INTERNATIONAL MULTIDISCIPLINARY JOURNAL OF RESEARCH FOR INNOVATION, SUSTAINABILITY AND EXCELLENCE
Published by: RISEJOURNALS.ORG | Online ISSN: 3028-032X | Print ISSN: 3028-0370
VOLUME 4, ISSUE NO. 7

Teachers' Perceptions, Challenges, and Perceived Limitations of Artificial Intelligence in Mathematics Instruction

DOI: 10.5281/zenodo.21413146

Chillou C. Buenavista
La Consolacion College Bacolod
https://orcid.org/0009-0002-6166-1796 | chilloubuenavista@gmail.com

Abstract:

Artificial intelligence (AI) has emerged as a promising instructional tool for supporting lesson preparation, assessment, differentiated instruction, and student engagement. However, its effective integration into mathematics education depends on teachers' competence, institutional support, and critical evaluation of AI-generated content. This study examined public secondary school mathematics teachers' perceptions, implementation challenges, and perceived limitations regarding the use of AI in mathematics instruction. A descriptive-correlational design with an embedded qualitative component was employed. Survey data were collected from 67 mathematics teachers in 16 public secondary schools in the Schools Division of Escalante City, Negros Occidental, during School Year 2025–2026. Semi-structured interviews with 16 purposively selected participants provided contextual insights into the quantitative findings. Results indicated highly favorable perceptions of AI ($M = 4.56$, $SD = 0.48$), alongside substantial implementation challenges ($M = 3.75$, $SD = 0.49$) and perceived limitations ($M = 3.70$, $SD = 0.50$). Perceptions were positively associated with implementation challenges ($rs = .379$, $p = .002$), while implementation challenges were positively associated with perceived limitations ($rs = .399$, $p < .001$). No significant association was found between perceptions and perceived limitations ($rs = -.065$, $p = .602$). Thematic analysis identified four themes: instructional benefits, implementation challenges, perceived limitations, and ethical and responsible AI use. Teachers viewed AI as a valuable instructional support but emphasized the need for reliable infrastructure, sustained professional development, careful verification of AI-generated outputs, ethical safeguards, and continued teacher oversight. The findings support a cautious, human-centered approach to AI integration in mathematics education.

Keywords: artificial intelligence, mathematics education, mathematics teachers, teacher perceptions, educational technology, generative artificial intelligence

Introduction:

Artificial intelligence (AI) has become one of the most influential technological developments shaping contemporary education. Advances in machine learning, natural language processing, and generative AI have expanded the capabilities of digital tools beyond information retrieval to include content generation, automated feedback, adaptive learning, and decision support. As these technologies become increasingly accessible, educators are exploring their potential to improve teaching efficiency, personalize learning experiences, and support instructional decision-making (Chen et al., 2020; Miao & Holmes, 2023; Zawacki-Richter et al., 2019). At the same time, the rapid adoption of AI has raised important questions regarding its accuracy, ethical use, data privacy, and implications for teaching and learning.

Within educational settings, AI encompasses a broad range of applications, including intelligent tutoring systems, adaptive learning environments, automated assessment tools, learning analytics, and generative AI platforms capable of producing text, images, lesson plans, examples, explanations, and assessment materials. These technologies have the potential to reduce teachers' administrative workload, support differentiated instruction, and provide timely feedback to learners. At the institutional level, AI can also facilitate data-informed decision-making and enhance educational management (Chen et al., 2020; OECD, 2021). However, the educational value of AI depends not only on the sophistication of the technology but also on teachers' ability to evaluate, adapt, and appropriately integrate AI-generated outputs into meaningful classroom instruction.

