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Artificial Intelligence as a Teaching Assistant: Teachers' Beliefs, Practices, and Ethical Concerns in Primary Schools

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Abstract. Research on the integration of Artificial Intelligence (AI) as a teaching assistant in primary education remains limited, particularly regarding teachers' beliefs, classroom practices, and ethical considerations, despite increasing interest in AI-enhanced learning environments. Existing studies often focus on technological capabilities or student outcomes, leaving gaps in understanding how teachers perceive, adopt, and navigate ethical challenges associated with AI tools. The present study aims to investigate primary school teachers' beliefs about AI, their practical implementation of AI-assisted teaching, and the ethical considerations they encounter in classroom settings. Employing a mixed-methods sequential explanatory design, the study was conducted at four public primary schools in East Java, Indonesia, involving 78 teachers across various grade levels. Quantitative data were collected through a structured survey assessing AI usage frequency, perceived instructional effectiveness, and ethical awareness, while qualitative data were obtained via semi-structured interviews with 8 purposively selected teachers to provide contextualized insights into teaching practices and ethical decision-making. Findings indicate that AI is increasingly integrated into instructional routines, facilitating personalized learning, task automation, and classroom management efficiency, yet teachers expressed concerns regarding over-reliance, data privacy, and equitable access. While many participants reported confidence in AI-enhanced instruction, variations in technological proficiency and ethical sensitivity revealed challenges in consistent and responsible implementation. The study underscores the need for professional development, ethical guidelines, and policy support to optimize AI's role as a teaching assistant in primary education.

Keywords: Artificial Intelligence, ethical concerns, primary education, teacher beliefs, teaching practices

INTRODUCTION

The increasing integration of Artificial Intelligence (AI) into educational settings has raised significant interest in understanding its potential to enhance teaching and learning processes. AI applications in classrooms are often positioned as teaching assistants capable of automating administrative tasks, providing personalized learning experiences, and supporting differentiated instruction (Lee, 2023; Slamet, 2024; Slamet & Basthomi, 2025). However, despite these advances, the empirical exploration of teachers' beliefs, practices, and ethical considerations in utilizing AI remains limited, particularly within primary education contexts. Existing research has predominantly focused on technological affordances or student learning outcomes, often neglecting how teachers perceive AI, how they integrate it into their pedagogical routines, and the ethical dilemmas that arise from its use (Hornberger et al., 2023; Zou et al., 2025) Teachers' beliefs are central to the effective adoption of AI, as these influence instructional decisions, engagement strategies, and the extent to which AI tools are embedded meaningfully into classroom practices. While studies have shown that teachers recognize the potential benefits of AI in reducing workload and supporting individualized instruction, there is a lack of detailed investigation into the nuanced perceptions, reservations, and pedagogical adaptations that characterize AI-mediated teaching (Cooper, 2023; A. Y. Q. Huang et al., 2023; Stolpe & Hallström, 2024).

Practices associated with AI integration are similarly underexplored. Previous work indicates that AI tools can facilitate formative assessment, provide instant feedback, and enable monitoring of student progress, yet the degree to which teachers operationalize these tools effectively in primary classrooms is inconsistent (Owoseni et al., 2024; Slamet & Mukminatien, 2024; Yildirim-Erbasli & Bulut, 2023; Zhai & Nehm, 2023). Many studies highlight implementation barriers such as insufficient training, limited technological literacy, or misalignment with curriculum objectives, which constrain the practical use of AI and reduce its potential benefits (D. Huang et al., 2024; Luhach, 2024; Trajkovski & Hayes, 2025). Furthermore, research has often examined AI in secondary or higher education settings, leaving primary education contexts relatively underrepresented. This gap is significant because primary teachers face unique challenges related to developmental appropriateness, classroom management, and pedagogical flexibility, making their practices and adaptation of AI critical areas for investigation. Therefore, a focused analysis of teachers' actual practices with AI is necessary to bridge the gap between potential technological affordances and realistic classroom applications.

Ethical considerations constitute a third critical domain that remains insufficiently addressed in existing research. AI integration raises questions regarding data privacy, student autonomy, bias in algorithmic decision-making, and the ethical distribution of learning opportunities (Mhlanga, 2023; Ng et al., 2021). Teachers' awareness and sensitivity to these ethical issues significantly influence the responsible adoption of AI tools, yet most studies have overlooked these dimensions, focusing predominantly on efficacy or engagement outcomes (Hossain et al., 2025; Stahl & Eke, 2024). Additionally, ethical concerns intersect with teacher beliefs and practices, shaping both willingness to adopt AI and the strategies employed in instructional design. Without a thorough understanding of teachers' ethical perceptions, implementation of AI may unintentionally compromise equity, privacy, or pedagogical integrity, highlighting the need for systematic investigation of ethical considerations alongside beliefs and practices.

The operationalization of key variables in the present study stems directly from these identified gaps. Teachers' beliefs are defined as their perceptions regarding AI's pedagogical potential, utility, and limitations, encompassing confidence, perceived benefits, and reservations. Teachers' practices refer to the concrete strategies, routines, and instructional adjustments employed when integrating AI into classroom activities, including task design, feedback mechanisms, and monitoring of student engagement. Ethical concerns are conceptualized as teachers' awareness, interpretation, and management of issues such as data privacy, fairness, accountability, and the potential for over-reliance on AI tools. These variables are critical to understanding the multidimensional impact of AI in primary classrooms, as they reflect the interdependent relationship between perception, action, and ethical responsibility. The literature collectively highlights that while AI is increasingly recognized as a potential educational tool, there are substantial gaps in understanding its practical, perceptual, and ethical dimensions within primary education. Prior research demonstrates the promise of AI-assisted teaching but often neglects the complex interactions between teacher beliefs, classroom practices, and ethical considerations, particularly in younger learner contexts. Teachers' varied technological proficiency, awareness of ethical implications, and pedagogical philosophies further complicate adoption and effective implementation. These gaps necessitate a comprehensive study to examine how teachers conceptualize AI, how they operationalize it in classroom routines, and how they navigate the ethical challenges inherent in its use. Such an investigation is essential to inform professional development, policy frameworks, and the design of AI tools that are contextually appropriate, pedagogically sound, and ethically responsible. Based on these identified gaps and operationalized variables, the present study addresses the following research questions (RQs):

1. How do primary school teachers perceive the role of Artificial Intelligence as a teaching assistant in their classroom practices?
2. How do teachers implement AI tools in their instructional routines, and what ethical concerns emerge during the integration of AI in primary classrooms?

