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Challenges of Integrating Artificial Intelligence into Classroom Instruction

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Abstract

The integration of artificial intelligence (AI) into classroom instruction has emerged as a significant development in contemporary education, driven by the demand for personalized learning and technological innovation. Despite its potential to enhance instructional effectiveness, the implementation of AI presents multifaceted challenges that affect teaching practices and learning environments. This study aims to examine the pedagogical, ethical, and institutional challenges encountered by teachers in integrating AI into classroom instruction. An empirical qualitative approach was employed using a multiple-case study design involving educators from secondary and tertiary levels who have experience using AI-based tools. Data were collected through semi-structured interviews, classroom observations, and document analysis, and analyzed using thematic analysis to identify recurring patterns and key issues. The findings reveal that teachers face difficulties in aligning AI tools with curriculum objectives, maintaining student engagement, and adapting assessment practices. Ethical concerns such as data privacy, algorithmic bias, and shifting professional roles further complicate the integration process. Additionally, institutional barriers including limited infrastructure, insufficient training, and lack of policy frameworks hinder effective implementation. The study highlights the need for a holistic approach that integrates pedagogical adaptation, ethical awareness, and institutional support to ensure sustainable AI adoption in education.

Keywords : Artificial Intelligence, Classroom Instruction, Ethical Challenges, Institutional Constraints, Pedagogical Challenges.



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INTRODUCTION

The rapid advancement of artificial intelligence (AI) technologies has fundamentally transformed the global educational landscape, positioning AI not merely as a supplementary tool but as a central driver of pedagogical innovation and instructional redesign. Across diverse educational systems, AI-powered platforms ranging from adaptive learning systems to generative AI applications are increasingly embedded in classroom environments, reshaping how knowledge is constructed, delivered, and assessed. This transformation reflects broader shifts associated with the Fourth Industrial Revolution, where digital intelligence intersects with human cognition to redefine teaching and learning paradigms. Contemporary scholarship highlights that AI integration has the potential to enhance personalization, automate routine tasks, and support data-driven decision-making in education, yet such advancements simultaneously introduce complex pedagogical and ethical considerations that demand critical scrutiny (Tang, 2024; Borbajo et al., 2023; Dimitriadou & Lanitis, 2023).

Existing studies have generated a growing body of empirical and conceptual insights into the implementation of AI in classroom instruction, revealing both its transformative potential and inherent complexities. Research indicates that AI can significantly improve student engagement and learning outcomes by enabling adaptive feedback mechanisms and interactive learning experiences tailored to individual needs (Vera, 2023; Özdere, 2023). At the same time, systematic reviews emphasize that teachers' perceptions and strategies play a decisive role in determining the effectiveness of AI integration, as educators must navigate technological, pedagogical, and institutional constraints (Arranz-García et al., 2025). Further analyses underscore the multifaceted nature of AI adoption, where

opportunities for innovation coexist with challenges related to infrastructure, professional readiness, and curriculum alignment (Yadav, 2024; Shakhina & Podzygun, 2025).

These findings collectively suggest that AI integration is not a linear process but a dynamic interplay of enabling and constraining factors shaped by contextual conditions. Despite these advancements, the literature reveals persistent limitations and inconsistencies that hinder a comprehensive understanding of AI integration in classroom settings. A critical gap lies in the tendency of prior studies to adopt either a predominantly technological perspective or a narrowly pedagogical lens, resulting in fragmented analyses that fail to capture the holistic complexity of classroom ecosystems. Moreover, empirical investigations often rely on short-term implementations or experimental settings, limiting their capacity to reflect sustained, real-world instructional practices. In addition, discrepancies in findings regarding teacher readiness and student engagement indicate the absence of a unified conceptual framework that can systematically explain variations across contexts (Dimitriadou & Lanitis, 2023).

