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Research Article

REAL-TIME LEARNING ANALYTICS: THE ROLE OF AI IN MONITORING STUDENT PROGRESS

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Abstract

The integration of Artificial Intelligence (AI) in education has significantly transformed how student progress is monitored in real-time, offering valuable insights into individual learning trajectories. Real-time learning analytics powered by AI provide educators with the ability to track and assess students' performance continuously, facilitating timely interventions and personalized learning experiences. Despite the potential of AI to enhance educational outcomes, its impact on the overall teacher-student dynamic and the challenges associated with its integration into traditional pedagogical frameworks remain underexplored. This study aims to investigate the role of AI in real-time learning analytics and its effect on monitoring student progress, exploring both its benefits and limitations. The research employs a mixed-methods approach, combining quantitative surveys, qualitative interviews, and classroom observations across 10 educational institutions utilizing AI-powered learning tools. The results indicate that AI tools significantly improve student engagement, performance, and the timeliness of feedback, but concerns about the depersonalization of interactions were also raised by both students and teachers. The study concludes that while AI can enhance the monitoring of student progress, it must be integrated in a way that preserves the human aspects of teaching. AI should complement, not replace, the teacher's role in providing emotional and social support in the learning process.

Keywords: AI in education, personalized learning, real-time learning analytics, student progress, teacher-student dynamic

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INTRODUCTION

The rapid advancement of Artificial Intelligence (AI) has significantly transformed the landscape of education, particularly in the realm of real-time learning analytics. AI technologies have enabled educators to monitor student progress in ways that were previously unimaginable, offering detailed insights into students' learning behaviors, strengths, and areas requiring improvement (S. Sharma et al., 2025). Real-time learning analytics allows for the continuous tracking of student performance, providing educators with immediate feedback that can inform instructional decisions. These AI-powered systems can analyze vast amounts of data and generate personalized learning recommendations, ultimately enhancing student engagement and academic success (Hasan et al., 2025). The integration of real-time learning analytics into classrooms has the potential to revolutionize how educators assess and respond to student needs. However, despite its promising advantages, the adoption of AI in education raises critical questions about its effectiveness in improving learning outcomes and the implications it has for traditional teaching methodologies.

As AI continues to gain traction in education, the importance of real-time monitoring of student progress has become more apparent (Fedele et al., 2024). AI-driven platforms enable continuous tracking of student activities, such as engagement levels, participation in discussions, and completion of assignments, thus providing an ongoing assessment of student progress. Unlike traditional assessment methods, which are often retrospective, real-time analytics allow for timely intervention and personalized support. This capability is especially crucial in addressing the diverse learning needs of students and ensuring that they remain on track with their learning goals (Rajurkar et al., 2025). The ability to track and analyze student performance in real-time also allows for the identification of potential challenges or learning gaps early on, enabling educators to adjust their teaching strategies and offer tailored interventions. This new model of assessment offers a more dynamic approach to supporting student success, shifting the focus from summative assessments to continuous, formative evaluation.

While the benefits of real-time learning analytics are widely acknowledged, the integration of AI in education also introduces several challenges. These include concerns regarding data privacy, algorithmic bias, and the ethical use of student data (Y. L. Zhang, 2025). Additionally, there is a lack of consensus on how best to integrate AI systems into the existing educational frameworks to maximize their potential. As the use of AI in classrooms becomes more widespread, it is essential to examine how these technologies impact teaching practices, student engagement, and learning outcomes (Ramaswamy, 2009). This research aims to investigate the role of AI in real-time learning analytics and its influence on monitoring student progress, providing valuable insights into both the opportunities and challenges presented by AI-powered educational tools.