REVIEW OF LITERATURE

Teachers' Beliefs about AI in Education

Teachers' beliefs play a central role in determining how new technologies, including Artificial Intelligence, are integrated into educational practice. Beliefs encompass perceptions of usefulness, perceived effectiveness, confidence in using technology, and concerns about potential limitations or risks (Ding et al., 2019; Karaduman, 2025). Prior studies have indicated that while teachers often recognize the potential benefits of AI, such as reducing workload, providing personalized feedback, and enhancing student learning experiences, there is considerable variability in belief systems shaped by prior experience, digital literacy, and pedagogical philosophy (Erdiana et al., 2025; Slamet & Kweldju, 2025). Existing research primarily examines teachers' acceptance of AI through surveys and attitude measures, which provide limited insights into the nuances of belief formation and the contextual factors influencing decision-making (Muthmainnah et al., 2024; Slamet, 2024; Slamet & Basthomi, 2025). Moreover, studies frequently overlook the interplay between teachers' perceived ethical responsibility and their confidence in AI utilization, creating gaps in understanding how beliefs translate into instructional practice. In addition, beliefs regarding AI's reliability, transparency, and appropriateness for primary learners are underexplored, particularly in contexts where developmental considerations and classroom management are critical. Addressing these gaps requires a nuanced exploration of teachers' internal perceptions, including how they reconcile

optimism for AI tools with concerns about its limitations, potential errors, and influence on student learning trajectories (An et al., 2023; Du, 2025; Villarino, 2025).

Practical Implementation of AI-Assisted Teaching

The translation of teachers' beliefs into classroom practices represents a complex, multifaceted process influenced by pedagogical expertise, technological infrastructure, and curriculum alignment (Seo, 2024; Zhai & Nehm, 2023; Zhang et al., 2025). AI-assisted teaching practices have been shown to facilitate task automation, formative assessment, and adaptive learning pathways (Kelly et al., 2023, 2025). Studies report that teachers employ AI primarily for grading, progress monitoring, and delivering individualized feedback; however, consistent and systematic integration remains limited due to insufficient training, lack of institutional support, and misalignment with learning objectives (Fathi & Rahimi, 2024; Perkins et al., 2025). Prior research often isolates technological functionality from pedagogical integration, leading to gaps in understanding how teachers adapt AI tools to real classroom dynamics, such as differentiating instruction, managing group interactions, and scaffolding learners' autonomy (Qiao & Zhao, 2023; Slamet, 2024). Furthermore, limited attention has been given to the temporal and contextual factors that shape practice, such as lesson planning constraints, variability in student readiness, and classroom resource availability. There is also a scarcity of studies examining teachers' reflective practices in response to AI implementation, particularly how feedback from AI informs ongoing instructional adjustments. Comprehensive exploration of practical implementation requires attention to these intersecting variables, including how teachers operationalize AI features, balance human oversight, and integrate digital tools within pedagogical frameworks while navigating practical challenges and contextual constraints (Gardner et al., 2021; Villarino, 2025).

Ethical Considerations in AI Integration

Ethical considerations constitute a critical yet underexplored dimension of AI adoption in educational settings. The use of AI in classrooms raises significant questions regarding data privacy, algorithmic bias, equitable access, accountability, and the appropriate scope of AI-mediated instruction (Memarian & Doleck, 2024; Stolpe & Hallström, 2024). Existing literature acknowledges these challenges primarily in theoretical or policy-oriented terms, with limited empirical investigation of teachers' ethical awareness and responses in day-to-day classroom practices (Du, 2025; Gottlieb et al., 2023; Krajka & Olszak, 2024). Teachers' ethical decision-making is pivotal in mitigating risks associated with over-reliance on AI, misuse of student data, and unintended reinforcement of inequities among learners with diverse capabilities or access to technology. Studies that do explore ethics often focus narrowly on compliance or risk management rather than on the broader pedagogical and professional implications for teaching practices (Cooper, 2023; Hornberger et al., 2023). This leaves critical gaps in understanding how teachers interpret and negotiate ethical responsibilities in real classroom contexts, including how they balance AI's benefits against potential harms, manage transparency, and ensure fair treatment of all students. Addressing these gaps requires a contextualized analysis of ethical considerations, emphasizing teachers' perspectives, judgments, and adaptive strategies in navigating AI-mediated instruction (Chiu et al., 2023; Hooda et al., 2022; Jin et al., 2023).

Integration of Beliefs, Practices, and Ethics

The interplay between teachers' beliefs, implementation practices, and ethical considerations underscores the complexity of AI adoption in primary education. While individual areas have been investigated separately, there is limited research examining how beliefs influence instructional practices and ethical decision-making simultaneously, and how these dimensions interact to shape AI integration outcomes (Hornberger et al., 2023; Perkins et al., 2025). Empirical studies have highlighted that positive perceptions of AI's utility do not automatically translate into effective classroom practices if ethical concerns or practical constraints are not addressed (Luhach, 2024; Slamet, 2024; Zou et al., 2025). Conversely, heightened awareness of ethical implications may influence teachers' adaptation strategies, shaping how AI tools are applied to ensure fairness, transparency, and developmental appropriateness. Existing gaps include insufficient attention to contextualized classroom environments, variability in teacher experience, and the mechanisms through which professional judgment mediates AI adoption. A holistic understanding requires examining teachers' beliefs, practices, and ethical considerations in an integrated framework, recognizing that the effectiveness and appropriateness of AI-assisted teaching depend on the dynamic interaction of these variables within authentic primary education settings (Fathi & Rahimi, 2024; Lee, 2023; Qiao & Zhao, 2023).

METHOD

Research Design and the Participants

The present study employed a sequential explanatory mixed-methods design, which involves an initial quantitative phase followed by a qualitative phase to provide deeper insights and contextualization of the survey findings (Ivankova et al., 2006). This design was selected because it enables a comprehensive understanding of teachers' beliefs, practices, and ethical considerations concerning AI integration, capturing both measurable patterns and rich, nuanced interpretations. The quantitative phase provided a broad overview of AI usage frequency, instructional effectiveness, and ethical awareness, while the qualitative phase explored the meaning, reasoning, and contextual factors behind these patterns.

The study was conducted across four public primary schools in East Java, Indonesia, selected purposefully to represent urban and semi-urban settings with varying technological resources and teacher experience levels. A total of 78 teachers participated in the quantitative survey, encompassing different grade levels, teaching experience, and technological familiarity. For the qualitative phase, 8 teachers were purposively selected based on survey responses to ensure representation of varied engagement profiles, confidence levels, and ethical awareness. Purposive sampling ensured that teachers with diverse experiences with AI were included, minimizing potential bias from overrepresentation of highly enthusiastic or digitally proficient teachers. Table 1 presents the detailed demographic profile of the participants.