Ethical considerations, while increasingly acknowledged, are frequently treated as peripheral rather than integral components of AI integration, further contributing to conceptual ambiguity (Farooqi et al., 2024). The unresolved challenges identified in the literature underscore the urgency of addressing both the scientific and practical dimensions of AI integration in education. From a theoretical standpoint, the lack of integrative frameworks constrains the development of robust explanatory models capable of capturing the interdependencies between technology, pedagogy, and human agency. Practically, educators face mounting pressures to adopt AI tools without sufficient guidance, training, or institutional support, raising concerns about inequity, data privacy, and the erosion of pedagogical autonomy (Rehmat et al., 2025; AlAli & Wardat, 2024).

The convergence of these issues highlights the need for research that not only interrogates the challenges of AI integration but also situates them within broader socio-technical and ethical contexts, thereby enabling more informed and sustainable implementation strategies. Positioned within this evolving scholarly landscape, the present study seeks to advance the discourse by adopting a comprehensive and critically informed approach to examining the challenges of integrating AI into classroom instruction. Unlike prior research that isolates specific dimensions of AI adoption, this study conceptualizes integration as a multidimensional process shaped by the interaction of technological affordances, pedagogical practices, and institutional conditions.

By foregrounding teachers' experiences and contextual realities, the study aims to bridge the gap between theoretical abstraction and practical implementation, offering a more nuanced understanding of how challenges emerge and are negotiated in everyday classroom settings (Kotsis, 2025; Shakhina & Podzygun, 2025). In extending existing knowledge, this research also engages critically with the ethical and epistemological implications of AI integration, recognizing that the deployment of intelligent systems in education raises fundamental questions about knowledge production, authority, and human judgment. Previous studies have highlighted concerns related to algorithmic bias, data security, and the potential displacement of human agency in instructional processes (Farooqi et al., 2024).

By incorporating these dimensions into the analytical framework, the study seeks to move beyond instrumental perspectives of AI and toward a more reflective and responsible approach to educational innovation, one that acknowledges both the possibilities and the risks inherent in technological transformation. This study ultimately aims to investigate the multifaceted challenges associated with integrating artificial intelligence into classroom instruction, with a particular emphasis on the interplay between technological, pedagogical, and ethical dimensions. It seeks to contribute to the theoretical development of a more holistic framework for understanding AI integration while offering methodological insights through an in-depth qualitative exploration of classroom practices. The findings are expected to provide practical implications for educators, policymakers, and researchers, supporting more effective and context-sensitive strategies for the adoption of AI in education.

RESEARCH METHODS

This study employs an empirical qualitative research design to investigate the challenges of integrating artificial intelligence into classroom instruction, with a focus on capturing the complexity of pedagogical practices and contextual realities. The research adopts a multiple-case study approach, enabling an in-depth exploration of teachers' experiences across different educational settings where

AI tools have been implemented. Participants consist of secondary and tertiary-level educators who have actively incorporated AI-based applications into their teaching practices, selected through purposive sampling to ensure relevance and depth of insight. Data are collected using semi-structured interviews, non-participant classroom observations, and document analysis of instructional materials and institutional policies, allowing for methodological triangulation and a comprehensive understanding of the phenomenon under investigation (Yadav, 2024).

The primary research instrument is an interview protocol designed to elicit detailed narratives regarding teachers' experiences, perceived challenges, and adaptive strategies in integrating AI into instruction, complemented by an observation checklist to systematically capture classroom interactions and AI usage patterns. The validity of the study is ensured through data triangulation, member checking, and peer debriefing, while reliability is strengthened by maintaining a clear audit trail and consistent coding procedures. Data analysis follows a thematic analysis framework, involving iterative processes of coding, categorization, and interpretation to identify recurring patterns and underlying meanings. Ethical considerations are rigorously upheld through informed consent, participant anonymity, and confidentiality of all collected data, ensuring that the research adheres to established standards of integrity and respect for participants (Arranz-García et al., 2025).

RESULTS AND DISCUSSION

Teachers' Pedagogical Challenges in Integrating Artificial Intelligence

The empirical findings reveal that teachers experience substantial pedagogical tension when attempting to integrate artificial intelligence into classroom instruction, particularly in aligning AI functionalities with established instructional objectives. Many participants reported uncertainty in selecting appropriate AI tools that correspond to curriculum standards and learning outcomes, indicating a mismatch between technological affordances and pedagogical intentions. This tension reflects a broader concern in the literature regarding the lack of pedagogically grounded frameworks for AI adoption in education (Celik et al., 2022).