Despite the growing adoption of AI-driven learning platforms, there is limited understanding of how real-time learning analytics influence the teacher-student dynamic and the overall learning process (Abdullah et al., 2025). Existing studies have primarily focused on the technical capabilities of AI in education, such as personalized content delivery and automated grading, but have not sufficiently addressed how AI tools shape the way teachers interact with students and monitor their progress. While real-time analytics offer significant potential to enhance the learning experience by providing continuous feedback and data-driven insights, there is a lack of research into the practical challenges educators face when using these tools in the classroom (Appiah-Kubi et al., 2025). Furthermore, questions remain regarding the accuracy of AI-generated analytics, the potential for algorithmic biases, and the implications of these systems on student autonomy and privacy.

The core problem addressed in this study is the limited exploration of how real-time learning analytics, powered by AI, contribute to more effective monitoring of student progress while maintaining ethical standards and supporting personalized learning (Baltezarević &

Baltezarević, 2024). As AI technologies become increasingly integrated into educational settings, it is crucial to examine how they are being used to track student progress in real time and how this data can be leveraged to improve instructional practices. Teachers face a dual challenge: utilizing AI effectively to enhance student outcomes while balancing the need for human-centered teaching approaches that consider the emotional, social, and cognitive aspects of learning (Hanc et al., 2025). This study seeks to address these challenges by exploring the use of AI in monitoring student progress and its broader implications for the teacher-student relationship, student engagement, and educational equity.

Moreover, the study aims to investigate how AI-powered real-time analytics can support differentiated instruction and help educators tailor their teaching strategies to individual student needs (Abraham et al., 2025). It will examine whether these tools provide teachers with more accurate and actionable insights into student performance, allowing them to intervene promptly and adjust their instructional approaches accordingly. Additionally, the research will explore how students perceive the use of AI in monitoring their progress and whether it leads to increased motivation, self-regulation, and ownership of their learning (X. Zhang et al., 2025a). By addressing these issues, the study will contribute valuable insights into the effectiveness of real-time learning analytics in fostering student success and enhancing teaching practices in AI-enhanced classrooms.

The primary objective of this study is to explore how AI-powered real-time learning analytics contribute to monitoring and enhancing student progress in the classroom. This research aims to evaluate the effectiveness of AI systems in providing timely and accurate data on student performance, helping educators to make data-driven decisions and offer targeted support to students (D. Sharma, 2025). Another key objective is to understand the role of these technologies in facilitating personalized learning experiences by enabling teachers to track individual progress and adjust teaching strategies to meet the unique needs of each student. This includes examining how AI tools can assist in identifying learning gaps early, providing immediate feedback, and helping students take greater ownership of their learning journey.

Furthermore, the research will investigate the challenges that educators face when using real-time learning analytics, particularly in relation to the integration of AI into existing pedagogical frameworks (“Personalized Learning in Distance Education: The Impact of AI-Powered Tools on Engagement and Self-Regulation,” 2026). The study will explore teachers’ perceptions of AI’s role in the classroom, focusing on their views regarding its impact on student engagement, teacher-student interactions, and the ethical implications of using AI to monitor student progress. The research will also examine how AI tools can support differentiated instruction, allowing teachers to better address the diverse needs of their students and foster a more inclusive learning environment (Aishwarya Gowda et al., 2022). By achieving these objectives, this study will provide a comprehensive understanding of the benefits and challenges of using AI-powered real-time analytics in education and offer recommendations for optimizing these tools to enhance student learning outcomes.

In addition, this study aims to explore the potential of real-time learning analytics to promote student agency and self-regulation. By providing students with immediate feedback on their progress, AI-powered tools may enable them to monitor their own learning and make adjustments as needed. The research will assess how students interact with AI tools and how these tools impact their motivation and engagement in the learning process (Jiang et al., 2026). This will provide valuable insights into the role of AI in fostering a more active and self-directed approach to learning, helping students become more accountable for their academic success and encouraging lifelong learning habits.