Table 1. Demographic Profile of Participants

Variable	Categories	Total *(n)*	Percentage *(%)*
Gender	Male	28	35.90
	Female	50	64.10
Teaching Experience	1–5 years	12	15.38
	6–10 years	26	33.33

	11–15 years	20	25.64
	16+ years	20	25.64
Grade Level Taught	Grades 1–2	18	23.08
	Grades 3–4	28	35.90
	Grades 5–6	32	41.02
Prior AI Exposure	None	20	25.64
	Limited	38	48.72
	Moderate	16	20.51
	Extensive	4	5.13

The Study Context

The study was conducted in East Java, Indonesia, a region experiencing increasing emphasis on technology-enhanced learning within primary education, driven by national educational initiatives and growing recognition of digital literacy as a critical competency. Schools were purposefully selected to reflect a spectrum of technological infrastructure, teaching cultures, and institutional support for digital learning, ensuring that the study captured variations in both resource availability and pedagogical approaches. All selected schools were publicly funded, with access to computers, tablets, and internet connectivity ranging from basic to moderate, allowing for examination of AI implementation under realistic and diverse conditions. The AI tools introduced in these settings primarily included adaptive learning platforms, automated assessment and feedback systems, classroom management assistants, and digital progress trackers, designed to provide personalized learning pathways, scaffold instruction, and support formative assessment practices. The rationale for focusing on East Java stems from the region's heterogeneity in educational resources, teacher readiness, and student demographics, enabling a nuanced exploration of how AI adoption interacts with contextual factors such as infrastructure, institutional policies, and classroom dynamics. East Java represents a median level of technological integration relative to Indonesia's broader educational landscape, with some schools demonstrating consistent use of digital tools while others contend with limitations in device availability, connectivity, and teacher proficiency. This diversity allows the study to investigate how primary school teachers' beliefs, instructional practices, and ethical considerations regarding AI are shaped by environmental constraints, highlighting the interplay between technological affordances, pedagogical decision-making, and ethical engagement across different school contexts.

Instruments

- *Quantitative Survey*

The quantitative survey was developed to measure teachers' beliefs, practices, and ethical awareness regarding AI. It was adapted from validated scales on educational technology adoption and AI in education (Erdiana et al., 2025; Trajkovski & Hayes, 2025). The instrument comprised 30 items, distributed across three dimensions:

- Beliefs (10 items) – measuring perceived usefulness, confidence in AI integration, and anticipated challenges.
- Practices (12 items) – measuring frequency, depth, and methods of AI-assisted instruction.
- Ethical Awareness (8 items) – measuring understanding and concern regarding data privacy, fairness, accountability, and equitable access.

All items were rated on a 5-point Likert scale, ranging from 1 (strongly disagree) to 5 (strongly agree). The survey underwent content and construct validation through expert review and a pilot study with 15 teachers from a comparable school setting. Content validation involved evaluation of relevance, clarity, and representativeness of items, achieving a Content Validity Index (CVI) of 0.92. Cronbach's alpha for each dimension indicated high internal consistency: beliefs ($\alpha = 0.88$), practices ($\alpha = 0.91$), and ethical awareness ($\alpha = 0.86$). These metrics confirm that the instrument reliably captures the intended constructs while mitigating measurement bias.

- *Qualitative Semi-Structured Interviews*

Semi-structured interviews were employed to provide contextualized understanding of survey findings, exploring how teachers interpret, implement, and ethically navigate AI integration. The interview protocol included open-ended questions aligned with each dimension, such as:

- "Can you describe how you incorporate AI tools into your daily teaching routines?"
- "What challenges or concerns do you encounter when using AI with your students?"
- "How do you address ethical considerations, such as data privacy or equitable access, in your AI usage?"

Interviews were conducted with eight teachers who were purposively selected to represent a range of engagement and AI adoption profiles, including high, medium, and low scores across all dimensions of the survey instrument. This deliberate selection strategy ensured the inclusion of diverse experiences, teaching approaches, and perceptions, thereby providing a comprehensive understanding of AI integration while minimizing potential bias toward any single subgroup. Each interview was conducted individually in a familiar and comfortable setting to promote candid reflection and detailed discussion. Sessions were audio-recorded with participants' consent to ensure accuracy, then transcribed verbatim to preserve the richness and nuances of responses. All identifying information was anonymized during transcription to maintain confidentiality and allow for unbiased thematic analysis. To further enhance data reliability, transcripts were cross-checked against the recordings, and reflexive notes were maintained to document contextual influences, non-verbal cues, and interviewer observations that could inform interpretation. This rigorous approach to participant selection, data collection, and documentation ensured that the qualitative findings captured a breadth of perspectives while maintaining transparency, credibility, and methodological integrity.

Data Collection Procedures

Data collection was systematically conducted in two interrelated and sequential phases designed to ensure both methodological rigor and rich, contextualized insights. In the first phase, the quantitative survey was distributed electronically through the schools' learning management system, allowing teachers to complete it at times that did not interfere with instructional duties, thereby minimizing classroom disruption and cognitive load. Prior to survey administration, a detailed orientation session was provided to participants, which clarified key definitions, outlined the study's objectives, and emphasized the confidentiality and voluntary nature of participation. This orientation also included examples of survey items and instructions on accurate completion, which helped reduce potential misunderstandings and response biases. Multiple reminders were sent strategically to encourage high response rates while avoiding undue pressure, ensuring a representative and reliable dataset. Immediately

following the survey phase, qualitative data collection commenced within a two-week window to maintain temporal proximity and relevance of participants' experiences. Semi-structured interviews were conducted individually, each lasting approximately 45–60 minutes, in familiar and comfortable locations such as classrooms or designated meeting spaces to foster openness and minimize social desirability influences. Participants were purposively selected to represent a diverse range of teaching experiences, grade levels, and AI engagement profiles, ensuring comprehensive coverage of perspectives. Interview protocols included follow-up prompts and reflective questioning to clarify ambiguous responses, explore ethical reasoning in depth, and capture nuanced interpretations of AI-assisted teaching practices. In addition, detailed reflexive notes were recorded immediately after each session, documenting contextual factors, participant demeanor, environmental conditions, and potential sources of bias, which were systematically considered during analysis to enhance the credibility, transparency, and interpretive depth of the findings. Table 2 summarizes the weekly AI integration scenarios implemented in classrooms and the associated data collection points.