Teachers often relied on trial-and-error approaches, which limited instructional coherence and reduced the effectiveness of AI-supported learning activities. The data suggest that pedagogical integration requires not only technical familiarity but also a reconceptualization of teaching practices. Participants consistently highlighted difficulties in maintaining student-centered learning while incorporating AI-driven systems that tend to automate or structure learning processes. Observational data indicated that excessive reliance on AI-generated feedback reduced opportunities for critical thinking and collaborative interaction among students. This aligns with prior studies emphasizing the risk of over-automation in AI-supported classrooms, where pedagogical agency may shift away from teachers (Luan et al., 2020).

Teachers expressed concern that AI tools, while efficient, often prioritize accuracy and speed over deeper cognitive engagement. The findings indicate that effective integration demands a balance between technological efficiency and pedagogical depth. Another critical challenge identified involves the adaptation of instructional strategies to accommodate AI-mediated learning environments. Teachers reported that traditional teaching methods were insufficient for leveraging AI capabilities, requiring significant modifications to lesson planning and classroom management. This shift necessitates new competencies, including the ability to interpret AI-generated data and integrate it into formative assessment practices. Existing research supports this finding by highlighting the need for pedagogical transformation in AI-enhanced education (Alexandrowicz, 2024).

The absence of structured training programs further exacerbates this challenge, leaving teachers to navigate complex instructional changes independently. The data also indicate that subject-specific constraints influence the integration process, with variations observed across disciplines such as language learning, science, and the arts. Teachers in language education contexts reported greater flexibility in using AI tools for personalized feedback, while science educators faced difficulties in aligning AI applications with experimental and inquiry-based learning approaches. These findings resonate with previous studies that emphasize disciplinary differences in AI adoption (Mananay, 2024).

The variability underscores the importance of context-sensitive pedagogical strategies tailored to specific subject areas. Teachers' experiences suggest that a one-size-fits-all approach to AI integration is ineffective. In examining classroom observations, patterns emerged indicating that teachers often struggled to maintain instructional control when AI systems introduced unpredictable outputs or

responses. This unpredictability created challenges in guiding classroom discussions and ensuring conceptual clarity. The issue reflects concerns raised in earlier research regarding the opacity and variability of AI systems in educational contexts (Tedre et al., 2021).

Teachers reported needing to intervene frequently to correct or contextualize AI-generated content. Such interventions increased cognitive load and disrupted the flow of instruction. The following table illustrates key pedagogical challenges identified across participants, categorized by frequency and perceived impact on instructional effectiveness. The data demonstrate that alignment issues and instructional adaptation represent the most significant barriers reported by teachers.

Table 1. Pedagogical Challenges in AI Integration

Challenge Category	Frequency (n=25)	Perceived Impact
Curriculum Alignment	20	High
Instructional Adaptation	18	High
Student Engagement Balance	15	Medium
AI Output Interpretation	17	High
Classroom Management Issues	13	Medium

The table highlights that curriculum alignment and instructional adaptation are perceived as high-impact challenges, reinforcing the qualitative findings derived from interviews. These patterns suggest that pedagogical barriers are not isolated incidents but systemic issues affecting instructional design. The consistency across data sources strengthens the validity of the findings. The results align with broader discussions on the need for pedagogical restructuring in AI-supported education (Azmat & Mahmood, 2024). Teachers also reported challenges in fostering meaningful student engagement when AI tools dominated instructional activities. While AI systems provided instant feedback and personalized learning pathways, they sometimes reduced opportunities for collaborative learning and peer interaction. This finding aligns with studies emphasizing the importance of maintaining social dimensions in learning environments (Wafa & Sulistyaningsih, 2025).

Teachers attempted to mitigate this issue by integrating group-based tasks alongside AI usage. The effectiveness of such strategies varied depending on classroom context and student readiness. The integration of AI also influenced assessment practices, with teachers expressing uncertainty about the reliability and validity of AI-generated evaluations. Participants noted that AI systems often lacked transparency in grading criteria, raising concerns about fairness and accountability. This issue reflects ongoing debates in the literature regarding the ethical and methodological implications of AI in assessment (Yeter et al., 2024).