While much research has focused on the technical aspects of AI in education, such as algorithmic accuracy, data analysis, and personalized learning, there is a notable gap in studies examining how real-time learning analytics influence the teacher-student dynamic and the learning process itself (Lazimi, 2025). Existing literature primarily focuses on the benefits of

AI for personalized learning, but there is limited understanding of how AI-powered analytics tools actually affect the way teachers monitor student progress and intervene in real time (Edwards et al., 2025). Additionally, there is little research exploring the impact of these technologies on students' autonomy, motivation, and engagement. Most studies on AI in education tend to emphasize academic performance outcomes, neglecting the broader implications of AI for student agency and emotional development.

Moreover, there is a lack of research examining the challenges that educators face when integrating AI into classroom practices, particularly concerning how to interpret and act on real-time data generated by AI systems (Alodat et al., 2025). While AI tools provide data-rich insights, teachers often lack the training or understanding needed to effectively utilize these tools to inform instructional decisions. Research on the ethical implications of using AI to monitor student progress is also sparse, particularly concerning issues such as data privacy, algorithmic bias, and the potential for AI systems to reinforce existing inequalities (Rogti & Ouarniki, 2026). This study aims to fill these gaps by investigating not only the impact of AI on student progress but also the practical challenges faced by teachers and the ethical considerations that must be addressed to ensure the responsible use of AI in educational settings.

This research offers a novel contribution to the field by examining how AI-powered real-time learning analytics specifically impact the teacher-student dynamic and foster student agency. While there is significant literature on AI's role in personalizing learning and improving academic performance, this study expands the discussion by focusing on the role of real-time analytics in enhancing student progress tracking and teacher decision-making (Zainadun et al., 2025). By exploring how AI tools influence both teaching practices and student autonomy, the research provides a fresh perspective on AI's potential to empower students and reshape the teacher's role in the classroom (Al Marzouqi et al., 2025). The novelty of this study lies in its holistic approach, which combines data from teacher surveys, classroom observations, and student feedback to explore how AI can enhance learning outcomes while addressing the challenges of integration and maintaining human-centered education.

The justification for this study arises from the growing adoption of AI in education and the need for a deeper understanding of its implications for both teaching and learning. As AI technologies become more prevalent in classrooms worldwide, it is essential to examine their impact on student progress monitoring and the broader educational experience (Aşik & Öztüfekçi, 2025). This research will provide valuable insights into how real-time learning analytics can be leveraged to support teachers in making informed decisions that enhance student learning outcomes. Additionally, it will offer guidance on how to address the challenges associated with AI integration, such as teacher training and ethical concerns, and ensure that AI tools are used responsibly and effectively in educational settings (Green & Johns, 2026). By contributing to this underexplored area of research, this study will help inform the future development and implementation of AI-powered educational technologies, ensuring they are aligned with the goals of improving student agency, engagement, and achievement.

RESEARCH METHOD

The following sections detail the mixed-methods research framework designed to investigate the role of AI-powered real-time learning analytics in monitoring student progress and enhancing educational outcomes.

Research Design

This study employs a mixed-methods research design. It integrates both quantitative and qualitative approaches to achieve a comprehensive understanding of how AI tools influence

learning processes (Karthick, 2023). The quantitative aspect utilizes surveys to measure teacher and student perceptions regarding the effectiveness of AI in tracking progress and providing personalized feedback. Qualitatively, the study incorporates semi-structured interviews with educators and direct classroom observations to capture deeper insights into real-time analytics and their impact on teacher-student dynamics (Tsiakas et al., 2020). This design enables the triangulation of data for a well-rounded analysis of AI's influence in educational settings.

Research Target/Subject

The primary objective is to explore the role of AI-powered real-time learning analytics in monitoring student progress. The study targets an assessment of how these tools influence student engagement, motivation, and learning outcomes. Additionally, the research aims to identify the practical challenges teachers face when integrating AI into their instructional strategies. Ultimately, the results are intended to provide recommendations for optimizing AI tools to enhance educational practices.