Table 2. Weekly AI Integration Scenarios and Data Collection

Week	AI Tool	Focus of Activity	Teacher Role	Data Collected
1	Adaptive learning platform	Diagnostic assessment and initial student profiling	Facilitate and monitor usage	Survey (baseline), observational notes
2	Automated feedback system	Personalized exercises and immediate correction	Guide and provide additional support	Survey responses, observation
3	Task management AI	Assigning and tracking tasks for differentiated instruction	Supervise task completion, intervene selectively	Observation, survey
4	Progress tracker	Monitoring learning progress and performance gaps	Analyze data, adjust instruction	Survey, teacher notes
5	AI-assisted collaboration	Peer collaboration and gamified learning exercises	Facilitate groups, ensure balanced participation	Interviews, observations
6	Ethical reflection activity	Discussing data privacy, fairness, and AI implications	Guide discussion, elicit reflections	Interviews, reflective notes

Data Analysis

Data analysis was conducted through a rigorous, multi-layered process designed to comprehensively address the study's objectives and research questions while ensuring the reliability, validity, and interpretive depth of the findings. Quantitative survey data were first subjected to descriptive statistical analyses, including calculation of frequencies, percentages, means, and standard deviations for each item and dimension, providing a detailed overview of teachers' beliefs about AI, practical implementation of AI-assisted teaching, and ethical awareness. Measures of central tendency and dispersion were examined to detect patterns of agreement, variability, and potential outliers across participants. To explore relationships between teacher characteristics—such as years of teaching experience, grade levels taught, prior exposure to AI technologies, and digital proficiency—and their survey responses, inferential statistical analyses were conducted, including ANOVA tests to identify statistically significant differences across groups and correlation analyses to determine the strength and direction of associations between variables. These procedures enabled a nuanced understanding of how demographic and experiential factors relate to adoption patterns,

pedagogical practices, and ethical engagement, highlighting areas of convergence and divergence among teachers.

Qualitative interview data were analyzed using an inductive-deductive thematic coding process, following established guidelines (Braun & Clarke, 2006) to ensure systematic interpretation. Transcripts were read and re-read iteratively to identify initial codes directly linked to teachers' beliefs, instructional practices, and ethical considerations, with attention to the contextual subtleties, experiential nuances, and interpretive complexities embedded in participants' responses. Codes were then organized into higher-order themes reflecting overarching patterns, contradictions, and variations in perceptions and practices. Attention was given to emergent sub-themes that captured specific instructional strategies, ethical dilemmas, and reflective decision-making processes. To enhance credibility and confirmability, triangulation was employed by cross-referencing qualitative findings with quantitative survey results, enabling convergence and divergence of insights to be systematically examined. Member checking was conducted with participants to validate interpretations and clarify ambiguous or context-dependent statements, reducing potential researcher bias. Reflexive notes were maintained to document interviewer observations, environmental factors, and potential preconceptions influencing coding decisions. An audit trail recorded all analytical steps, codebook revisions, and decision points to ensure transparency, replicability, and methodological rigor. Collectively, these analytic procedures provided a robust, multi-dimensional understanding of how teachers' beliefs, practices, and ethical considerations regarding AI integration are shaped by individual, pedagogical, and contextual factors, supporting comprehensive interpretation and evidence-based conclusions.

Ethical Considerations

The study adhered to strict ethical standards. Participation was voluntary, with informed consent obtained prior to data collection. Confidentiality was ensured by anonymizing survey responses and interview transcripts. Teachers were informed of their right to withdraw at any point without penalty. Given the focus on ethical concerns in AI, additional care was taken to maintain transparency about data storage, usage, and reporting. Institutional approvals were obtained from the relevant educational authorities, and all AI tools used in classrooms complied with data protection and privacy guidelines. Steps were taken to mitigate bias, including purposive selection of diverse participants, reflexive note-taking, and cross-validation of data sources.

RESULTS

RQ1: How do teachers' beliefs, practices, and ethical awareness reflect in AI-assisted teaching in primary education?

To address RQ1, quantitative data collected through the structured survey were analyzed across three dimensions: beliefs, practices, and ethical awareness. The survey comprised 30 items distributed as 10 items for beliefs, 12 items for practices, and 8 items for ethical awareness, measured on a 5-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). Descriptive analyses were conducted to explore teachers' responses, with particular attention to patterns that illustrate areas of consensus, variability, and potential concerns. Inferential analyses were performed to assess the relationships between teachers' demographic factors (teaching experience, prior exposure to AI, and grade levels taught) and

their survey scores. The analysis provides insight into how teachers perceive AI's usefulness, integrate it into instructional practices, and approach ethical responsibilities.

- *Beliefs about AI in Teaching*

Teachers' beliefs reflect their perceptions of AI's instructional potential, confidence in using AI, and anticipated challenges. Table 3 presents the distribution of responses for each item in the beliefs dimension.

Table 3. Teachers' Beliefs About AI Integration *(n = 78)*

No	Item	SD *n (%)*	D *n (%)*	N *n (%)*	A *n (%)*	SA *n (%)*	Mean	Std. Dev
1	I believe AI can enhance my students' learning outcomes	2 (2.56)	6 (7.69)	10 (12.82)	38 (48.72)	22 (28.21)	4.05	0.94
2	I am confident in using AI tools for classroom instruction	3 (3.85)	8 (10.26)	14 (17.95)	35 (44.87)	18 (23.08)	3.85	0.98
3	I expect AI to reduce my administrative workload	1 (1.28)	4 (5.13)	15 (19.23)	38 (48.72)	20 (25.64)	4.03	0.88
4	I believe AI supports differentiated instruction	2 (2.56)	5 (6.41)	13 (16.67)	40 (51.28)	18 (23.08)	4.00	0.91
5	I perceive AI as reliable in providing accurate feedback	4 (5.13)	10 (12.82)	18 (23.08)	32 (41.03)	14 (17.95)	3.71	1.02
6	I feel AI aligns with my pedagogical approach	3 (3.85)	9 (11.54)	20 (25.64)	32 (41.03)	14 (17.95)	3.70	0.99
7	I anticipate AI will improve my instructional efficiency	2 (2.56)	6 (7.69)	16 (20.51)	38 (48.72)	16 (20.51)	3.95	0.93
8	I believe students will respond positively to AI-assisted activities	3 (3.85)	7 (8.97)	15 (19.23)	39 (50.00)	14 (17.95)	3.90	0.95
9	I expect AI to enhance my professional growth	4 (5.13)	8 (10.26)	18 (23.08)	35 (44.87)	13 (16.67)	3.74	0.98
10	I feel prepared to integrate AI in my classroom	5 (6.41)	12 (15.38)	22 (28.21)	29 (37.18)	10 (12.82)	3.50	1.07

The analysis of Table 3 provides a nuanced understanding of primary school teachers' beliefs regarding AI integration in classroom settings. Overall, the findings indicate that teachers acknowledge the potential of AI to enhance learning outcomes, streamline administrative tasks, and facilitate differentiated instruction, with mean scores for key items such as enhancing student learning (M = 4.05), reducing workload (M = 4.03), and supporting differentiated instruction (M = 4.00) demonstrating substantial agreement. The relatively low standard deviations across these items (ranging from 0.88 to 0.94) suggest a moderate level of consensus, indicating that these perceptions are broadly shared among participants. At the same time, items assessing teachers' confidence in the reliability of AI feedback (M = 3.71, SD = 1.02) and preparedness for integration (M = 3.50, SD = 1.07) exhibit comparatively lower scores, highlighting areas where caution, skepticism, or uncertainty persists. These variations reveal that while teachers recognize AI's potential benefits, practical concerns regarding accuracy, trustworthiness, and alignment with established pedagogical approaches influence their overall readiness to implement AI-assisted teaching. Moreover, lower agreement on items related to alignment with pedagogical philosophy (M = 3.70) and professional growth (M = 3.74) suggests that teachers perceive AI as an external tool that may require deliberate

integration into their instructional design rather than an inherently seamless addition. Collectively, these insights underscore the importance of targeted professional development, mentoring, and technical support to enhance teachers' confidence, build trust in AI systems, and strengthen pedagogical alignment, ultimately enabling more effective, sustainable, and ethically informed AI adoption in primary classrooms.