The application of AI is particularly relevant in mathematics education, where teachers are expected to facilitate conceptual understanding, mathematical reasoning, and problem-solving while responding to learners with varying

INTERNATIONAL MULTIDISCIPLINARY JOURNAL OF RESEARCH
FOR INNOVATION, SUSTAINABILITY AND EXCELLENCE
Published by: RISEJOURNALS.ORG | Online ISSN: 3028-032X | Print ISSN: 3028-0370
VOLUME 4, ISSUE NO. 7

levels of readiness. AI tools can generate worked examples, alternative solution strategies, visual representations, practice exercises, and formative assessment activities that may enrich mathematics instruction. A recent systematic review and meta-analysis reported that AI-supported interventions can positively influence mathematics learning when integrated within sound pedagogical practices rather than used as replacements for teacher instruction (Yi et al., 2024). These findings suggest that AI can serve as a valuable instructional resource when guided by effective teaching practices.

Despite these opportunities, the use of generative AI presents important pedagogical and ethical concerns. Large language models generate responses by predicting probable outputs based on patterns in training data rather than through human-like conceptual reasoning. Consequently, AI-generated content may contain factual inaccuracies, computational errors, fabricated information, or explanations that appear convincing but lack conceptual depth. In mathematics instruction, such inaccuracies may lead students to develop misconceptions if AI-generated solutions are accepted uncritically. Teachers therefore remain responsible for verifying AI-generated materials, aligning them with curricular expectations, and ensuring that they promote genuine mathematical understanding rather than mere answer generation (Kasneci et al., 2023; Miao & Holmes, 2023).

These issues shift the discussion beyond whether AI should be adopted toward how it should be integrated responsibly into educational practice. AI can encourage inquiry, creativity, and independent learning when students are required to analyze, evaluate, and improve AI-generated responses. Conversely, excessive reliance on AI may encourage cognitive dependency, reduce opportunities for productive struggle, and increase concerns regarding academic integrity (Kasneci et al., 2023). Consequently, the effectiveness of AI depends largely on teachers' professional judgment and their ability to design learning experiences that position AI as a supplementary instructional resource rather than a replacement for human teaching.

Teachers play a central role in determining how AI is implemented in classrooms. Their perceptions of AI influence their willingness to explore emerging technologies, integrate them into instruction, and evaluate their educational value. Teachers who perceive AI as useful and manageable may be more inclined to adopt it, whereas concerns regarding accuracy, ethics, or instructional relevance may discourage classroom implementation. Previous studies indicate that teachers often recognize both the potential and the limitations of AI, demonstrating optimism toward its instructional applications while expressing reservations about its reliability, professional implications, and ethical use (Alwaqdani, 2024; Mishra et al., 2023).

The Technology Acceptance Model (Davis, 1989) provides a useful framework for understanding teachers' acceptance of AI by proposing that technology adoption is influenced primarily by perceived usefulness and perceived ease of use. Similarly, the Unified Theory of Acceptance and Use of Technology explains technology adoption through performance expectancy, effort expectancy, social influence, and facilitating conditions (Venkatesh et al., 2003). These models suggest that teachers are more likely to embrace AI when they believe it enhances instructional effectiveness and when adequate institutional support is available. However, technology acceptance alone does not guarantee meaningful classroom integration. Teachers must also possess the pedagogical competence required to evaluate AI-generated content and apply it appropriately within their instructional contexts.

This broader perspective is reflected in the Technological Pedagogical Content Knowledge (TPACK) framework, which emphasizes that effective technology integration requires the interaction of technological knowledge, pedagogical knowledge, and subject-matter expertise (Mishra & Koehler, 2006). In mathematics education, this means that teachers must understand not only how AI tools operate but also how to evaluate the mathematical accuracy of AI-generated outputs, adapt instructional materials to learners' needs, and ensure that technology supports rather than replaces meaningful mathematical reasoning. Recent discussions further argue that teachers should function as designers, evaluators, and ethical decision-makers in AI-assisted instruction rather than passive users of machine-generated content (Mishra et al., 2023). Likewise, the AI Competency Framework for Teachers emphasizes the importance of AI literacy, ethical awareness, pedagogical competence, and continuous professional learning in preparing educators for AI-supported teaching (Miao & Cukurova, 2024).