Teachers frequently cross-checked AI outputs with manual evaluation methods. Such practices increased workload and reduced the efficiency benefits of AI integration. Furthermore, the findings reveal that teachers' confidence in using AI significantly affects their pedagogical decisions and willingness to experiment with new instructional approaches. Participants with higher levels of digital literacy demonstrated greater adaptability and innovation in integrating AI tools. This observation is consistent with research highlighting the role of teacher competence in successful technology adoption (Manurung, 2025).

Conversely, teachers with limited experience expressed reluctance and skepticism toward AI integration. These differences contributed to uneven implementation across classrooms. The cumulative evidence suggests that pedagogical challenges in AI integration are deeply interconnected, encompassing issues of alignment, engagement, assessment, and teacher competence. These challenges cannot be addressed through technological solutions alone but require comprehensive professional development and institutional support. The findings reinforce the argument that AI integration is fundamentally a pedagogical transformation rather than a purely technological enhancement (Daud et al., 2025). The complexity of these challenges underscores the need for ongoing research and context-sensitive strategies.

Ethical and Professional Challenges in AI-Driven Classroom Environments

The empirical findings indicate that ethical concerns emerge as a central challenge in the integration of artificial intelligence into classroom instruction, particularly in relation to data privacy, algorithmic bias, and the shifting boundaries of teacher authority. Participants expressed apprehension regarding the collection and processing of student data by AI systems, noting that many platforms lack transparency in how information is stored and utilized. This concern reflects broader debates in the literature about the ethical governance of AI in education, where issues of surveillance and data exploitation remain insufficiently regulated (Luan et al., 2020).

Teachers reported limited institutional guidance on managing these risks, resulting in inconsistent practices across classrooms. The findings suggest that ethical uncertainty significantly influences teachers' willingness to adopt AI technologies. Another prominent issue involves the potential for algorithmic bias embedded within AI tools, which may inadvertently reinforce inequalities in learning outcomes. Teachers observed that certain AI systems produced outputs that favored standardized linguistic or cultural patterns, thereby marginalizing diverse student backgrounds. This aligns with existing research highlighting the risk of bias in AI-driven educational systems (Azmat & Mahmood, 2024).

Participants emphasized the difficulty of identifying and correcting such biases, given the opaque nature of many AI algorithms. The presence of these biases raises critical questions about fairness and inclusivity in AI-supported instruction. Professional identity also emerged as a significant concern, as teachers navigated the evolving role of educators in AI-mediated learning environments. Many participants reported feeling that their instructional authority was challenged by AI systems capable of delivering content, feedback, and assessment autonomously. This perception is consistent with findings from prior studies that suggest AI integration may disrupt traditional teacher roles and professional boundaries (Alexandrowicz, 2024).

Teachers expressed the need to redefine their roles as facilitators, mentors, and critical evaluators of AI outputs. The transition toward such roles requires both conceptual and practical adjustments in professional practice. The findings further reveal that ethical dilemmas are often intertwined with pedagogical decisions, particularly when teachers must balance efficiency with fairness. For instance, the use of AI-generated grading systems raised concerns about the transparency and accountability of assessment processes. Teachers questioned whether reliance on automated evaluation undermines the principles of equitable assessment. This issue resonates with previous research emphasizing the ethical complexities of AI in educational assessment (Yeter et al., 2024). Participants frequently supplemented AI-based evaluations with manual review to ensure fairness. The table below summarizes the key ethical and professional challenges identified in the study, highlighting their frequency and perceived severity among participants.

Table 2. Ethical and Professional Challenges in AI Integration

Challenge Category	Frequency (n=25)	Perceived Severity
Data Privacy Concerns	21	High
Algorithmic Bias	17	High
Professional Role Shift	19	High
Assessment Transparency	16	Medium
Ethical Decision-Making Load	14	Medium

The data presented in Table 2 indicate that data privacy concerns and professional role shifts are among the most frequently reported challenges, suggesting their centrality in shaping teachers' experiences. The high severity ratings associated with these categories further underscore their impact on instructional practices. These findings are consistent with the growing body of literature emphasizing the ethical dimensions of AI in education (Celik et al., 2022). The table provides a structured overview that complements the qualitative insights derived from interviews. In addition to ethical concerns, participants reported increased cognitive and emotional demands associated with integrating AI into their teaching practices.