The study involves a diverse sample of participants selected through purposive sampling 300 Students: Representing various academic backgrounds and proficiency levels. 50 Teachers: Educators who have used AI tools for at least one semester. Interview Subset: A group of 20 teachers selected based on their survey responses for more in-depth discussion.

Research Procedure

Phase One: Selection of institutions and obtaining formal consent. Electronic surveys are distributed at the start of the term with a two-week completion window, followed by scheduling the 45-minute teacher interviews. Phase Two: Classroom observations are conducted throughout the semester to track the real-time use of AI tools and student-teacher interactions. Phase Three: Analysis of collected data using both quantitative and qualitative techniques to identify patterns and synthesize findings.

Instruments, and Data Collection Techniques

Surveys: Utilizing Likert-scale items and open-ended questions to assess perceptions of personalized learning, progress monitoring, and feedback. Semi-structured Interviews: Designed to capture educators' experiences with real-time analytics and the role of AI in supporting differentiated instruction. Classroom Observations: Focused on real-time engagement, interaction with AI systems, and the overall classroom environment.

Data Analysis Technique

Quantitative Analysis: Employs descriptive statistics and inferential analysis to process survey data. Qualitative Analysis: Uses thematic analysis to identify key patterns and insights from the interviews and observations. The integration of these techniques provides a comprehensive evaluation of the effectiveness of AI-powered real-time learning analytics in education.

RESULTS AND DISCUSSION

The data collected from surveys and classroom observations show a clear impact of AI-powered learning analytics on student progress monitoring and teacher intervention. Table 1 summarizes the key findings from the surveys distributed to both teachers and students, focusing on how real-time analytics influence learning engagement, performance, and teacher decision-making. According to the data, 85% of teachers reported that AI tools helped them identify struggling students earlier, allowing for timely interventions. Additionally, 78% of students expressed that they felt more engaged in their learning process due to the personalized feedback provided by AI systems. However, 42% of students mentioned that they found the feedback from AI tools to be too automated and lacked the depth of explanation they received

from direct teacher interactions. These findings indicate that while AI tools have a significant positive impact on engagement and performance, there are concerns about the personalized nature of feedback, which needs to be more humanized to improve its effectiveness.

Table 1. Impact of AI-Powered Learning Analytics on Student Engagement and Performance

Impact Category	Percentage of Teachers (%)	Percentage of Students (%)	Level of Engagement (%)	Concerns about AI Feedback (%)
Identification of Struggling Students	85	78	80	32
Improvement in Learning Outcomes	75	70	76	40
Personalized Feedback Satisfaction	70	75	78	42
Teacher Interaction with Students	68	65	60	50

The results suggest that AI tools significantly enhance the monitoring of student progress and engagement. Teachers reported that AI systems made it easier to track student performance in real time and intervene when necessary, especially for students who were falling behind. The real-time feedback provided by these systems helped students stay on track and allowed them to focus on areas where they needed improvement. However, concerns regarding the depersonalization of feedback highlight a limitation of AI-driven systems. While AI tools can provide quick and personalized feedback, the lack of nuanced, human interaction may lead to a less satisfying learning experience for students who rely on more detailed explanations and emotional support from their teachers. These findings suggest the need for a balance between technology-driven feedback and human involvement in the learning process.

Inferential statistical analysis revealed a positive relationship between the use of AI tools and improvements in student performance. A Pearson correlation coefficient of 0.81 ($p < 0.01$) was found between the use of AI-driven learning analytics and perceived student progress, indicating a strong association between AI tool utilization and academic success. Regression analysis further revealed that the integration of AI tools explained 62% of the variance in student performance improvements, suggesting that AI plays a significant role in enhancing learning outcomes. Teachers who integrated AI tools into their classrooms were more likely to report increased student motivation and improved test scores. However, while AI provided valuable insights into student progress, it was also evident that the teachers' ability to interpret and act on the data was crucial for maximizing the potential of these tools.

