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Teachers' Attitudes Towards and Challenges Faced in Integrating Artificial Intelligence in Teaching and Learning in Secondary Schools in Kicukiro District

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Abstract

The integration of Artificial Intelligence (AI) in secondary education offers transformative potential but also presents significant challenges, particularly in developing-country contexts. This qualitative case study explored senior secondary school teachers' attitudes, practices, and strategic needs for AI integration in Kicukiro District. Twelve purposively selected senior teachers from four secondary schools (two public and two private) participated in semi-structured interviews, and data were analyzed thematically. Findings revealed that teachers generally perceive AI as a powerful tool for enhancing lesson planning, learner engagement, and personalized instruction, while emphasizing that it should augment rather than replace human teaching. However, integration is constrained by limited infrastructure, inequitable access to digital devices, insufficient professional training, and ethical concerns, including over-reliance on technology and data privacy. Participants highlighted the importance of balanced pedagogical approaches that combine AI with human interaction. The study concludes that effective and ethical AI integration requires inclusive policies, sustained professional development, clear ethical frameworks, and context-sensitive implementation strategies. These findings provide actionable insights for policymakers, school leaders, and teacher education institutions to support responsible and equitable AI adoption in Rwandan secondary schools.

Keywords: Artificial Intelligence, Kicukiro District, Qualitative Study, Secondary Education, Teachers' Attitudes

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Introduction

Artificial Intelligence (AI) is increasingly influencing educational systems worldwide by reshaping instructional practices, assessment methods, and learner support mechanisms. AI-powered tools such as intelligent tutoring systems, adaptive learning platforms, automated assessment systems, and educational chatbots promise to enhance teaching efficiency and personalise learning experiences. However, despite this global momentum, empirical evidence on how AI is perceived and implemented at the secondary school level in sub-Saharan Africa remains limited, particularly in Rwanda.

Rwanda has made significant investments in Information and Communication Technology (ICT) as part of its national development agenda, including the Smart Rwanda Master Plan and the One Laptop per Child programme. Yet, persistent disparities in access to digital infrastructure, levels of digital literacy, and pedagogical preparedness continue to constrain the effective integration of emerging technologies such as AI in secondary schools. Teachers' attitudes towards AI are therefore a critical factor, as they mediate technology adoption and classroom practice.

This study focused on Kicukiro District, one of the three districts of Kigali City, which hosts a mix of public and private secondary schools with varying levels of technological infrastructure. This study examines senior teachers' perceptions and experiences of AI and is motivated by the need to generate localized evidence to inform policy, professional development, and sustainable AI integration strategies in Rwandan secondary education. Through this focus, the research provides context-specific insights into the opportunities and challenges of AI adoption in secondary schools.

Literature Review

Previous studies conceptualize Artificial Intelligence (AI) in education as the integration of computational systems capable of emulating human cognitive functions such as reasoning, pattern recognition, and decision-making within teaching and learning environments (Hwang et al., 2020; Abbasi et al., 2025). These studies provide strong theoretical grounding by clearly defining AI as more than mere automation and emphasizing its cognitive and adaptive capacities. A major strength of this body of literature lies in its comprehensive classification of AI-driven tools, including adaptive learning systems, intelligent tutoring systems, learning analytics, and automated assessment platforms. However, a notable limitation is the predominantly technology-centered perspective, with limited attention to pedagogical alignment and classroom realities, particularly in resource-constrained settings.

More recent scholarship extends this foundational work by situating AI within learner-centered pedagogical frameworks, emphasizing personalization and responsiveness to learners' abilities, learning pace, and preferences (Yambal & Waykar, 2025). While these contemporary studies successfully bridge AI with instructional design principles, they often rely on experimental or short-term implementations, raising questions about long-term sustainability and scalability in real-world educational systems.

Empirical research consistently demonstrates AI's potential to enhance learning outcomes through individualized learning pathways, real-time feedback, and data-informed instructional decision-making (Akintola et al., 2025). A key strength of this study is its evidence-based approach, which frequently employs learning analytics to quantify improvements in learner engagement and achievement. Additionally, research highlights AI's role in reducing teachers' administrative workload, enabling educators to devote more time to instructional planning and learner support.