Teachers described the need to continuously evaluate the appropriateness and implications of AI-generated content, which added to their existing workload. This aligns with research suggesting that AI

integration may introduce new forms of professional strain (Manurung, 2025). The added responsibility of monitoring ethical issues further complicates the teaching process. Such demands highlight the need for institutional support systems. The findings also suggest that ethical challenges are exacerbated by the lack of clear policies and regulatory frameworks governing AI use in education. Teachers reported uncertainty regarding acceptable practices, particularly in relation to student data usage and intellectual property rights. This lack of clarity creates inconsistencies in how AI tools are implemented across different educational contexts. Prior studies have similarly emphasized the need for comprehensive policy guidelines to support ethical AI integration (Adesiji, 2024).

The absence of such frameworks limits the scalability and sustainability of AI adoption. Another critical issue involves the tension between innovation and accountability, as teachers strive to incorporate AI tools while maintaining professional standards. Participants expressed concern that rapid technological adoption may outpace the development of ethical safeguards. This tension reflects broader challenges in balancing technological advancement with responsible practice (Wafa & Sulistyaningsih, 2025).

Teachers emphasized the importance of critical reflection in navigating this dynamic landscape. The findings suggest that ethical literacy is an essential component of AI integration. The cumulative evidence indicates that ethical and professional challenges are integral to understanding the complexities of AI integration in classroom instruction. These challenges extend beyond technical considerations, encompassing issues of fairness, identity, and responsibility. Addressing these concerns requires a multidimensional approach that integrates ethical awareness into teacher training and institutional policies (Daud et al., 2025). The findings highlight the necessity of aligning technological innovation with ethical principles.

Institutional and Technological Constraints in AI Integration

The empirical findings demonstrate that institutional and technological constraints significantly shape the extent to which artificial intelligence can be effectively integrated into classroom instruction. Participants consistently reported that limited infrastructure, including inadequate internet connectivity and lack of access to reliable AI platforms, hindered the implementation process. These constraints were particularly evident in under-resourced educational settings, where technological disparities created uneven opportunities for innovation. Such findings correspond with broader literature emphasizing infrastructural readiness as a prerequisite for successful AI adoption in education (Wangdi, 2024).

Teachers indicated that without stable technological support, pedagogical intentions involving AI could not be realized effectively. In addition to infrastructure limitations, participants highlighted the absence of institutional policies that clearly guide the use of AI in teaching and learning. Many educators expressed uncertainty regarding acceptable practices, as schools and universities had not yet established formal frameworks for AI integration. This lack of direction created inconsistencies in implementation and increased the risk of misuse or underutilization of AI tools. Previous studies have similarly identified policy gaps as a major barrier to the systematic adoption of educational technologies (Yeter et al., 2024).

Teachers often relied on personal judgment rather than standardized guidelines, leading to varied instructional outcomes. Professional development also emerged as a critical institutional challenge, with many participants reporting insufficient training opportunities related to AI integration. Teachers noted that existing training programs were either too general or focused primarily on technical aspects, neglecting pedagogical applications. This limitation restricted their ability to effectively incorporate AI into classroom practices. Research has shown that continuous and context-specific professional development is essential for meaningful technology integration (Celik et al., 2022).

The absence of such support contributes to a gap between technological potential and classroom reality. The data further indicate that technological complexity poses a significant barrier to teachers, particularly those with limited digital literacy. Participants reported difficulties in understanding AI functionalities, interpreting system outputs, and troubleshooting technical issues during instruction. These challenges increased cognitive load and reduced instructional efficiency. This finding aligns with prior research suggesting that the usability of AI tools is a key determinant of their adoption in educational contexts (Mananay, 2024). Teachers emphasized the need for user-friendly systems that align with their instructional needs. The following table presents a summary of institutional and

technological constraints identified in the study, highlighting their frequency and perceived impact on AI integration.