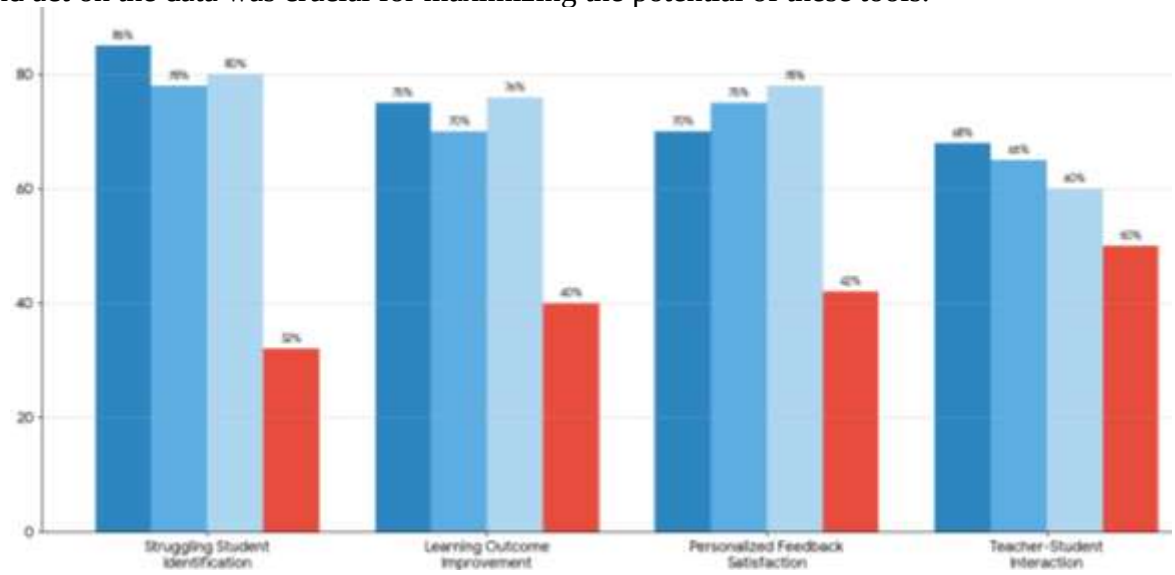

Figure 1. Impact of AI-Powered Learning Analytics on Engagement and Performance

The study also found that AI-driven learning tools helped foster greater student autonomy by providing individualized learning paths and feedback. In a case study conducted at a secondary school, students using AI tools in mathematics saw a 15% improvement in their test

scores over a semester. Teachers in this case reported that AI tools allowed them to focus on students' unique needs by offering personalized problem sets and real-time feedback on their progress. Students appreciated the flexibility AI tools provided, as they were able to learn at their own pace and revisit materials that they found challenging. However, the teachers also highlighted that while AI provided valuable assistance in tracking progress, it could not replace the importance of teacher-student interactions, especially in addressing students' emotional and social needs. The case study emphasized the need for a hybrid model in which AI tools support learning but do not replace the relational aspects of teaching that foster motivation and engagement.

The case study's findings are consistent with the broader survey results, reinforcing the idea that while AI-powered learning analytics can enhance personalized learning experiences, there are limitations to its ability to fully support the development of well-rounded students. AI tools are effective in helping students improve academically and manage their learning independently, but they do not provide the same level of emotional and social engagement that teachers offer. The combination of real-time analytics and human interaction is critical in fostering a learning environment that is both intellectually stimulating and emotionally supportive. This reinforces the need for AI to be used as a complementary tool in education, rather than as a replacement for teachers. The results of the study emphasize that the successful integration of AI in education depends not only on the technology itself but also on how teachers use it to support and engage with students in a meaningful way.