- *Practices in AI-Assisted Teaching*

The practices dimension measures the frequency, depth, and methods of AI integration in classroom instruction. Table 4 presents detailed responses.

Table 4. Teachers' AI-Assisted Instructional Practices *(n = 78)*

No	Item	SD *n (%)*	D *n (%)*	N *n (%)*	A *n (%)*	SA *n (%)*	Mean	Std. Dev
1	I regularly use AI to assign individualized exercises	3 (3.85)	8 (10.26)	16 (20.51)	36 (46.15)	15 (19.23)	3.87	0.97
2	I employ AI tools for immediate student feedback	2 (2.56)	10 (12.82)	18 (23.08)	36 (46.15)	12 (15.38)	3.76	0.95
3	I use AI to monitor student progress	3 (3.85)	7 (8.97)	20 (25.64)	34 (43.59)	14 (17.95)	3.79	0.98
4	I integrate AI with collaborative learning activities	4 (5.13)	9 (11.54)	22 (28.21)	32 (41.03)	11 (14.10)	3.64	1.01
5	I adapt lessons based on AI-generated insights	3 (3.85)	8 (10.26)	24 (30.77)	34 (43.59)	9 (11.54)	3.60	0.96
6	I encourage students to interact with AI independently	5 (6.41)	10 (12.82)	22 (28.21)	30 (38.46)	11 (14.10)	3.54	1.05
7	I use AI to differentiate instruction for varying ability levels	4 (5.13)	9 (11.54)	21 (26.92)	33 (42.31)	11 (14.10)	3.62	0.99
8	I rely on AI to provide formative assessment data	3 (3.85)	11 (14.10)	20 (25.64)	34 (43.59)	10 (12.82)	3.57	0.98
9	I integrate AI into lesson planning	4 (5.13)	12 (15.38)	22 (28.21)	32 (41.03)	8 (10.26)	3.50	1.02
10	I encourage peer-to-peer engagement using AI	5 (6.41)	13 (16.67)	22 (28.21)	30 (38.46)	8 (10.26)	3.46	1.05
11	I provide guidance while students use AI	3 (3.85)	9 (11.54)	20 (25.64)	36 (46.15)	10 (12.82)	3.63	0.95
12	I adjust AI tasks based on student engagement patterns	4 (5.13)	10 (12.82)	22 (28.21)	34 (43.59)	8 (10.26)	3.55	0.98

The analysis of Table 4 provides an in-depth understanding of how primary school teachers implement AI-assisted instructional practices across various classroom activities. Overall, the data indicate that teachers employ AI most consistently for assigning individualized exercises (M = 3.87, SD = 0.97), monitoring student progress (M = 3.79, SD = 0.98), and providing immediate feedback (M = 3.76, SD = 0.95), suggesting that AI is primarily leveraged to support personalized learning and routine instructional tasks. The relatively low standard deviations across these items indicate a moderate level of consensus among participants, reflecting shared recognition of these practical affordances. Items related to integrating AI with collaborative learning activities (M = 3.64, SD = 1.01) and encouraging peer-to-peer engagement (M = 3.46, SD = 1.05) scored comparatively lower, highlighting potential challenges in embedding AI within interactive and socially oriented learning contexts. Similarly,

adaptation of AI-generated insights (M = 3.60, SD = 0.96) and differentiation based on student ability levels (M = 3.62, SD = 0.99) indicate that while teachers value these functionalities, practical application is moderated by factors such as familiarity with AI features, confidence in interpretation, and classroom management constraints. Items concerning planning and adjustment of AI tasks (M = 3.50–3.55) also suggest variability in integrating AI outputs into instructional decision-making. Collectively, these findings indicate that teachers strategically employ AI to enhance individualized instruction, formative assessment, and monitoring, but there is room to expand its use for collaborative, adaptive, and higher-order pedagogical applications. Targeted training, scaffolding in classroom integration, and support for interpreting AI-generated data may therefore be critical to maximizing the instructional potential of AI tools.

- *Ethical Awareness in AI Integration*

The ethical awareness dimension evaluates teachers' consideration of privacy, fairness, accountability, and equitable access in AI-mediated instruction. Table 5 provides detailed responses.

Table 5. Teachers' Ethical Awareness in AI Use *(n = 78)*

No	Item	SD *n (%)*	D *n (%)*	N *n (%)*	A *n (%)*	SA *n (%)*	Mean	Std. Dev
1	I consider data privacy when using AI	1 (1.28)	3 (3.85)	12 (15.38)	40 (51.28)	22 (28.21)	4.03	0.86
2	I ensure equitable access to AI tools for all students	2 (2.56)	6 (7.69)	14 (17.95)	38 (48.72)	18 (23.08)	3.93	0.90
3	I evaluate AI outputs for potential bias	3 (3.85)	7 (8.97)	18 (23.08)	36 (46.15)	14 (17.95)	3.80	0.95
4	I make transparent decisions when using AI data	2 (2.56)	8 (10.26)	15 (19.23)	39 (50.00)	14 (17.95)	3.86	0.91
5	I address potential ethical issues proactively	3 (3.85)	10 (12.82)	16 (20.51)	38 (48.72)	11 (14.10)	3.69	0.97
6	I follow institutional guidelines for AI use	2 (2.56)	6 (7.69)	14 (17.95)	40 (51.28)	16 (20.51)	3.95	0.88
7	I monitor student interactions with AI for fairness	3 (3.85)	9 (11.54)	18 (23.08)	38 (48.72)	10 (12.82)	3.74	0.94
8	I critically reflect on the ethical implications of AI use	4 (5.13)	10 (12.82)	20 (25.64)	36 (46.15)	8 (10.26)	3.60	0.97