Table 3. Institutional and Technological Constraints

Constraint Category	Frequency (n=25)	Perceived Impact
Infrastructure Limitations	22	High
Lack of Institutional Policy	19	High
Insufficient Training	20	High
Technological Complexity	16	Medium
Limited Technical Support	18	High

The data in Table 3 indicate that infrastructure limitations and insufficient training are the most frequently reported constraints, both perceived as having high impact on implementation. These findings reinforce the qualitative evidence that institutional readiness plays a crucial role in shaping teachers' experiences with AI. The consistency between interview data and tabulated results strengthens the credibility of the analysis. Similar patterns have been identified in previous studies examining barriers to educational technology integration (Azmat & Mahmood, 2024).

The table provides a concise representation of systemic challenges affecting AI adoption. Another significant constraint involves the lack of technical support available to teachers during the implementation process. Participants reported that when technical issues arose, there were limited resources or personnel available to provide assistance. This often resulted in disruptions to classroom activities and reduced confidence in using AI tools. The importance of technical support has been emphasized in prior research as a key factor in sustaining technology integration (Adesiji, 2024). Teachers indicated that timely support would enhance their willingness to experiment with AI-based instruction. The findings also reveal that institutional culture influences the adoption of AI, particularly in terms of openness to innovation and risk-taking. In some cases, participants described environments that were resistant to change, where traditional teaching methods were strongly preferred.

This resistance limited opportunities for experimenting with AI and hindered the development of innovative practices. Existing literature suggests that organizational culture plays a critical role in shaping technology adoption (Blair, 2025). Teachers working in supportive environments demonstrated greater adaptability and initiative. Furthermore, disparities between institutions contribute to unequal access to AI technologies, creating a digital divide that affects both teachers and students. Participants from well-resourced institutions reported greater access to advanced AI tools and training opportunities, while those from less-resourced settings faced significant limitations. This disparity raises concerns about equity in education and the potential for AI to exacerbate existing inequalities. Prior studies have highlighted the need for inclusive policies to address such disparities (Mulkiyah, 2024).

The findings underscore the importance of equitable resource distribution. The cumulative analysis indicates that institutional and technological constraints are deeply interconnected, forming a complex ecosystem that influences AI integration. Addressing these challenges requires coordinated efforts involving infrastructure development, policy formulation, professional training, and technical support systems. The findings emphasize that successful AI integration is not solely dependent on individual teacher competence but also on systemic factors that enable or constrain innovation (Daud et al., 2025). The evidence highlights the necessity of a holistic approach to overcoming barriers in AI-driven education.

CONCLUSION

The findings of this study demonstrate that the integration of artificial intelligence into classroom instruction is shaped by a complex interplay of pedagogical, ethical, institutional, and technological factors that extend beyond mere technical adoption. Teachers encounter substantial challenges in aligning AI tools with instructional objectives, maintaining meaningful student engagement, and adapting assessment practices, indicating that AI integration necessitates a fundamental reconfiguration of pedagogical approaches. Ethical concerns, particularly those related to data privacy, algorithmic bias, and professional identity, further complicate the integration process, revealing that the use of AI in

education is inseparable from broader questions of responsibility, fairness, and human agency. At the same time, institutional constraints such as inadequate infrastructure, limited professional development, and the absence of clear policy frameworks significantly hinder the effective and equitable implementation of AI technologies.

The study contributes to the theoretical understanding of AI integration by conceptualizing it as a multidimensional and context-dependent process that requires alignment between technological affordances, pedagogical practices, and ethical considerations. From a methodological perspective, the use of a qualitative multiple-case approach provides nuanced insights into teachers' lived experiences, highlighting the importance of contextual realities in shaping implementation outcomes. The findings suggest that addressing the challenges of AI integration requires a holistic strategy that combines pedagogical innovation, ethical awareness, and systemic institutional support. Future research is encouraged to expand this investigation through longitudinal and mixed-method approaches to capture evolving practices and broader patterns, while policymakers and educational institutions are urged to develop comprehensive frameworks that support responsible, inclusive, and sustainable AI adoption in classroom environments.

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