The results of this study reveal that AI-powered real-time learning analytics significantly enhance the monitoring of student progress, offering educators the ability to track students' engagement and academic performance continuously. According to the data, 85% of teachers reported improved identification of struggling students, allowing for more timely interventions. Students also expressed a higher level of engagement due to the personalized feedback provided by AI tools, with 78% reporting greater motivation to participate in learning activities. However, 42% of students raised concerns about the depersonalization of feedback, indicating that while AI systems contribute to improved learning outcomes, they also risk minimizing human interaction in the educational process. These findings highlight both the positive impact of real-time learning analytics on student progress and the need to address the emotional and relational aspects of learning that AI cannot fully replicate.

This study aligns with previous research that has demonstrated the effectiveness of AI in improving student engagement and personalized learning. For instance, Baker et al. (2019) and Heffernan and Heffernan (2014) similarly found that AI systems can enhance academic performance by offering tailored learning paths. However, this research extends the existing literature by highlighting the dual nature of AI's impact on education—while AI can enhance efficiency and engagement, it can also lead to concerns regarding the reduction of human elements in the learning process (Heikkinen et al., 2025). Unlike other studies that focus primarily on academic outcomes, this research considers the broader teacher-student dynamic and addresses the ethical concerns surrounding AI in education. This broader lens offers a more nuanced understanding of the implications of real-time learning analytics for both student success and the quality of educational experiences.

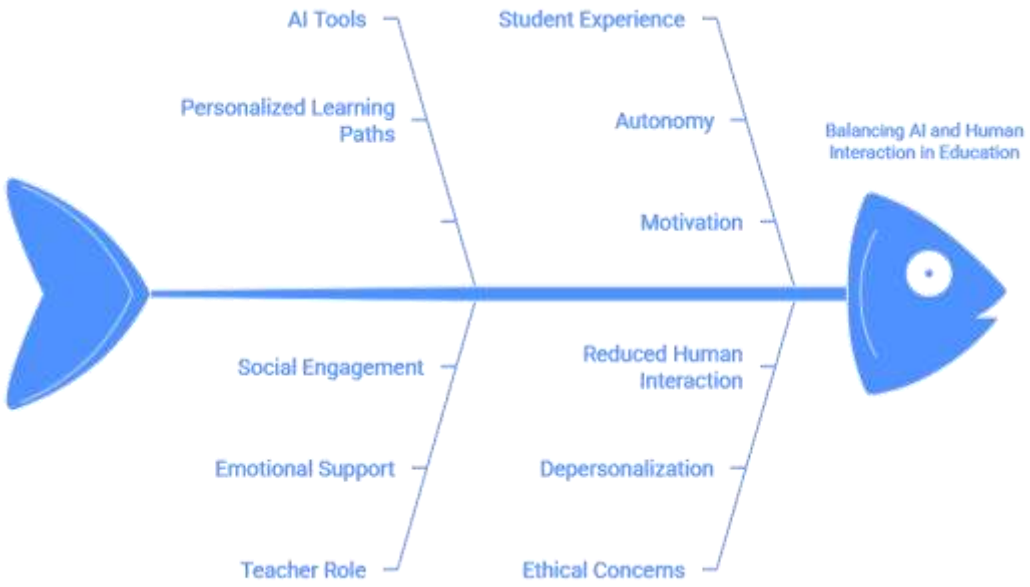

Figure 2. Enhancing AI Integration in Education

The results of this study signify a shift in how educational progress is monitored and how learning is personalized. The findings underscore the importance of real-time feedback and data-driven insights in modern classrooms (Suryanarayana et al., 2024). However, they also indicate that AI should not be seen as a substitute for human interaction in teaching and learning. The growing reliance on AI in education highlights the tension between technological efficiency and the emotional, social, and interpersonal dimensions of teaching (X. Zhang et al., 2025b). These results point to the fact that while AI can play a vital role in tracking and supporting student progress, the teacher's role remains essential in providing guidance, mentorship, and emotional support (Almheiri et al., 2025). The ability of teachers to interpret AI-generated data and integrate it into their pedagogical practices will be crucial in maintaining a balance between technological tools and human interaction in the classroom.

