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Research Paper

High School Mathematics Teachers' Perception on Artificial Intelligence as a Tool to Enhance Students' Conceptual Understanding and Critical Thinking

Melvin A. Alonzo*, Joe Art E. Pague, Marvi Diane D. Tumapon, Shiela P. Dio, Genesis B. Naparan
Saint Columban College, Philippines

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Abstract

This study seeks to explore the views of secondary school mathematics teachers on the use of Artificial Intelligence (AI) as a tool to enhance students' conceptual understanding and critical thinking skills. It also examines the challenges they encountered when using AI in their classroom instruction. The study used a descriptive quantitative research design involving 33 mathematics teachers in selected public secondary schools in Iligan City, Philippines. A structured questionnaire was used to gather data from the respondents. The findings of the study revealed that teachers have a high positive perception of the use of AI in enhancing both students' conceptual understanding and critical thinking skills. In terms of challenges, teachers have a high positive perception that they face challenges in the ethical use of AI in their mathematics instruction. The study contributes to the practical knowledge of AI application in mathematics education and provides guidance for future research and policy development to improve teaching and learning practices with AI from the perspective of mathematics teachers.

Keywords: *Artificial Intelligence, Conceptual Understanding, Critical Thinking, Mathematics Instruction*

INTRODUCTION

One of the many technological advancements is the advent of artificial intelligence (AI), which is shifting how mathematics teachers deliver classroom instruction and how learners engage. This technology promotes individualized learning, enhances engagement, and improves conceptual understanding and critical thinking skills. AI also produces tools that provide instant feedback and an adaptable learning strategy, allowing students to learn at their own pace and enabling teachers to differentiate instruction to meet diverse learning needs. It can assist teachers in planning classes, grading, and accessing statistics that show where students are not learning as much, helping improve their teaching methods (Lee, S., & Song, K., 2024).

The use of AI in the mathematics classroom invites both opportunities and risks. While AI can benefit both students and teachers, it can also pose several risks that may negatively affect the student learning process. Manto et al. (2026) noted that AI use in mathematics instruction may foster overreliance on technology, which can lead to reduced cognitive effort, challenges with assessment validity, academic integrity, and teacher readiness to integrate AI effectively into teaching. Meanwhile, teachers who understand the value of AI tools to enhance conceptual understanding, provide quick feedback, and encourage critical thinking are more likely to incorporate and use these technologies effectively in the classroom. Thus, teachers' perceptions are a key mediating factor between AI technologies and students' learning outcomes (Wang et al., 2023; Velli & Zafiropoulos, 2024).

Opposing views on AI's contribution to developing students' conceptual understanding and critical thinking imply a limited view of AI as an efficient learning tool. Also, little is known about how teachers interpret AI-generated feedback and how that feedback informs their instructional

Corresponding author's email: melvin.alonzo@sccpag.edu.ph

decisions and support for students' conceptual understanding and critical thinking development (Holmes et al., 2019; Zawacki-Richter et al., 2019). Moreover, less attention has been paid to teachers' opinions and classroom experiences with deploying AI tools in classroom teaching. This creates a gap in the research, given that instructors are the implementers of AI-assisted instruction and constitute a crucial component of assessing the effectiveness of these tools when incorporated into classroom practice. This difference calls for more empirical research on teachers' perceptions. Therefore, this study intends to fill this gap by exploring teachers' perceptions of AI in boosting conceptual knowledge and critical thinking using a descriptive quantitative method.

To address this gap, the study focused on teachers' perceptions of Artificial Intelligence (AI) in mathematics instruction. Specifically, it sought to determine teachers' views on the use of AI in mathematics teaching and examined the following: (1) teachers' perceptions of the use of AI to improve students' conceptual understanding, (2) teachers' perceptions of the use of AI to improve students' critical thinking skills, and (3) the challenges teachers face in using AI in their teaching practices.

This study contributes to the growing body of literature on educational technology by addressing gaps and providing empirical insights from the perspective of mathematics teachers. Practically, the findings can inform curriculum developers, school administrators, and policymakers in designing targeted professional development programs, establishing clear guidelines for academic integrity, and supporting teachers in effectively leveraging AI to enhance learning while mitigating the risks of over-reliance.