The integration of AI into schools also depends on contextual and institutional conditions. Implementation challenges may arise from limited internet connectivity, insufficient access to digital devices, inadequate technical support, lack of professional development opportunities, financial constraints, and time limitations. In contrast, perceived

INTERNATIONAL MULTIDISCIPLINARY JOURNAL OF RESEARCH
FOR INNOVATION, SUSTAINABILITY AND EXCELLENCE
Published by: RISEJOURNALS.ORG | Online ISSN: 3028-032X | Print ISSN: 3028-0370
VOLUME 4, ISSUE NO. 7

limitations relate primarily to concerns about the technology itself, including issues of accuracy, contextual understanding, learner dependency, privacy, and ethical use. Although conceptually distinct, these two constructs are closely related because institutional barriers often shape teachers' perceptions of AI's educational capabilities and limitations.

These issues are particularly relevant in the Philippine educational context, where schools continue to experience disparities in technological infrastructure and access to digital resources. Variations in internet connectivity, availability of devices, and opportunities for teacher training influence the extent to which AI can be integrated into classroom instruction. At the same time, government agencies and educational institutions have demonstrated growing interest in AI-enabled education. In Negros Occidental, the International AI Education Summit and the establishment of an AI education training hub through the Negros Occidental Language and Information Technology Center reflect increasing institutional efforts to prepare educators for AI integration (Guadalquiver, 2025a, 2025b). These developments underscore the need for empirical evidence describing teachers' experiences with AI within local public-school settings.

Although research on AI in education has grown substantially, much of the existing literature focuses on higher education, educational technologies, or student outcomes rather than teachers' classroom experiences (Zawacki-Richter et al., 2019). Studies examining mathematics teachers remain comparatively limited, particularly within Philippine public secondary schools where institutional conditions, professional development opportunities, and technological resources differ from those reported in international contexts. Consequently, context-specific evidence is needed to understand how mathematics teachers perceive AI, the implementation challenges they encounter, and the limitations they attribute to the technology.

Against this backdrop, the present study examined public secondary school mathematics teachers' perceptions, implementation challenges, and perceived limitations regarding the use of AI in mathematics instruction in the Schools Division of Escalante City, Negros Occidental, during School Year 2025–2026. Specifically, the study described teachers' perceptions, implementation challenges, and perceived limitations; examined the relationships among these constructs; and used qualitative findings to contextualize teachers' experiences with AI integration. By providing empirical evidence from a Philippine public-school context, the study contributes to the growing body of literature on artificial intelligence in education and offers insights that may inform teacher professional development, institutional support, and the responsible integration of AI into mathematics instruction.

Methodology:

This study employed a descriptive-correlational design with an embedded qualitative component to examine public secondary school mathematics teachers' perceptions, implementation challenges, and perceived limitations regarding the use of artificial intelligence (AI) in mathematics instruction. The quantitative component described teachers' perceptions of AI and examined the relationships among the study variables, while the qualitative component provided contextual explanations for the quantitative findings through semi-structured interviews. The embedded qualitative approach enabled a richer interpretation of teachers' experiences without constituting an independent qualitative inquiry (Creswell & Clark, 2017).

The study was conducted in 16 public secondary schools in the Schools Division of Escalante City, Negros Occidental, during School Year 2025–2026.

The target population consisted of 80 Junior High School and Senior High School mathematics teachers employed in the participating public secondary schools. An attempted census was conducted, and 67 teachers (83.8%) completed the survey.

For the qualitative component, 16 survey respondents were purposively selected to represent varying levels of teaching experience, educational attainment, school contexts, and familiarity with AI tools. Their responses provided contextual insights that complemented and explained the quantitative findings.

The questionnaire was developed by the researcher based on the study constructs and relevant literature on teachers’ acceptance, implementation challenges, and perceived limitations of AI.