Despite these advantages, a significant limitation of existing empirical studies is their narrow focus on performance metrics, often overlooking deeper cognitive outcomes such as conceptual understanding, creativity, and critical thinking. Currently, in the field, carefulness that improved efficiency does not automatically translate into meaningful learning, arguing that AI-enhanced environments must be pedagogically mediated to avoid surface-level engagement (Gerlich, 2025). This critique underscores the need for research that integrates AI effectiveness with robust learning theories.

Several scholars raise concerns that excessive reliance on AI tools may reduce meaningful human interaction and weaken learners' critical thinking skills (Adams & Alzaabi, 2025; Elzerman, 2025). These studies are particularly strong in their qualitative insights, capturing teachers' and students' lived experiences with AI-supported instruction. They reveal that when AI systems dominate instructional processes, learners may become passive recipients of algorithm-driven feedback rather than active constructors of knowledge.

However, a limitation of these studies lies in their tendency to frame AI as inherently reductive, without sufficiently exploring hybrid or blended pedagogical models. Contemporary scholars argue for a balanced, human-in-the-loop approach, where AI augments rather than replaces teacher judgment and dialogic interaction (Gerlich, 2025). This perspective reframes AI not as a threat to pedagogy, but as a tool whose educational value depends on intentional instructional design.

Ethical concerns emerge prominently in the literature, particularly regarding data privacy, algorithmic bias, transparency, and accountability (Gupta et al., 2025). A strength of this research strand is its interdisciplinary approach, integrating insights from education, data science, and ethics. These studies effectively highlight risks associated with opaque algorithms and the misuse of learner data.

Nevertheless, many ethical discussions remain largely normative and policy-oriented, offering limited empirical evidence on how ethical AI principles are enacted in classroom practice. Recent authors call for operational frameworks that translate ethical guidelines into actionable strategies for educators and institutions, emphasizing participatory design and contextual sensitivity as pathways toward responsible AI integration (Gupta et al., 2025).

Studies focusing on developing contexts emphasize that unequal access to digital devices, reliable electricity, and stable internet connectivity can exacerbate existing educational inequalities (Assefa et al., 2025). The strength of this literature lies in its contextual realism, drawing attention to structural constraints often overlooked in global AI-in-education narratives.

However, a limitation is the frequent portrayal of developing contexts as technologically deficient, without adequately exploring innovative low-cost or offline AI solutions. Currently, advocate for context-responsive AI models, arguing that sustainability and inclusivity should guide AI adoption rather than the replication of high-resource models from developed systems (Assefa et al., 2025).

Teachers' perceptions are widely recognized as a decisive factor in AI adoption, with studies showing that positive attitudes are closely linked to adequate training, institutional support, and perceived usefulness (Habib, 2025; Liu, 2025; Zhao et al., 2025). A key strength of this research is its focus on the human dimension of technological change, highlighting teachers as active agents rather than passive adopters.

Nonetheless, many studies rely heavily on self-reported survey data, which may not fully capture actual classroom practices. Recent scholars call for mixed-methods and longitudinal research to better understand how teachers' attitudes evolve over time and how professional development can support meaningful and ethical AI integration (Liu, 2025).

Research Objectives

The study was guided by the following objective: To investigate teachers' perceptions, practices, and strategic needs for effective and ethical integration of artificial intelligence in secondary school education.

Methodology

Research design

This study adopted a qualitative case study research design to generate an in-depth, context-sensitive understanding of teachers' perceptions, practices, and strategic needs regarding the integration of artificial intelligence (AI) into secondary school education. The qualitative approach was considered appropriate because the research objective sought to explore subjective experiences, meanings, and professional judgments that cannot be adequately captured through quantitative measures. The case study design enabled a holistic examination of AI integration within real school contexts, allowing the researcher to capture nuanced interactions between technology, pedagogy, and institutional conditions.

Study Context

The study was conducted in Kicukiro District, located in the City of Kigali, Rwanda, a setting characterized by increasing investment in digital education initiatives alongside persistent infrastructural and capacity-related challenges. This context was strategically selected because it reflects both the opportunities and constraints associated with emerging AI adoption in secondary education in a developing country. Focusing on a single district enhanced contextual depth and analytical coherence, ensuring that findings were grounded in shared policy and administrative environments.