LITERATURE REVIEW

Artificial Intelligence (AI) is becoming an increasingly transformational tool for education, teaching, and learning. The number of application systems that offer intelligent tutoring has increased dramatically. Adaptive learning platforms and other AI-generated tools are increasingly used in instructional classroom settings to match learning and bolster student performance. All these technologies are deliberately designed to improve conceptual understanding by providing real-time feedback and adaptive information that is suitable for students' needs (Holmes et al., 2019; Zawacki-Richter et al., 2019).

AI has been progressively transforming educational approaches through personalized learning, adaptive teaching, and data-driven decisions to improve teaching and learning experiences. New research shows that AI-driven intelligent tutoring systems and generative AI apps can accelerate student learning through personalized instruction, interactive experiences, and feedback. However, there is one caveat, and that is the teachers themselves, who are vital to directing the use of AI and ensuring it meets the purposes of education. AI is not only a technology but also a meaningful learning method. Thus, it is very important to understand educators' perspectives on whether AI supports or inhibits educational success (Holmes et al., 2019; Zawacki-Richter et al., 2019). Furthermore, because teachers are the ones in control of AI, they are irreplaceable by this technology (Orhani, 2023).

With the adoption of Artificial Intelligence (AI) in contemporary mathematics education, including Intelligent Tutoring Systems (ITS), generative AI such as Large Language Models (LLMs), and dynamic computational environments, the pedagogical focus has shifted from passive procedural drill-and-practice to deeper cognitive engagement. Research indicates that teachers can view AI as a useful tool when it is integrated with learner-centered strategies and supported by technical competency and pedagogical infrastructure for its adoption (Timotheou et al., 2022). AI generates dynamic inquiry-based learning environments for students that encourage reflection on reasoning and the development of alternative ways to solve problems. Conversely, studies have shown that excessive dependence on AI technologies hinders students' cognitive processes and

independent thinking, adversely affecting the development of higher-order thinking skills. This dual approach underscores the necessity of using AI as a tool rather than a substitute for human thinking and of maintaining the basic function of teachers to encourage critical interaction with AI-generated content (Chan & Tsi, 2024; Darwin et al., 2023).

Students' conceptual understanding in mathematics enables them to transfer knowledge, connect abstract symbols to visual representations, and reason through nonconventional problems (Bognar et al., 2025). Conceptual understanding in mathematics is an understanding of mathematical concepts, procedures, and relations. Some of the major strategies teachers believe artificial intelligence uses to improve conceptual understanding include: providing students with opportunities to visually explore abstract mathematical structures, such as functions, geometric transformations, and statistical distributions, through computational systems and AI-driven platforms. These platforms and systems support multiple, dynamic representations (Bognar et al., 2026). Research suggests that linking various representations, such as visual, symbolic, and verbal, may reduce extraneous cognitive load and make abstract concepts more tangible.

Intelligent tutoring tools can evaluate student error patterns in real time and provide targeted feedback and scaffolding. As Bognar et al. (2025) and Timotheou et al. (2022) note, adaptive systems not only indicate whether an answer is correct or incorrect but also offer conceptual hints to students, presented in a step-by-step format. These cues prompt students to recognize basic mathematical principles and correct errors independently. Teachers have observed that AI systems facilitate differentiated instruction by aligning problem difficulty with the varying levels of mastery demonstrated by different students. This approach engages children in cognitively demanding tasks appropriate to their zone of proximal development, helping consolidate conceptual foundations rather than prompting premature memorization of algorithmic information (Bognar et al., 2025).

Mathematical critical thinking includes using logical reasoning, asking questions, evaluating multi-step solutions, considering alternative strategies, and reflecting metacognitively (Bognar et al., 2025; Tirschwell & Horton, 2025). Critical thinking in mathematics also includes assessing different tactics. Educators can recognize that AI technologies foster critical thinking skills in many ways. Routine computational and procedural tasks are delegated to digital and artificial intelligence systems, allowing students to focus their mental resources on modeling, hypothesis testing, and the evaluation of mathematical arguments (Tirschwell & Horton, 2025). This shift from calculation to higher-order reasoning liberates students to focus on higher-order reasoning techniques.