The analysis of Table 5 provides a comprehensive view of primary school teachers' ethical awareness in the use of AI within classroom settings. Across all items, teachers exhibit strong attention to core ethical responsibilities, particularly regarding data privacy (M = 4.03, SD = 0.86), ensuring equitable access to AI tools (M = 3.93, SD = 0.90), and adherence to institutional guidelines (M = 3.95, SD = 0.88). These high mean scores, coupled with relatively low standard deviations, indicate a broad consensus among participants on the importance of procedural compliance and formal ethical requirements. Teachers also show considerable diligence in transparency when using AI-generated data (M = 3.86, SD = 0.91) and evaluating outputs for potential bias (M = 3.80, SD = 0.95), suggesting a growing recognition of the need for fairness and accountability in AI-mediated instructional decisions. However, comparatively lower agreement emerges for proactive ethical problem-solving (M = 3.69, SD = 0.97), monitoring student interactions for fairness (M = 3.74, SD = 0.94), and critically reflecting on the broader ethical implications of AI use (M = 3.60, SD = 0.97). These items highlight areas

where practical application of ethical reasoning and anticipatory bias mitigation is less consistently enacted. Collectively, these results indicate that while teachers demonstrate foundational knowledge and procedural adherence to ethical standards, there is room to deepen reflective practice, contextual ethical judgment, and strategic monitoring of AI interactions. Strengthening these competencies can equip educators to navigate the complex ethical landscape of AI-assisted teaching, anticipate unintended consequences, and ensure equitable, responsible, and pedagogically sound integration of AI tools in primary education.

Overall, the quantitative results indicate that teachers generally maintain favorable perceptions of AI's pedagogical utility, engage in moderate application of AI-assisted instructional practices, and exhibit robust awareness of ethical responsibilities. The data suggest nuanced patterns where confidence in the reliability of AI, integration of AI for collaborative and interactive learning, and reflective ethical reasoning remain less fully realized, pointing to strategic areas for capacity building. Collectively, these findings underscore that AI adoption in primary classrooms is progressing, yet its potential to meaningfully enhance learning outcomes is contingent on structured professional development, targeted support for collaborative implementation, and cultivation of reflective ethical practices. The synthesis of these dimensions highlights the interdependent nature of beliefs, practices, and ethical awareness, demonstrating that holistic teacher readiness involves not only favorable perceptions and procedural compliance but also deeper critical engagement, adaptive problem-solving, and continuous reflection on both pedagogical and ethical implications of AI-assisted teaching.

RQ2: How do teachers interpret the engagement experiences facilitated by AI-assisted teaching in primary education?

To address RQ2, qualitative data were collected through semi-structured interviews with 8 purposively selected teachers representing diverse AI usage patterns and 78 teachers completed the survey for context alignment. Interview protocols were designed to explore teachers' interpretations of AI-assisted teaching, focusing on beliefs, practical implementation, and ethical considerations. Questions were aligned with the three dimensions of engagement: perceived instructional benefits, classroom interactions, and reflective ethical practices. Interviews were transcribed verbatim, coded thematically, and organized to illustrate recurring patterns, variations, and contextualized insights. This approach ensures that participants' nuanced experiences, both supportive and cautionary, are captured comprehensively. The qualitative analysis revealed three overarching themes corresponding to the survey dimensions: beliefs about AI in teaching, practical integration of AI in classroom activities, and ethical awareness in AI use. Within each theme, subthemes emerged to capture variations in teachers' experiences, motivations, and perceived challenges. Representative quotations are presented in Tables 6–8, accompanied by thematic coding to illustrate the interpretive process and highlight patterns across participants.

- *Theme 1: Beliefs About AI in Teaching*

The first theme captures teachers' personal and professional beliefs about AI as an instructional tool, including perceived advantages, anticipated challenges, and alignment with pedagogical goals. The primary interview question for this theme was:

Q1: *How do you perceive the role of AI in supporting your teaching practices and enhancing student learning?*

Table 6. Theme 1: Beliefs About AI in Teaching – Coding and Original Quotes

Subtheme	Description	Participant Quotes	Code
Perceived instructional enhancement	Teachers believe AI can improve lesson delivery and student comprehension	P1: "AI helps me quickly generate exercises for different levels, making learning more tailored." P4: "It provides suggestions I might not have considered, enriching my teaching."	BEL-ENH
Professional confidence	Teachers feel more competent and informed with AI support	P2: "Knowing AI can manage routine tasks allows me to focus on explaining concepts." P6: "I feel more confident experimenting with interactive activities with AI assistance."	BEL-CONF
Anticipated limitations	Concerns about AI reliability, student overreliance, or technical errors	P3: "Sometimes I worry AI might give incorrect feedback, so I always check first." P7: "I think students could become dependent if AI is overused."	BEL-LIM
Alignment with pedagogy	AI integration supports personalized instruction and differentiated learning	P5: "It fits with my goal of addressing multiple learning paces within the same class." P8: "I can adjust the AI tasks to match my lesson plan, which helps maintain coherence."	BEL-ALIGN

The findings from Table 6 reveal a multidimensional and nuanced understanding of teachers' beliefs regarding AI integration in teaching. Teachers consistently perceive AI as a valuable tool for enhancing instructional delivery, particularly in facilitating personalized learning, differentiating instruction, and providing targeted support for students with varying abilities, as indicated by frequent references to tailoring exercises and adjusting AI tasks to lesson objectives (BEL-ENH; BEL-ALIGN). This recognition of AI's instructional affordances is closely linked with increased professional confidence, where educators report feeling more competent and able to explore interactive and adaptive teaching strategies due to AI managing routine or time-intensive tasks (BEL-CONF). Simultaneously, teachers maintain critical awareness of AI's limitations, expressing concerns about the reliability of AI-generated feedback, the potential for student overreliance, and the need for ongoing oversight to ensure instructional integrity (BEL-LIM). Such cautious reflections underscore an active negotiation process, where teachers balance automated guidance with their professional judgment, ensuring that AI enhances rather than substitutes pedagogical decision-making. Alignment with existing pedagogical frameworks emerges as a decisive factor in adoption, with teachers selectively deploying AI to reinforce learning objectives and classroom coherence, demonstrating that beliefs about AI are not merely optimistic but grounded in practical, reflective, and context-sensitive considerations. Overall, these insights illustrate that teachers' adoption of AI is informed by a combination of perceived utility, confidence in implementation, ethical and practical vigilance, and adherence to instructional philosophy, revealing a dynamic interplay between enthusiasm and critical discernment in AI-mediated teaching.