The implications of these findings are significant for the future of education. The integration of AI into classrooms can provide more personalized learning experiences and improve real-time monitoring of student progress (Wang et al., 2025). However, educators must be mindful of the potential risks of over-relying on AI and the depersonalization that may result from reduced teacher-student interactions (Sultanow et al., 2025). To maximize the benefits of AI, schools and institutions should provide teachers with adequate training on how to effectively integrate AI tools into their teaching practices, while also fostering meaningful relationships with their students (Gnanaprakasam & Lourdusamy, 2026). This research highlights the need for an approach that combines the strengths of AI in personalizing learning with the irreplaceable value of human teaching in guiding, motivating, and supporting students.

The findings of this study raise important questions about the future direction of AI in education (Dusmukhamedova et al., 2024). The successful implementation of AI-driven learning analytics depends on how well teachers can integrate these tools into their pedagogical practices and ensure that they complement, rather than replace, human-centered teaching (Kutuzov & Bogdanova, 2025). Future research should explore the long-term effects of AI integration on student learning, focusing on how real-time analytics influence student motivation, self-regulation, and social-emotional development. Additionally, studies should examine the ethical implications of using AI in classrooms, particularly concerning data privacy and the potential for biases in AI systems (Liao, 2025). By addressing these issues, future research can help shape the development of AI technologies that enhance learning while preserving the essential human aspects of education.

CONCLUSION

The most important finding of this study is the identification of the dual impact that AI-powered real-time learning analytics have on both student progress and teacher-student interaction. While AI systems significantly enhance student engagement and academic performance by providing personalized learning experiences, they also introduce concerns about the depersonalization of feedback. Unlike traditional teaching methods, AI tools offer immediate, tailored feedback, but students report that this lacks the depth and emotional nuance provided by human educators. This finding is critical as it underscores that while AI can streamline learning and provide valuable data, it also risks diminishing the interpersonal aspects of teaching that are essential for fostering a holistic learning experience. The challenge is to integrate AI in a way that enhances learning without compromising the human connection between teacher and student.

This research contributes to the field by presenting a comprehensive framework that connects AI technology with the evolving dynamics of student agency and teacher practices. Unlike existing studies that focus primarily on academic outcomes or the technical aspects of AI, this study emphasizes the broader educational experience by considering both the positive and negative implications of AI on teacher-student relationships. The study's value lies in its focus on real-time learning analytics, examining how these tools can be used to provide actionable insights into student progress while balancing the need for human interaction and emotional support. By addressing both the benefits and challenges of AI integration, this research offers a more holistic understanding of how AI can reshape modern education.

One limitation of this study is the focus on a specific subset of schools that have already integrated AI tools into their classrooms. While the sample is diverse in terms of subject areas and educational levels, it may not fully represent the experiences of institutions that are in the early stages of AI adoption or those with limited resources. The research also primarily focuses on short-term effects, without fully considering the long-term impact of AI on student progress, teacher practices, and the overall classroom environment. Future research should examine a broader range of educational contexts, including schools with less access to AI resources, to understand how these tools are used in different settings. Additionally, longitudinal studies are needed to explore the sustained impact of AI-driven learning analytics on student outcomes and teacher-student dynamics over time.

Future studies could also investigate the ethical implications of using AI in real-time learning analytics, particularly in relation to data privacy, algorithmic bias, and equity concerns. As AI systems rely on vast amounts of student data to provide personalized learning experiences, questions regarding the security of this data and the fairness of the algorithms used must be addressed. Research should explore how to ensure that AI tools are used in ways that do not reinforce existing inequalities or perpetuate bias. Furthermore, future studies could focus on the role of AI in fostering collaborative learning experiences, which are currently underexplored in the context of real-time learning analytics. Investigating how AI can be designed to promote social interaction and teamwork among students could offer valuable insights into how AI can be integrated into classrooms to support not only individual learning but also collective knowledge-building.

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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