INTERNATIONAL MULTIDISCIPLINARY JOURNAL OF RESEARCH FOR INNOVATION, SUSTAINABILITY AND EXCELLENCE
Published by: RISEJOURNALS.ORG | Online ISSN: 3028-032X | Print ISSN: 3028-0370
VOLUME 4, ISSUE NO. 7

The questionnaire comprised two sections. The first section gathered demographic information, including age, sex, teaching experience, and educational attainment. The second section consisted of 35 five-point Likert-type items organized into three constructs: Perceptions of AI Tools (15 items), Implementation Challenges (10 items), and Perceived Limitations (10 items). Responses ranged from 1 (Strongly Disagree) to 5 (Strongly Agree).

Perceptions referred to teachers' evaluations of the usefulness, ease of use, instructional relevance, and appropriateness of AI tools for mathematics instruction. Implementation challenges addressed practical barriers to AI integration, including internet connectivity, access to digital devices, technical support, time constraints, professional development, and curriculum alignment. Perceived limitations referred to teachers' concerns regarding the capabilities and educational suitability of AI, including issues of accuracy, contextual understanding, learner dependency, privacy, ethical use, and support for higher-order thinking.

The semi-structured interview guide explored teachers' experiences regarding the instructional benefits of AI, barriers to implementation, concerns about accuracy and reliability, ethical issues, learner dependency, and the continuing role of teachers in AI-supported mathematics instruction.

The questionnaire and interview guide were reviewed by three experts in mathematics education, educational technology, and research methodology. They assessed the instruments for clarity, relevance, appropriateness, and alignment with the study objectives. The questionnaire obtained an overall mean validity rating of 2.82, interpreted as highly valid. The validators' comments and recommendations were incorporated before pilot testing.

Based on the responses of the 30 pilot participants, Cronbach's alpha coefficients were .92 for Perceptions, .88 for Implementation Challenges, and .86 for Perceived Limitations. These coefficients indicate good to excellent internal consistency (Taber, 2017).

For the qualitative component, trustworthiness was enhanced through verbatim transcription, systematic coding, maintenance of an audit trail, and careful examination of recurring and divergent responses. Interview data were analyzed using the thematic analysis procedures described by Braun and Clarke (2006).

Following the approval of the Schools Division Office and participating school heads, informed consent was obtained from all participants before data collection. Participation was voluntary, and respondents were informed of the study's purpose, procedures, confidentiality measures, and their right to withdraw without penalty.

Questionnaires were administered either in printed form or through secure electronic platforms. Completed responses were reviewed for completeness before encoding and analysis. Composite scores for each construct were computed by averaging participants' responses to the corresponding questionnaire items.

Following the quantitative analysis, the 16 purposively selected participants were invited to participate in individual semi-structured interviews. Interviews were conducted privately, audio-recorded with participants' permission, transcribed verbatim, anonymized using participant codes, and analyzed to provide contextual explanations for the quantitative findings.

Descriptive statistics, including frequencies, percentages, means, and standard deviations, were used to summarize respondent characteristics and describe teachers' perceptions, implementation challenges, and perceived limitations regarding AI use.

Spearman's rank-order correlation was employed to examine the relationships among the three study variables. Statistical significance was evaluated at the .05 level, and exact p-values were reported. Correlation coefficients were interpreted following the guidelines of Schober et al. (2018). Findings were interpreted as measures of association rather than evidence of causation.

Interview transcripts were analyzed thematically following Braun and Clarke's (2006) six-phase framework of familiarization, coding, theme development, review, definition, and reporting. The qualitative findings were

INTERNATIONAL MULTIDISCIPLINARY JOURNAL OF RESEARCH FOR INNOVATION, SUSTAINABILITY AND EXCELLENCE
Published by: RISEJOURNALS.ORG | Online ISSN: 3028-032X | Print ISSN: 3028-0370
VOLUME 4, ISSUE NO. 7

subsequently integrated with the quantitative results to provide a more comprehensive interpretation of teachers' experiences with AI integration.