As students use conversational AI models, they need to write effective math prompts, evaluate whether the AI's proofs or steps are valid, and identify any logical flaws or 'hallucinations.' Two such activities are Socratic dialogue and prompt engineering. This evaluation method turns students from passive consumers of mathematical reasoning into critical auditors of it. Generative artificial intelligence tools serve as collaborative problem-solving partners, enabling effective metacognitive engagement and strategic problem-solving. Teachers have found that students become more metacognitively aware and strategically flexible when they consider why an artificial intelligence proposed a particular approach or when they contrast AI-generated strategies with traditional approaches (Bognar et al., 2025; Timotheou et al., 2022).

RESEARCH METHOD

A descriptive quantitative research design was used to investigate in depth the viewpoints of secondary school instructors on the use of AI to enhance students' conceptual understanding and critical thinking skills. This design provided insight into the characteristics or phenomenon of the population under investigation without attempting to establish causal relationship (Slater & Hasson, 2024).

The study was conducted at selected public secondary schools in Iligan City, Philippines, particularly in the West 1 and West 2 Districts, which comprise six schools where the integration of Artificial Intelligence (AI) tools into classroom instruction is actively promoted. These institutions were selected for their involvement in digital education programs and the variation in their technological infrastructure. The study environment includes classrooms with interactive whiteboards, computer labs, and internet connections that allow teachers to employ AI-powered educational applications, such as adaptive learning platforms, automated grading tools, and intelligent tutoring systems. The schools also hosted quarterly professional development seminars on technology integration, where staff could improve their digital literacy and pedagogical skills. Moreover, the setting reflects a diverse student population in terms of socioeconomic backgrounds, learning requirements, and academic performance. This variability enabled a wide range of explorations of teachers' perceptions of the effects of AI on students' conceptual understanding and critical thinking skills in diverse circumstances.

The participants in this study are junior high school mathematics teachers who currently teach academic courses with an emphasis on conceptual understanding and critical thinking skills. These teachers are selected because they are actively teaching under the new curriculum, supporting learning, and directly assessing students' higher-order thinking, which positions them well to share valuable insights about the use of artificial intelligence (AI) in the classroom.

The respondents in this study are the thirty-three (33) mathematics teachers selected from secondary schools in the West 1 and West 2 districts. They were selected for their experience integrating Artificial Intelligence (AI) tools into their mathematics instruction. Purposive sampling was used to recruit teacher respondents. This approach is often used in educational research to ensure that respondents have the necessary competencies (Etikan & Bala, 2017). This technique ensured that the data were collected from mathematics teachers with experience using AI. In recent AI studies in education, purposive sampling has been used to gather insights from teachers experienced in technology-enhanced learning environments (Fernández-Batanero et al., 2022; Shaikh, 2023).

The research tool underwent validation by 3 experts in the field of mathematics education. The validators were given an assessment tool to provide numerical scores and remarks to further improve the research instrument. The research tool adapted items that were thoroughly examined and adjusted to reflect the specific aims of the research and the local educational setting. Some of the remarks were paraphrased for clarity and suitability to the context, but the original intent of the constructs measured was preserved. The validation tool has three domains: construct and content validity, clarity and language precision, and usability and design structure.

The construct and content validity domain has a combined mean rating of 4.00 and is described as acceptable. All its indicators are above the acceptable rating. This implies that the research instrument has construct and content validity as viewed by qualified validators. Moreover, clarity and language precision have a combined mean rating of 4.13 and are described as acceptable. This suggests that the research instrument uses language that is easy for respondents to understand. Lastly, the instrument usability and design structure have a combined mean rating of 4.00 and are described as acceptable. All its indicators are above the acceptable rating. Overall, the instrument has an overall mean of 4.02. This mean rating falls within the acceptable range, indicating that the research instrument can be used to measure respondents' insights.

