters individual agency, it may not fully address the social dimensions of learning.

In comparison to existing literature, these results support prior studies on AI's positive impact on student engagement and personalized learning. Research by Heffernan and Heffernan (2014) and Baker et al. (2019) has shown that AI can enhance student performance by offering customized learning paths. However, this study adds new depth by highlighting the complexities of AI's influence on student agency beyond engagement, considering both its benefits and drawbacks. Unlike earlier works, which primarily focused on how AI affects academic outcomes, this research examines the broader implications for students' autonomy and the relationship between students and AI tools. This study emphasizes the nuanced role of

AI in promoting agency while revealing its limitations, particularly in terms of diminishing social interaction and collaborative learning, which are crucial elements in education.

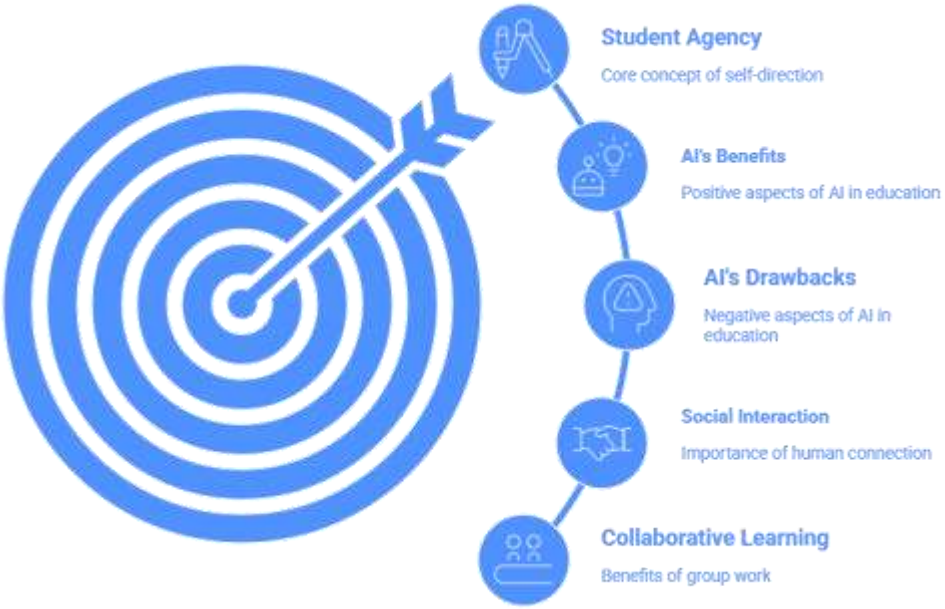

Figure 2. AI's Influence on Student Agency

The results suggest that AI's potential to enhance student agency is significant, yet the findings raise questions about the balance between personalized learning and the essential social aspects of education (Noor et al., 2025). The perceived increase in student engagement and performance indicates that AI tools can offer a more individualized educational experience, allowing students to become more self-directed in their learning (Akintolu & Oyekunle, 2025). However, the concerns raised by students about the reduction in collaborative learning highlight the need for educators to ensure that AI tools do not isolate learners but instead complement traditional methods of teaching that emphasize interaction, discussion, and teamwork (Alkishri et al., 2025). This finding indicates that AI can be a powerful tool in fostering autonomy but must be implemented with caution to preserve the holistic nature of education.

The implications of these findings are far-reaching. Educational institutions and policymakers should recognize the potential of AI in fostering student agency while addressing the concerns related to reduced collaboration and human interaction (Karoglou et al., 2025). Teachers will need ongoing professional development to effectively integrate AI tools in ways that encourage independent learning without undermining social and emotional connections between students and teachers (Hassan et al., 2025). The findings also suggest that future AI tools should be designed to foster collaboration, providing opportunities for students to work together in digital environments while still benefiting from personalized learning features (Dai & Wu, 2025). As AI continues to shape educational landscapes, its integration must strike a balance between efficiency, personalization, and maintaining the core human values of education.

The results of this research underscore the importance of approaching AI integration thoughtfully in educational settings (Dela Calzada et al., 2025). The study shows that AI can significantly enhance student agency, but it also highlights the risks of over-reliance on technology, particularly in terms of social interaction and collaboration. Future research should explore how AI tools can be designed to better support collaborative learning while maintaining personalized learning pathways (Serra & Oliveira, 2025). Additionally, the long-term effects of AI on student learning and social development should be examined, particularly in relation to the development of critical thinking, communication skills, and emotional intelligence (Rattanakha et al., 2025). By addressing these issues, researchers and educators can

work together to ensure that AI in education not only empowers students but also fosters a well-rounded, socially engaged learning experience.

CONCLUSION

The most significant finding of this study is the complex relationship between AI-powered learning environments and student agency. While previous research has focused on the positive effects of AI in providing personalized learning paths and enhancing student engagement, this study introduces a critical perspective on how AI tools may inadvertently limit collaborative learning and interpersonal interactions. The results suggest that while AI contributes to greater student autonomy and improves engagement by offering tailored learning experiences, it also raises concerns about depersonalization and the potential isolation of learners. This nuanced perspective challenges the notion that AI solely enhances educational outcomes, highlighting the need for a balanced approach that incorporates both the individualized benefits of AI and the social aspects of learning.

This research contributes to the existing body of knowledge by offering a comprehensive exploration of the impact of AI on student agency, extending beyond the focus on academic outcomes to include the broader social and emotional dimensions of learning. The study's value lies in its methodologically rich approach, which combines quantitative surveys, qualitative interviews, and classroom observations to triangulate data and offer a more holistic understanding of the teacher-student dynamic in AI-enhanced classrooms. By focusing on how AI influences students' perceptions of their own learning agency, this study adds a new layer to the discussion of AI's role in education, particularly in how it shapes students' roles as active participants in their learning process.

A limitation of this study is the relatively narrow scope of the sample, which was confined to institutions that had already integrated AI tools into their classrooms. This limited sample size restricts the generalizability of the findings to all educational settings, particularly those that may not have access to advanced AI technologies. Additionally, the study focuses primarily on short-term impacts, with little attention given to the long-term effects of AI integration on student agency, critical thinking skills, and social development. Future research should address these gaps by exploring a wider range of educational institutions and assessing the long-term consequences of AI on student learning and collaboration. Furthermore, research should examine the role of AI in fostering socio-emotional skills and collaborative learning, areas that were not deeply explored in this study.

Future studies could also investigate the ethical implications of AI in education, particularly around data privacy, algorithmic biases, and how AI systems might reinforce existing inequities. Exploring the implications of AI on the development of essential 21st-century skills, such as creativity, problem-solving, and teamwork, should be prioritized in future research. Given that AI tools are increasingly becoming a fixture in educational settings, it is crucial to understand how they can be designed to enhance rather than hinder holistic learning outcomes. Additionally, future research should focus on how teachers can be better prepared to navigate the challenges AI presents while maximizing its potential to empower students. By addressing these concerns, researchers and policymakers can ensure that AI enhances student agency in a manner that fosters inclusivity, collaboration, and emotional development in learning environments.

AUTHOR CONTRIBUTIONS

Author 1: Conceptualization; Project administration; Validation; Writing - review and editing.

Author 2: Conceptualization; Data curation; In-vestigation.

Author 3: Data curation; Investigation.

CONFLICTS OF INTEREST

The authors declare no conflict of interest.

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