The study received the necessary approvals from the appropriate educational authorities before implementation. Participation was voluntary, and written informed consent was obtained from all respondents. Participant identities and school names were replaced with identification codes to protect confidentiality. Survey responses, interview transcripts, and digital files were stored in password-protected locations accessible only to the research team.

The study involved minimal risk and did not collect personally identifiable student information. Findings are presented only in aggregate or anonymized form to ensure participants' privacy and confidentiality.

Results:

A total of 67 public secondary school mathematics teachers from 16 public secondary schools participated in the study, representing 83.8% of the identified population of 80 teachers. Most respondents were 25–33 years old (58.2%), female (68.7%), had 1–9 years of teaching experience (74.6%), and had attained a master's degree or graduate units (76.1%). Only a small proportion of respondents belonged to the older age groups, had more than 19 years of teaching experience, or held doctoral degrees. These demographic characteristics are presented to describe the study sample and are not intended for inferential comparison.

Table 1
Demographic Characteristics of the Respondents

Characteristic	Category	n	%
Age	25–33 years	39	58.2
	34–42 years	21	31.3
	43–51 years	2	3.0
	52–60 years	5	7.5
Sex	Male	21	31.3
	Female	46	68.7
Teaching experience	1–9 years	50	74.6
	10–18 years	14	20.9
	19–27 years	1	1.5
	28–36 years	2	3.0
Educational attainment	Bachelor’s level	12	17.9
	Master’s level	51	76.1
	Doctorate level	4	6.0

Note. N = 67. Percentages may not total 100 because of rounding.

Table 2 presents the descriptive statistics for the three study variables.

Teachers reported highly favorable perceptions toward the use of AI tools in mathematics instruction (M = 4.56, SD = 0.48). They likewise reported relatively high levels of implementation challenges (M = 3.75, SD = 0.49) and perceived limitations (M = 3.70, SD = 0.50).

INTERNATIONAL MULTIDISCIPLINARY JOURNAL OF RESEARCH
FOR INNOVATION, SUSTAINABILITY AND EXCELLENCE
Published by: RISEJOURNALS.ORG | Online ISSN: 3028-032X | Print ISSN: 3028-0370
VOLUME 4, ISSUE NO. 7

These findings indicate that although teachers generally viewed AI positively, they also acknowledged considerable challenges and limitations associated with its classroom implementation.

Table 2
Descriptive Statistics for Teachers' Perceptions, Implementation Challenges, and Perceived Limitations

Construct	Number of items	M	SD	Possible range
Perceptions of AI tools	15	4.56	0.48	1–5
Implementation challenges	10	3.75	0.49	1–5
Perceived limitations	10	3.70	0.50	1–5

Note. Higher perception scores indicate more favorable views of AI tools. Higher challenge and limitation scores indicate greater reported difficulty or concern.

Spearman's rank-order correlation was used to examine the relationships among teachers' perceptions, implementation challenges, and perceived limitations.

As shown in Table 3, teachers' perceptions were positively associated with implementation challenges (r_s = .379, p = .002). According to Schober et al. (2018), this represents a weak positive association.

No statistically significant relationship was found between teachers' perceptions and perceived limitations (r_s = −.065, p = .602).

Implementation challenges were positively associated with perceived limitations (r_s = .399, p < .001), likewise indicating a weak positive association.

Table 3
Means, Standard Deviations, and Spearman Correlations Among the Study Variables

Variable	M	SD	1	2	3
1. Perceptions of AI tools	4.56	0.48	—		
2. Implementation challenges	3.75	0.49	.38**	—	
3. Perceived limitations	3.70	0.50	−.07	.40***	—

Note. N = 67. Values are Spearman's rank-order correlations. ** p < .01. *** p < .001.

Thematic analysis identified four interrelated themes describing teachers' experiences with AI in mathematics instruction: Instructional benefits of AI; Implementation challenges; Perceived limitations of AI; and Ethical and responsible use.