Table 1. Research Instrument Validation

	Criteria	Weighted Mean	Descriptive Interpretation
	Construct & Content Validity		
1.	The items directly align with the overarching research objectives and sub-questions.	4.00	Acceptable
2.	The instrument comprehensively covers all essential dimensions/variables of the construct.	4.00	Acceptable
3.	The items are grounded in relevant theories, literature, or established frameworks.	4.33	Highly Acceptable
4.	The instrument avoids unnecessary, irrelevant, or redundant questions.	4.00	Acceptable
5.	The scale or response categories used are appropriate for measuring the intended variables.	3.67	Acceptable
	Combined Mean	4.00	Acceptable
	Clarity & Language Precision		
1.	The language used is clear, direct, and free of technical jargon (unless required by the target audience).	3.67	Acceptable
2.	Items are free from double-barreled structures (asking two distinct questions in one item).	4.00	Acceptable
3.	The wording is neutral, objective, and avoids leading or biased assumptions.	4.33	Highly Acceptable
4.	The instructions provided at the beginning and within sections are explicit and easy to follow.	4.67	Highly Acceptable
5.	The statements are grammatically correct and free of typographical errors.	4.00	Acceptable
	Combined Mean	4.13	Acceptable
	Instrument Usability & Design Structure		
1.	The questionnaire follows a logical flow (e.g., general to specific, thematic grouping).	4.00	Acceptable
2.	The estimated completion time is reasonable and avoids participant fatigue.	4.33	Acceptable
3.	The formatting and visual layout are clean, consistent, and easy to navigate.	3.67	Acceptable
4.	The privacy, anonymity, and informed consent disclosures are clearly communicated.	3.67	Acceptable
5.	The overall layout minimizes cognitive load and potential response bias.	4.00	Acceptable
	Combined Mean	3.93	Acceptable
	Overall Mean	4.02	Acceptable

Legend: 1.00-1.80 Not Acceptable; 1.81-2.60-Least Acceptable; 2.61-3.40 Moderately Acceptable; 3.41-4.20 Acceptable; 4.21-5.00 Highly Acceptable

The level of agreement among respondents was measured by computing the weighted mean score for each item of the questionnaire using the following formula.

Where;

$$\text{Weighted Mean} = \frac{\Sigma_1^n w_i x_i}{\Sigma_1^n w_i}$$

x_i = weighted mean variable

w_i = weighted value

A weighted mean is a type of average in which data points are assigned different weights or levels of importance before the average is calculated, so that more important data has a greater impact on the average than in a basic mean.

To ensure the ethical conduct of the study, the researchers obtained approval from the schools where the respondents are affiliated. After approval, the informed consent form was administered to ensure that respondents participate voluntarily and are aware of their right to refuse and withdraw from participation. The study also adheres to Republic Act 10173, otherwise known as the Data Privacy Act of 2012, to ensure that respondents' identities and other personal information are kept confidential.

FINDINGS AND DISCUSSION

This section presents the findings and their corresponding discussions of the answers to the research questions raised in this study. Specifically, it discusses the following points: teachers' perceptions of the use of Artificial Intelligence to enhance students' conceptual understanding in the teaching of mathematics; teachers' perceptions of the impact of Artificial Intelligence on improving students' critical thinking skills in teaching mathematics; and the challenges encountered by mathematics teachers in integrating Artificial Intelligence in the classroom.

Perceptions of Teachers Towards the Usage of Artificial Intelligence (AI) to Enhance Students' Conceptual Understanding in the Teaching Of Mathematics

Table 2 presents teachers' perceptions of using artificial intelligence (AI) to improve students' conceptual understanding. The total composite mean score is 3.72, which falls within the "High Positive Perception" range as per the legend provided. This suggests that, overall, teachers are optimistic about AI's role in helping students understand complex ideas. AI-powered instructional programs allow students to learn complex ideas through individual questions, with a mean score of 4.09, according to teachers. Teachers also felt confident in their ability to use AI-based platforms to support conceptual learning in their classrooms (mean = 4.02). Moreover, teachers believe that students gain greater knowledge and understanding of the subjects taught when they participate in AI-supported lessons (mean = 3.72). They also believe AI technologies are effective in addressing gaps in students' understanding of difficult aspects of the curriculum (M = 4.06). The mean value of 3.57 suggests that teachers feel sufficiently qualified and equipped to use AI to deepen conceptual understanding. One issue was rated a "Moderate Perception" score (mean = 2.87), indicating that some teachers are still struggling to employ AI technology in the classroom to enhance conceptual understanding. The overall attitude is encouraging, but there are challenges in the proper implementation of AI that may be related to individual teacher training or institutional support. Zawacki-Richter et al. (2019) also noted this difficulty, stating that the successful implementation of AI in education is often hampered by challenges such as poor training and a lack of institutional resources.