Sampling and Participants

Purposive sampling was employed to select four secondary schools, comprising two public and two private schools, in order to capture variations in resource availability and school support for AI-related innovations. A total of 12 senior teachers participated in the study, each meeting predefined inclusion criteria: a minimum of five years of teaching experience, prior engagement with ICT-supported instruction, and basic awareness of AI tools. This sampling strategy aligned with the research objective

by ensuring that participants had sufficient professional exposure to meaningfully reflect on AI integration, its pedagogical implications, and the strategic requirements for effective implementation.

Data Collection Methods

Data were collected through face-to-face semi-structured interviews, which allowed for both consistency across participants and flexibility to probe emerging issues. The interview protocol was designed to directly address the research objective by exploring teachers' perceptions of AI, current instructional practices involving AI-related tools, perceived benefits and challenges, ethical considerations, and professional development needs. This method facilitated rich, descriptive accounts of teachers' lived experiences, while enabling participants to articulate their views in their own professional language. Ethical procedures, including informed consent, voluntary participation, and confidentiality, were strictly observed throughout the data collection process.

Data Analysis Procedures

All interviews were audio-recorded, transcribed verbatim, and analyzed using thematic analysis, with coding conducted iteratively and systematically. Initial open coding was conducted to identify meaningful units of data, which were subsequently refined into categories and broader themes aligned with teachers' perceptions, practices, and strategic needs. The iterative nature of the analysis allowed themes to emerge inductively from the data, rather than being imposed a priori, thereby enhancing analytical rigor. Direct quotations were incorporated into the findings to preserve participants' voices authenticity and strengthen the credibility and trustworthiness of the study.

Trustworthiness and Rigor

To ensure the trustworthiness of the findings, multiple strategies were employed, including prolonged engagement with participants, careful documentation of analytical decisions, and the use of verbatim excerpts to support interpretations. Credibility was enhanced through thematic saturation and consistent cross-checking of codes, while transparency in methodological procedures supported dependability and confirmability. These measures ensured that the study's conclusions accurately reflected participants' experiences and aligned closely with the research objective.

Findings

A total of 12 senior secondary school teachers (P1-P12) participated in the study, comprising 7 males and 5 females, with 8 from public secondary schools and 4 from private secondary schools. Participants represented different teaching disciplines, including Sciences and Mathematics (5), Languages (4), and Humanities and Social Sciences (3). All participants met the predefined inclusion criteria: at least 5 years of teaching experience, prior engagement with ICT-supported instructional practices, and basic awareness of artificial intelligence tools. This demographic composition ensured representation across gender, school type, and subject areas, thereby enabling the study to capture informed and contextually grounded insights into teachers' perceptions, classroom practices, and strategic needs for the effective and ethical integration of artificial intelligence in secondary school education.

Table 1: Demographic Characteristics of Participants (N = 12)

Variable	Category	Frequency
Gender	Male	7
	Female	5
School Type	Public	8
	Private	4
Teaching Subject	Sciences & Mathematics	5
	Humanities & Social Sciences	3
	Languages	4

Theme 1: Teachers' Perceptions of AI in Teaching and Learning

Most participants perceived AI as a transformative instructional tool that could enhance teaching efficiency and learner engagement. This perception reflects an emerging instrumental understanding of AI, where its value is primarily associated with practical classroom benefits such as time-saving, content adaptation, and instructional support rather than autonomous teaching. One teacher from a public school stated:

"*AI can help us prepare lessons faster and give learners exercises that match their level. It saves time and makes learning more interesting.*" (P3)

Teachers consistently emphasized AI's supportive role in lesson planning, assessment, and learner engagement. This suggests that teachers view AI as an augmentation tool aligned with their pedagogical responsibilities, rather than a replacement for professional judgment or classroom interaction. Another participant clearly articulated this stance:

"*Technology should support the teacher, not replace us. Students still need guidance and motivation from a real person.*" (P1)

Critically, this finding indicates a balanced perception of AI, where teachers recognize its instructional potential while reaffirming the irreplaceable role of human agency in teaching and learning processes. Such perceptions are essential for sustainable and ethical AI integration, as they mitigate fears of professional displacement while encouraging responsible adoption.