These themes provide contextual insights into the quantitative findings and illustrate how teachers simultaneously recognized AI's instructional value while remaining aware of its practical, pedagogical, and ethical constraints.

Table 4
Themes, Subthemes, and Summary of Participants' Experiences

Theme	Subthemes	Summary of participants' experiences
Instructional benefits of AI	Lesson preparation; alternative explanations; practice generation; differentiated instruction; student engagement	Participants described AI as useful for preparing lessons, generating examples and practice exercises, presenting mathematical concepts in different ways, and creating materials suited to varying learner needs. They also reported that AI reduced preparation time and helped make classroom activities more engaging.
Implementation challenges	Internet connectivity; device access; technical support; training; subscription costs; time constraints; student dependency	Participants reported that unstable internet connections, limited access to devices, insufficient training, and the cost of some AI platforms restricted regular classroom use. They also expressed concern that some students relied on AI-generated answers without understanding the mathematical processes involved.
Perceived limitations of AI	Accuracy; inconsistent outputs; shallow reasoning; weak contextualization; limited diagnostic ability; lack of human interaction	Participants noted that AI sometimes produced incorrect, incomplete, inconsistent, or overly complex mathematical responses. They questioned its ability to identify misconceptions, respond to learners' emotional and contextual needs, and support proofs, abstraction, and higher-order mathematical reasoning without substantial teacher mediation.
Ethical and responsible use	Verification; teacher accountability; academic integrity; privacy; learner independence; human oversight	Participants emphasized that AI should supplement rather than replace teachers. They viewed teachers as responsible for checking the accuracy and appropriateness of AI-generated content, protecting sensitive information, discouraging passive copying, and designing tasks that require students to explain and justify their reasoning.

Instructional Benefits of AI

Teachers described AI as a useful instructional support for lesson preparation, content generation, differentiated explanation, practice development, and student engagement. Participants particularly valued AI's ability to provide alternative representations of mathematical ideas and reduce the time required to prepare instructional materials.

One participant explained:

> "AI helps me explain concepts in different ways and generates practice problems" (Participant 12).

Another emphasized its contribution to instructional efficiency:

> "AI helps save time in preparing materials and makes lesson planning faster" (Participant 15).

Teachers also associated AI-supported activities with increased student interest. As one participant stated:

> "AI allows me to use interactive activities and visual activities which keeps students more engaged" (Participant 15).

These accounts show that teachers primarily valued AI as an instructional assistant that could expand available learning materials, support different learner needs, and make lesson preparation more efficient.

Implementation Challenges

INTERNATIONAL MULTIDISCIPLINARY JOURNAL OF RESEARCH
FOR INNOVATION, SUSTAINABILITY AND EXCELLENCE
Published by: RISEJOURNALS.ORG | Online ISSN: 3028-032X | Print ISSN: 3028-0370
VOLUME 4, ISSUE NO. 7

Participants identified unstable internet connectivity, limited access to devices, insufficient training, subscription costs, and student dependency as major barriers to AI integration. These conditions made AI use intermittent rather than routine in some schools.

One participant described connectivity as the principal obstacle:

> "Limited internet connection is a big challenge; sometimes there is no signal" (Participant 7).

Access to equipment also affected students' ability to participate in AI-supported activities:

> "Some students cannot use AI because they don't have devices" (Participant 13).

Teachers likewise acknowledged gaps in professional preparation. One participant stated:

> "I still need more training on how to properly use these tools" (Participant 15).

Student overreliance emerged as another implementation concern. One teacher observed:

> "Students rely on AI for homework instead of developing their own thinking" (Participant 15).

These responses indicate that implementation challenges extended beyond technological infrastructure. They also involved teachers' professional preparation and the need to design activities that discourage passive copying and preserve students' independent mathematical reasoning.

Perceived Limitations of AI

Teachers identified limitations involving accuracy, reliability, contextual understanding, higher-order reasoning, and the human dimensions of instruction. Participants reported that AI-generated mathematical responses could be incorrect or inconsistent and therefore required verification.