Table 2. Teachers perceive the use of AI in enhancing students' conceptual understanding

Criteria	Weighted Mean	Descriptive Interpretation
1. AI driven instructional tools make it easier for students to understand complicated topics in my subject area. (Holmes, et al. 2019)	4.09	High Positive Perception
2. I am confident in my abilities to use AI based platforms to support conceptual learning in my classroom (Chounta et al., 2022)	4.02	High Positive Perception
3. After going thorugh AI-supported classes, my students have a beter knowledge of the concepts. (Zawacki-Richter at al., 2019)	3.72	High Positive Perception
4. I struggle to use AI tools in my teaching for the purpose of improving conceptual understanding.	2.87	Moderate Perception
5. I think AI technologies are good at enabling students to fill in the gaps in their grasp of tough topics (Holmes, et al., 2019)	4.06	High Positive Perception
6. I am adequately trained and resourced to use AI to improve students' conceptual understanding. (Huang et al., 2023)	3.57	High Positive Perception
Combined Mean	3.72	High Positive Perception

Legend: 1.00-1.80 Very Low Positive Perception; 1.81-2.60 Low Positive Perception; 2.61-3.40 Moderate Perception; 3.41-4.20 High Positive Perception; 4.21-5.00 Very High Positive Perception

To summarize, the findings suggest that teachers would likely view AI as a helpful tool to enhance students' conceptual understanding. These findings align with Chen et al. (2020), which report that most teachers are aware of AI's potential to support deeper learning, but that ongoing professional development and robust support systems are needed to realize its benefits. This requires continued support, training, and tools to enable all teachers to successfully incorporate AI into their teaching practice.

Teachers' Perceptions of the Impact of Artificial Intelligence on Improving Students' Critical Thinking Skills

Teachers' assessment of the application of artificial intelligence (AI) to improve students' critical thinking skills is presented in Table 3. The overall mean score for all items is 3.71. This falls within the "High Positive Perception" range according to the set legend. This suggests that teachers tend to hold a positive opinion on the role of AI in fostering students' critical thinking skills. A more detailed examination of the individual criteria provides crucial information. Teachers agree that AI-powered instructional technologies foster the development of critical thinking abilities in students by engaging them in activities that involve analysis and problem-solving, as evidenced by a weighted mean of 3.69. This indicates that teachers value the role of AI in developing learning environments that require critical thinking and engagement in higher-order thinking tasks. Teachers were also comfortable implementing AI-based tasks in which students are required to analyze facts and make judgments (highest mean score of 3.87 for this item). This suggests that teachers are generally ready and prepared to integrate AI into their teaching tactics to improve students' critical thinking skills. Additionally, teachers report that students show stronger critical

thinking skills when participating in AI-supported activities, with a mean score of 3.51. The findings suggest that AI-powered learning experiences have the potential to foster critical thinking skills. However, teachers also recognize the difficulties of using AI effectively in this context. The item on barriers, including lack of training and limited resources, also obtained a mean of 3.87 ("High Positive Perception").

This indicates that while teachers have positive perceptions, they are aware of significant barriers that may prevent the full implementation and use of AI technologies to build critical thinking skills. Finally, teachers believe that their schools promote the proper use of AI to develop critical thinking, with a mean score of 3.63. This suggests institutional support, which is vital for the successful incorporation of AI in educational contexts.

Table 3. Teachers' Perceived Use of AI in improving students' critical thinking skills

Criteria	Weighted Mean	Descriptive Interpretation
1. AI-enhanced instructional technologies encourage students to develop critical thinking skills through analysis and problem-solving (Choi & Lee, 2023).	3.69	High Positive Perception
2. I am comfortable incorporating AI exercises where students are evaluating information and making decisions. (Holmes et al., 2019)	3.87	High Positive Perception
3. My students show better critical thinking skills when they are working on activities helped by AI. (Zawacki-Richter et al., 2019).	3.51	High Positive Perception
4. With proper training and resources, AI can be effectively integrated into teaching strategies to enhance students' critical thinking skills	3.87	High Positive Perception
5. My school encourages me to use AI appropriately to develop students' critical thinking skills. (Huang et al., 2023).	3.63	High Positive Perception
Combined Mean	3.71	High Positive Perception

Legend: 1.00-1.80 Very Low Positive Perception; 1.81-2.60 Low Positive Perception; 2.61-3.40 Moderate Perception; 3.41-4.20 High Positive Perception; 4.21-5.00 Very High Positive Perception

Statistics and ongoing professional development will be crucial to overcoming these barriers and maximizing AI's positive impact on students' critical thinking skills. Research consistently shows that targeted professional development and continuous institutional support significantly enhance teachers' ability to implement AI effectively in instruction, thereby improving student outcomes (Wang et al., 2023; Yue et al., 2024; Tammets & Ley, 2023). These studies emphasize that when teachers receive dedicated training and ongoing support, they are more confident and competent in facilitating AI-driven activities that foster critical thinking, problem-solving, and deeper learning among students (Du et al., 2024; Holmes et al., 2019).