- *Theme 2: Practical Integration of AI in Classroom Activities*

The second theme captures teachers' practices, highlighting how AI is applied across instructional tasks, classroom management, and student interaction. The guiding interview question was:

Q2: *In what ways do you implement AI in your teaching, and how does it affect classroom engagement and participation?*

Table 7. Theme 2: Practical Integration of AI – Coding and Original Quotes

Subtheme	Description	Participant Quotes	Code
Individualized learning	AI is used to tailor exercises to student levels	P1: "I assign AI-generated exercises to struggling students while advanced learners get enrichment tasks." P3: "The AI adapts questions based on prior answers, which helps me focus on guidance."	PRAC-IND
Feedback and assessment	AI provides formative feedback and monitors progress	P2: "AI instantly flags errors, allowing me to correct misconceptions immediately." P5: "I can track class performance trends without spending hours grading."	PRAC-FB
Classroom engagement	AI promotes active participation and motivation	P6: "Students enjoy using AI tools; it turns practice into a game, and they remain engaged longer." P7: "They compete in AI tasks, which encourages consistent effort."	PRAC-ENG
Collaboration and interaction	AI integration supports peer-to-peer learning and cooperative tasks	P4: "I pair students to solve AI challenges together, which stimulates discussion." P8: "AI allows for group problem-solving while giving me oversight of each student's contribution."	PRAC-COL
Implementation challenges	Technical difficulties, time constraints, and uneven access	P2: "Sometimes the system lags, which disrupts the lesson flow." P3: "Not all students have equal access to devices, so I must manage rotations carefully."	PRAC-CHL

The analysis of Table 7 demonstrates that teachers' practical integration of AI in classrooms is multifaceted, reflecting both the instructional potential of technology and the contextual realities of implementation. Teachers consistently report using AI to support individualized learning, tailoring exercises to accommodate students' diverse abilities and prior knowledge, which allows them to dedicate greater attention to guidance and targeted support (PRAC-IND). Formative feedback and progress monitoring emerge as critical functions of AI in practice, with teachers emphasizing the efficiency of instant error detection, trend tracking, and timely intervention without requiring extensive manual grading (PRAC-FB). The impact on classroom engagement is also notable, as AI tools foster motivation, sustained attention, and a sense of challenge among students, often through gamified or interactive features that transform routine exercises into engaging learning experiences (PRAC-ENG). Integration for collaborative and peer-based activities is observed, although less consistently,

indicating that while AI can facilitate group problem-solving and peer interaction, adoption depends on teachers' ability to manage contributions and ensure meaningful participation (PRAC-COL). Implementation challenges further shape practical adoption, with technical disruptions, time constraints, and unequal access to devices requiring teachers to employ adaptive strategies such as task rotation and scaffolded support (PRAC-CHL). Collectively, these findings highlight that while AI offers substantial benefits in enhancing instructional efficiency, engagement, and formative assessment, successful classroom integration relies on teachers' strategic planning, real-time problem-solving, and alignment of AI use with pedagogical objectives, emphasizing that technology adoption is both an opportunity and a nuanced practice shaped by contextual constraints.

- *Theme 3: Ethical Awareness in AI Use*

The third theme captures teachers' attention to ethical principles, focusing on fairness, data privacy, accountability, and reflective practice. The guiding interview question was:

Q3: *How do you consider ethical implications when integrating AI into your classroom practices?*

Table 8. Theme 3: Ethical Awareness in AI Use – Coding and Original Quotes

Subtheme	Description	Participant Quotes	Code
Data privacy	Teachers ensure student data is protected when using AI	P1: "I never share student AI data without consent and ensure passwords are secure." P5: "Privacy is my top concern; I check settings before assigning AI tasks."	ETH-DP
Equity and access	Ensuring all students benefit fairly from AI tools	P2: "I rotate devices and provide alternative tasks for those who cannot use AI simultaneously." P7: "I adjust lessons so no student is left behind due to technological gaps."	ETH-EQ
Monitoring and accountability	Teachers actively monitor AI outputs and student interactions	P3: "I always verify AI feedback before sharing it with students." P6: "I intervene when AI suggestions seem biased or misleading."	ETH-MON
Reflective ethical reasoning	Teachers critically evaluate potential consequences and biases	P4: "I think about how AI might influence student thinking patterns and adjust tasks accordingly." P8: "I reflect on whether AI is reinforcing fairness and not unintentionally disadvantaging some students."	ETH-REF

The analysis of Table 8 illustrates that teachers exhibit a pronounced ethical awareness in their use of AI, encompassing multiple dimensions critical for responsible integration. Data privacy is prioritized, with educators consistently safeguarding student information, controlling access, and verifying security settings before assigning AI-facilitated tasks (ETH-DP). Equity and access also emerge as central concerns, as teachers employ strategies such as rotating devices, providing alternative tasks, and adjusting lessons to ensure all students can meaningfully participate regardless of technological constraints (ETH-EQ). Monitoring and

accountability are actively practiced, with teachers reviewing AI-generated feedback and student interactions to prevent errors, bias, or misleading outputs, maintaining both instructional integrity and fairness (ETH-MON). Reflective ethical reasoning, while present, is applied less consistently, suggesting that although teachers follow procedural guidelines, deeper engagement with potential long-term consequences, systemic biases, and unintended impacts on student learning remains an area for growth (ETH-REF). These findings indicate that teachers' ethical practices are strongly rooted in compliance and practical oversight, yet developing critical and anticipatory ethical judgment is necessary to enhance comprehensive responsibility in AI-mediated instruction. Overall, the data suggest that targeted professional development focusing on scenario-based ethical reflection, bias recognition, and decision-making frameworks could support teachers in extending beyond procedural adherence to a more nuanced, context-sensitive approach to AI ethics, thereby reinforcing trust, equity, and accountability in primary education settings.

The qualitative findings illustrate a comprehensive perspective on teachers' interpretations of AI integration, highlighting coexisting advantages and challenges across beliefs, practices, and ethical awareness. Teachers perceive AI as a valuable pedagogical resource, enhancing instructional quality, student engagement, and individualized learning opportunities. Implementation practices are generally aligned with these beliefs, although contextual constraints such as technology access, time management, and collaborative integration moderate the depth of adoption. Ethical awareness is robust at the procedural level but requires further development in reflective, anticipatory reasoning to ensure responsible and equitable AI use. Collectively, the data reveal that teachers are actively negotiating the balance between technological affordances and professional judgment, demonstrating adaptive strategies to optimize learning outcomes while safeguarding ethical standards. This synthesis underscores the need for targeted professional development, infrastructural support, and reflective practices to strengthen teachers' ability to integrate AI effectively and ethically, bridging the gap between theoretical potential and practical classroom realities.

DISCUSSION

The findings of the present study reveal a multifaceted and nuanced landscape of primary school teachers' beliefs, practical implementation, and ethical considerations regarding AI-assisted teaching, reflecting both the promise and the complexities inherent in integrating AI technologies into classroom pedagogy. Teachers' beliefs about AI, as evidenced through structured surveys and semi-structured interviews, indicate a generally favorable perception of its potential to enhance instructional effectiveness, support differentiated learning, and facilitate student-centered engagement. Participants recognized AI as a tool that can personalize learning pathways, offer adaptive scaffolding, and maintain sustained student interaction through gamified or interactive platforms. These observations align with extant research highlighting the capacity of AI to support individualized learning trajectories, reduce cognitive load for educators, and provide data-informed insights for instructional decision-making (Du, 2025; Stolpe & Hallström, 2024). Despite these positive inclinations, the study also uncovered a spectrum of cautious appraisals, including concerns over the reliability and interpretability of AI outputs, potential overreliance by students, and limitations in fostering higher-order cognitive skills when teacher mediation is minimal. These insights underscore a critical awareness among teachers that AI functions as a complementary, rather than substitutive, element in education, with pedagogical judgment, contextual understanding, and professional expertise remaining indispensable to meaningful learning outcomes (Gardner et al., 2021; Villarino, 2025).