Theme 2: Opportunities for Enhancing Learning Outcomes

Participants identified multiple opportunities for AI integration, including personalized learning, differentiated instruction, increased learner engagement, and faster feedback. These opportunities align closely with contemporary learner-centered pedagogical approaches, suggesting that teachers view AI as part of inclusive and adaptive teaching practices. A teacher highlighted AI's role in addressing learner diversity:

"*With AI-based platforms, slow learners can practice more without feeling embarrassed, while fast learners move ahead.*" (P10)

This finding critically illustrates teachers' recognition of AI as a tool for reducing learning-related stigma and supporting equitable participation in the classroom. However, while participants acknowledged these pedagogical benefits, their responses focused more on perceived potential than on documented classroom practices, indicating a gap between awareness and systematic implementation. This gap points to a strategic need for structured support to translate perceived opportunities into consistent instructional practice.

Theme 3: Challenges in AI Integration

Despite generally positive perceptions, teachers reported several interrelated challenges that constrain effective and ethical AI integration. These challenges reveal structural, professional, and ethical barriers that must be addressed to move beyond exploratory or fragmented AI use in secondary schools.

Theme 3.1: Infrastructure and Access

Limited access to computers, stable internet connectivity, and reliable electricity emerged as a major challenge, particularly in public schools. This finding underscores a structural digital divide that shapes not only access to AI tools but also teachers' confidence in integrating them into routine instruction. One participant noted:

"*Sometimes we want to use technology, but the internet is not reliable, and many students do not have devices at home.*" (P12)

Critically, this challenge highlights that teachers' perceptions and intentions alone are insufficient for AI integration without enabling infrastructural conditions. It also suggests that inequitable access risks reinforcing existing educational disparities rather than mitigating them.

Theme 3.2: Professional Training

Most participants reported insufficient training in AI tools and their pedagogical applications. This indicates a mismatch between the growing discourse on AI in education and teachers' actual professional readiness to implement it meaningfully. As one teacher explained:

"*We hear about AI, but we are not trained on how to use it effectively in our subjects.*" (P1)

This finding critically reveals that awareness of AI does not equate to instructional competence, underscoring a strategic need for continuous, subject-specific professional development that integrates the pedagogical, technical, and ethical dimensions of AI use.

Theme 3.3: Ethical Concerns

Teachers expressed concerns related to data privacy, academic dishonesty, and learners' over-reliance on AI tools. These concerns reflect an emerging ethical consciousness among teachers, even in contexts where AI use remains limited. One participant cautioned:

"*Students may depend too much on AI tools and stop thinking for themselves.*" (P9)

Critically, this finding suggests that teachers are not only concerned with access and functionality but also with the long-term cognitive and moral implications of AI use in education. This ethical awareness reinforces the need for clear institutional guidelines and ethical frameworks to support responsible AI integration.

Overall, the findings demonstrate that teachers hold largely positive yet thoughtful perceptions of AI, recognize its pedagogical opportunities, and clearly articulate strategic needs in infrastructure, professional development, and ethical safeguards. These interrelated dimensions directly address the study's objective by revealing that effective and ethical AI integration in secondary education depends not only on the availability of technology but also on teachers' preparedness, contextual support, and principled-use frameworks.

Discussion

The findings indicate that senior secondary school teachers in Kicukiro District generally hold positive perceptions of AI as a transformative pedagogical tool capable of enhancing lesson planning, learner engagement, and individualized instruction. This aligns with prior literature emphasizing AI's potential for adaptive learning, automated feedback, and individualized pathways (Abbasi et al., 2025; Yambal & Waykar, 2025; Akintola et al., 2025). Participants, such as P1 and P3, clearly valued AI for saving instructional time and providing level-appropriate exercises, yet insisted that AI should augment rather than replace teachers, reflecting a human-in-the-loop perspective. This finding supports the contemporary pedagogical argument that AI's effectiveness depends on the intentional integration of human judgment with technology, in contrast to studies that overly emphasize AI as an autonomous teaching tool (Gerlich, 2025). Moreover, the teachers' balanced perceptions highlight the critical role of professional agency in mediating AI adoption, directly addressing the study's objective by revealing teachers' attitudes as both a facilitator and a condition for effective and ethical AI integration.