Challenges Encountered by Mathematics Teachers in the Integration of Artificial Intelligence (AI) in Classroom Instruction

The problems teachers face when using artificial intelligence (AI) in their teaching techniques are presented in Table 3. The combined mean score is 3.50, which falls within the "High Positive Perception" range according to the legend provided. This indicates that, generally,

instructors acknowledge and agree that they encounter many problems in integrating AI into education. A closer look at the individual criteria provides subtle insights into the nature and scope of these challenges.

Table 4. The challenges teachers encounter in using AI in their teaching practices

Criteria	Weighted Mean	Descriptive Interpretation
1. I don't have the training to be productive with AI technologies in my teaching (Celk et al., 2022).	3.51	High Positive Perception
2. When I integrate AI in my classroom, I have technical challenges (bugs in the program, restrictions of the hardware, etc.) (Chounta et al., 2022).	3.57	High Positive Perception
3. My school provides support or infrastructure to use AI in teaching (Huang et al., 2023).	3.36	Moderate Perception
4. I am also concerned about the ethics of employing AI in the classroom (e.g. data privacy, bias). (Holmes et al., 2019)	3.81	High Positive Perception
5. The curriculum is not yet in sync with the deployment of AI technologies (Zawacki-Richter et al., 2019)	3.27	Moderate Perception
Combined Mean	3.50	High Positive Perception

Legend: 1.00-1.80 Very Low Positive Perception; 1.81-2.60 Low Positive Perception; 2.61-3.40 Moderate Perception; 3.41-4.20 High Positive Perception; 4.21-5.00 Very High Positive Perception

The first criterion, with a mean score of 3.51, shows that teachers believe they do not have enough training to use AI technologies productively in their instruction. This indicates the need for training in AI integration and professional development for most educators. The rapid pace of AI tool development and the complexity of these technologies may leave teachers feeling unprepared or ill-equipped to use AI effectively in the classroom. Second, technological obstacles are also widely cited by teachers as a main barrier, as indicated by the mean score of 3.57. These include defects in AI programs, hardware constraints, and other technology-related challenges. Such obstacles can hinder teaching and learning, making teachers reluctant or less inclined to include AI in their usual educational activities. The mean score for the criterion considering the absence of assistance and infrastructure at schools was 3.36, which is regarded as "Moderate Perception." This indicates that teachers are split on whether institutional support and resources for AI integration are adequate. Some may feel supported, while others may believe they lack the infrastructure they need, such as reliable internet, updated technology, or technical assistance. Ethical considerations were also a major challenge, with instructors agreeing (mean = 3.81) that difficulties such as data privacy and algorithmic prejudice arise when implementing AI in the classroom. The high mean score shows the need to take ethical concerns into account and to ensure that teachers are aware of and equipped to address such issues in order to safeguard children and maintain educational standards. Lastly, the criterion that the curriculum is not adapted to the use of AI technology obtained a "Moderate Perception" mean score of 3.27. This result shows that while for some teachers the curriculum may be a barrier to effectively integrating AI, for others this may not be a major concern. This neutrality may be an indication of distinct curricular frameworks in various schools or areas, or of differing ideas of freedom in curriculum. The results indicate that teachers usually have good attitudes about the use of AI to support students' conceptual comprehension and critical thinking skills, while there are some remaining obstacles.

The combined mean score for teachers' perceptions is 3.72 ("Moderate Perception"), suggesting hope that AI can help students learn difficult subjects. Teachers agree that AI technologies make learning easier (mean = 4.09) and are confident using AI platforms (mean = 4.02). However, some teachers feel ambivalent about their capacity to use AI in their teaching (mean = 2.87), indicating a need for greater support and training. These findings align with broadly positive attitudes documented in prior studies (Holmes et al., 2019; Zawacki-Richter et al., 2019) and underscore persistent challenges related to teacher preparedness.