In terms of practical implementation, teachers employed AI across a range of classroom activities, from supporting individualized assignments and streamlining formative assessment to facilitating collaborative problem-solving and enhancing engagement during instructional sequences. The findings demonstrate that AI was leveraged to reduce the administrative burden, provide real-time feedback, and enable educators to allocate more attention to monitoring, scaffolding, and personalized student support. This reflects prior research suggesting that effective technology integration depends on the alignment of digital tools with instructional objectives and pedagogical strategies that prioritize learning outcomes over technological novelty (Cooper, 2023; Gottlieb et al., 2023). At the same time, teachers identified operational challenges, including unequal device access, varying student digital literacy, intermittent connectivity issues, and occasional limitations in AI adaptability. To mitigate these constraints, educators implemented adaptive strategies such as rotational access, guided task scaffolding, and preemptive troubleshooting. These measures highlight the importance of context-sensitive interventions and flexible classroom management in optimizing AI-supported learning.

Ethical considerations emerged as a central dimension of AI integration. Teachers demonstrated strong procedural awareness regarding student data privacy, equitable access, and adherence to institutional protocols. Qualitative insights indicate that educators actively monitored AI outputs, adjusted instructional tasks to ensure fairness, and maintained vigilance over sensitive student information. However, anticipatory reflection on potential biases in AI algorithms and critical engagement with long-term ethical implications were inconsistently applied, suggesting an area for professional growth. These observations align with the broader literature emphasizing that responsible AI adoption requires more than compliance; it necessitates proactive ethical reasoning, critical assessment of algorithmic outputs, and consideration of potential unintended consequences for learning equity and digital literacy development (Hornberger et al., 2023; Kelly et al., 2025; Perkins et al., 2025). Scenario-based professional development, iterative reflective practices, and collaborative ethical discussions are therefore recommended to enhance teachers' competence in navigating these challenges while maintaining pedagogical integrity.

Synthesizing the quantitative and qualitative findings, it becomes evident that favorable teacher beliefs are mirrored in deliberate, purposeful AI-assisted practices, with ethical awareness functioning as a guiding framework. The interplay between beliefs, practice, and ethics underscores a dynamic process of teacher adaptation, negotiation, and reflective decision-making, where positive experiences include increased instructional efficiency, heightened student engagement, and more personalized learning opportunities. Simultaneously, areas of tension remain, particularly around technological limitations, variability in student engagement patterns, and the need for deeper critical reflection on ethical implications. This duality underscores the importance of comprehensive professional development programs that integrate technical, pedagogical, and ethical dimensions, preparing educators to critically assess AI recommendations, contextualize interventions, and adapt teaching strategies responsively (Huang et al., 2023; Lee, 2023).

The study further underscores that the successful integration of AI into primary classrooms hinges not merely on access to technology but critically on teachers' interpretive, evaluative, and decision-making capacities. Effective implementation requires educators to carefully scrutinize AI-generated outputs, assess their alignment with curriculum objectives, and strategically determine when to accept, modify, or override automated recommendations to maintain pedagogical coherence. This evaluative process extends to balancing AI-driven

suggestions with learners' individual needs, ensuring that behavioral participation, cognitive engagement, and emotional investment are continuously nurtured. Teachers engage in iterative adjustments, calibrating levels of student autonomy, providing scaffolding where necessary, and adapting instructional sequences in response to ongoing feedback from both AI systems and classroom interactions. Such practices illustrate the intricate pedagogical judgment demanded in AI-mediated teaching, encompassing foresight, contextual awareness, and responsiveness to the dynamics of learning. By framing AI as a complementary instructional assistant rather than a substitute for teacher expertise, educators are able to leverage its technological affordances—including personalized feedback, progress monitoring, and adaptive learning pathways—while preserving professional accountability, fostering learner agency, and sustaining rich, meaningful, and developmentally appropriate learning experiences. This approach positions AI as a tool that enhances instructional quality when mediated through skilled and reflective teaching practice, emphasizing the inseparability of technology, pedagogy, and ethical responsibility in contemporary education.

Overall, the study advances the understanding of AI as a teaching assistant in primary education by illustrating the interdependent relationships among beliefs, practices, and ethical considerations. It demonstrates that AI adoption is a multifaceted process, contingent on teacher expertise, contextual conditions, and reflective engagement with ethical imperatives. While AI offers clear potential to enhance instructional efficiency and enrich student learning experiences, its effectiveness is mediated by teachers' competencies, institutional support, and critical ethical reasoning. The findings suggest that future interventions should prioritize professional development targeting technical proficiency, reflective pedagogical strategies, and ethical scaffolding, alongside resource allocation to address inequities. This study contributes to the literature by elucidating the mechanisms through which AI influences teaching and learning and by highlighting the ongoing challenges in translating AI's theoretical potential into sustainable, equitable, and pedagogically meaningful practice.

CONCLUSION

The present study provides a comprehensive examination of primary school teachers' beliefs, classroom practices, and ethical considerations regarding the integration of AI as a teaching assistant. The findings indicate that teachers generally perceive AI as a valuable pedagogical tool capable of enhancing instructional efficiency, supporting individualized learning, and increasing student engagement. Practical implementation reflects this orientation, with teachers strategically leveraging AI to provide formative feedback, scaffold differentiated activities, and facilitate collaborative learning experiences, while simultaneously negotiating technological and contextual constraints. Ethical awareness emerges as a foundational element of AI integration, with teachers attentive to privacy, equity, and accountability, though reflective consideration of potential biases and long-term impacts remains an area requiring further cultivation. Collectively, these insights highlight that effective AI adoption in primary classrooms is contingent upon teachers' capacity for critical evaluation, contextual adaptation, and pedagogically informed decision-making, reinforcing the centrality of professional judgment in technology-mediated instruction. Implications of the study emphasize the need for targeted professional development programs focusing on ethical reasoning, AI literacy, and pedagogical integration strategies, alongside institutional support to address infrastructure and access disparities. Limitations include the study's focus on a regional sample within East Java and the relatively small purposive interview group, which may constrain generalizability. Future research could expand to diverse educational contexts, longitudinally examine the sustainability of AI-assisted practices, and explore student

perspectives on AI-mediated learning experiences. Overall, this study underscores that AI's potential in primary education can be fully realized when coupled with informed, reflective, and ethically grounded teaching practices.

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