The study also identified specific opportunities and constraints in translating AI's potential into classroom practice. Teachers highlighted AI's ability to support personalized learning, differentiated instruction, and equitable participation among learners (P10), which mirrors findings from global studies on learner-centered AI applications (Yambal & Waykar, 2025; Akintola et al., 2025). However, the results reveal a notable gap between perceived benefits and actual implementation, largely due

to infrastructural limitations, insufficient professional training, and contextual challenges. This contrasts with much of the experimental literature, which often reports AI effectiveness under controlled or high-resource conditions, highlighting the importance of context-responsive strategies for real-world classrooms (Assefa et al., 2025). By explicitly capturing participants' experiences across gender, school type, and subject areas, the study emphasizes that strategic support, targeted training, and contextual adaptation are essential to bridge the gap between AI potential and pedagogical practice, thus meeting the research objective of investigating teachers' strategic needs for effective AI integration.

Finally, the findings underscore teachers' ethical concerns and professional responsibility in AI-mediated instruction. Participants, such as P9, expressed worries about students' over-reliance on AI, reduced critical thinking, and data privacy issues. These concerns align with literature emphasizing the necessity of ethical frameworks, transparency, and accountability in AI use (Gupta et al., 2025; Adams & Alzaabi, 2025). The study further highlights that ethical consciousness is not only normative but also grounded in daily teaching practice, demonstrating teachers' active role as guardians of both learning quality and learner wellbeing. This reinforces the research objective by identifying ethical awareness as a key strategic requirement for sustainable AI adoption in secondary education, emphasizing that the infrastructural, pedagogical, and ethical dimensions must intersect to achieve effective and responsible AI integration that aligns with global and local realities.

Implications for Policy and Practice

The findings of this study have important implications for policy, practice, and teacher education. At the policy level, there is a need to develop comprehensive national and school-level guidelines for AI integration, with particular attention to ethical use, data privacy, and equitable access for all learners. In practice, schools, especially public schools, should prioritize investment in reliable infrastructure and affordable digital tools to ensure that AI-enhanced learning is accessible and sustainable. Finally, teacher education programs must provide continuous professional development focused on AI pedagogy and digital ethics, equipping educators with the knowledge and skills to implement AI responsibly and effectively in their classrooms. Collectively, these implications underscore that successful AI integration requires coordinated efforts across policy, infrastructure, and professional capacity building.

Conclusion

This study explored senior secondary school teachers' attitudes towards AI integration in Kicukiro District and highlighted that they hold positive yet cautious perceptions of AI, recognizing its potential to enhance lesson planning, learner engagement, and personalized instruction, while emphasizing that AI should augment rather than replace teachers. The study highlights that effective and ethical integration of AI depends on addressing key contextual challenges, including infrastructural limitations, insufficient professional training, and ethical considerations such as data privacy and learners' critical thinking. By capturing teachers' perspectives across gender, school type, and subject areas, the study demonstrates that strategic support, targeted training, and context-sensitive policies are essential for bridging the gap between AI's potential and actual classroom practice. Overall, these findings underscore that successful AI adoption in secondary education requires a balanced integration of technology, human agency, and ethical responsibility, directly addressing the study's objective of investigating teachers' perceptions, practices, and strategic needs for AI implementation.

Recommendations

Based on the findings, it is recommended that secondary schools provide sustained professional development on AI integration to equip teachers with the necessary pedagogical and technical skills. Additionally, schools should improve ICT infrastructure and ensure equitable access to digital devices to enable meaningful AI-supported learning. The development of clear ethical guidelines for AI use is essential to safeguard data privacy, promote responsible use, and maintain learners' critical thinking. Finally, educators should be encouraged to adopt blended pedagogical approaches that balance AI tools with human interaction, ensuring that technology complements rather than replaces teacher guidance and relational teaching.

Suggestions for Further Research

Future studies could examine students' perspectives on AI use, conduct longitudinal research on learning outcomes, or explore AI integration in rural secondary schools across Rwanda.

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