Furthermore, teachers consider AI helpful in fostering students' critical thinking (combined mean = 3.71, "High Positive Perception"). Respondents felt comfortable using AI in activities that enhance analysis and decision-making (mean = 3.87) and observed improvement in students' critical thinking (mean = 3.51). Importantly, teachers acknowledge the benefits but also cite major challenges, such as a lack of training and resources (mean = 3.87). This aligns with the findings of Choi & Lee (2023) and Celik et al. (2022); however, the current study is more specialized in terms of institutional support and continual professional development.

The overall mean for obstacles faced is 3.50 ("High Positive Perception"), indicating that teachers encounter considerable challenges in integrating AI into education. The primary problems are inadequate training (mean=3.51), technical concerns (mean=3.57), and ethical issues, such as data privacy (mean=3.81). Support and infrastructure at schools received a "Neutral" rating (mean = 3.36), suggesting variation across settings. These results align with previous studies (Celik et al., 2022; Huang et al., 2023) but underscore the ongoing need for substantial support mechanisms.

Previous research consistently shows positive teacher attitudes toward AI, but the present findings suggest ongoing obstacles, especially in teacher preparedness, institutional support, and ethical issues. It also places further emphasis on practical hurdles (training, resources, technical issues) that may not have been fully addressed in prior papers, showing that optimism about AI is tempered by real-world constraints.

CONCLUSIONS

The study's findings revealed that teachers hold a highly positive perception of using AI to enhance their students' conceptual understanding. In particular, most teachers perceived that AI-driven instructional tools make it easier for students to understand complex topics. However, they also reported struggling to use AI tools to improve students' conceptual understanding. This positive perception suggests that AI is used in the classroom to discuss complex topics, yet teachers face challenges in aligning its use specifically to improve conceptual understanding.

The teachers also held a highly positive perception of using AI to improve students' critical thinking. In particular, they reported being comfortable incorporating AI exercises in which students evaluate the information they receive and make decisions based on it. However, they also reported that they perceive barriers, such as a lack of training and limited resources, in applying AI to develop students' critical thinking. The results suggest that, while teachers see AI as a useful tool, they encounter difficulty because they lack training and infrastructure to use these tools.

In terms of challenges, the teachers held a highly positive perception that they face challenges in using AI. They raised the highest concern about the ethical use of AI in the classroom. This shows that the use of AI raises ethical concerns among teachers. They perceived that there might be a privacy breach that may occur upon its use.

Practically, the findings suggest that mathematics teachers should receive training on the use of Artificial Intelligence in their classroom instruction. The school administrators may arrange training and tap AI professionals to address concerns about the proper use of AI. Furthermore, the teachers may initiate upskilling themselves by seeking online training on the use of AI.

Overall, the study underscores teachers' positive perception of using AI and their

challenges in integrating it into classroom instruction. It contributes to the growing body of knowledge on integrating technology into classroom instruction.

LIMITATION & FURTHER RESEARCH

The study's limitations include its descriptive quantitative design and the use of a purposive sample of 33 mathematics teachers from selected secondary schools, which limits the generalizability of the findings beyond the specific context analyzed. Self-reported survey data may have introduced social desirability bias, and the lack of qualitative data limited the ability to gain a more nuanced understanding of teachers' lived experiences, challenges, and perspectives on AI integration. Additionally, different levels of infrastructural and institutional support were observed among schools, though these were not deeply probed as factors influencing AI adoption. Rapid development of AI technologies may mean the results will need to be updated frequently to remain relevant. The study also focused more on teachers' impressions and did not directly measure students' learning outcomes, leading to gaps in understanding the real impact of AI on students' conceptual understanding and critical thinking skills.

Future studies should focus on increasing the sample size and the diversity of the population to improve the generalizability of the findings and overcome these limitations. Qualitative approaches such as interviews or classroom observations can offer deep insight into how teachers meet and deal with AI integration in practice. Longitudinal studies enable us to follow the evolution of AI technologies and educational policies over time. Direct measurements of the impact of AI on student performance should also be included in the research. Moreover, examining institutional support systems, the impact of professional development, and ethical guidelines will contribute to a comprehensive understanding of how to foster responsible and effective AI use in educational contexts. Finally, research developing and testing concrete pedagogical practices and evaluation models for AI-supported learning environments would be a useful practical help for educators. Future research to address these deficiencies will extend and validate the present findings and allow for a more complete, context-sensitive, and evidence-based approach to the incorporation of AI in mathematics instruction and beyond.

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