One participant explained:

> "AI answers [are] sometimes wrong; [we] need to double-check" (Participant 8).

Another expressed concern about the reliability of answers generated by different platforms:

> "Different AI tools give different answers" (Participant 12).

Teachers also questioned AI's ability to replace the deeper reasoning and human responsiveness required in mathematics instruction. One participant noted that AI could "oversimplify or miss the human touch" (Participant 1).

Another emphasized its limitations in more complex mathematical work:

> "Problem-solving and proofs need deeper discussion" (Participant 1).

These accounts indicate that teachers did not view AI-generated output as automatically reliable or pedagogically sufficient. AI was considered more useful for preparatory, procedural, and supplementary tasks than for diagnosing misconceptions, responding to learners' emotional and contextual needs, or independently facilitating complex mathematical reasoning.

Ethical and Responsible Use

Participants consistently maintained that AI should support rather than replace teachers. Responsible use involved verifying generated responses, protecting students from misleading information, preserving academic integrity, and ensuring that teachers remained accountable for classroom content.

One participant stated:

> "AI should complement, not replace the teacher" (Participant 1).

Another emphasized teacher accountability:

> "We must be attentive to errors because teachers are responsible for what students learn from AI" (Participant 12).

Responsible integration also required purposeful and ethical use:

> "Use AI in something good and be accountable for its use" (Participant 16).

Participants further emphasized that students should not become dependent on AI-generated answers. As one teacher explained:

> "Students cannot answer on their own because they are very dependent on AI without checking" (Participant 12).

These statements demonstrate that teachers viewed human oversight as essential to AI-supported instruction. They regarded themselves as responsible for evaluating mathematical accuracy, adapting content to students' levels, safeguarding independent thinking, and ensuring that AI remained a supplementary educational resource.

Integration of Quantitative and Qualitative Findings

The qualitative findings complemented the quantitative results by explaining why teachers simultaneously expressed favorable perceptions of AI and reported substantial implementation challenges and perceived limitations. Teachers appreciated AI's instructional benefits but consistently emphasized that its effective classroom use depended on reliable infrastructure, professional development, careful verification of AI-generated outputs, and continued teacher oversight.

The findings portray mathematics teachers as cautiously receptive to AI. They recognized its potential to improve planning, generate materials, and support engagement, but they did not regard it as a self-sufficient instructional solution. Effective integration remained dependent on reliable infrastructure, relevant professional development, institutional guidance, critical verification, and continued teacher oversight.

Table 5
Integrated Interpretation of the Quantitative and Qualitative Findings

Quantitative finding	Qualitative elaboration	Integrated interpretation
Highly favorable perceptions of AI	Teachers described AI as useful for lesson preparation, examples, practice tasks, differentiation, and engagement.	Teachers valued AI primarily as an instructional support and efficiency tool.
Substantial implementation challenges	Participants reported unstable connectivity, limited access to devices, insufficient training, subscription costs, and time constraints.	Positive views of AI did not eliminate structural and operational barriers.

INTERNATIONAL MULTIDISCIPLINARY JOURNAL OF RESEARCH FOR INNOVATION, SUSTAINABILITY AND EXCELLENCE
Published by: RISEJOURNALS.ORG | Online ISSN: 3028-032X | Print ISSN: 3028-0370
VOLUME 4, ISSUE NO. 7

Quantitative finding	Qualitative elaboration	Integrated interpretation
Substantial perceived limitations	Teachers raised concerns about accuracy, inconsistent outputs, shallow reasoning, learner dependency, privacy, and lack of human interaction.	Teachers distinguished AI's instructional usefulness from its pedagogical and ethical adequacy.
Positive association between perceptions and challenges	Teachers expressed favorable views of AI while also reporting practical barriers involving connectivity, devices, training, and cost.	Favorable perceptions did not preclude recognition of implementation complexity.
Positive association between challenges and limitations	Operational barriers frequently occurred alongside concerns about AI accuracy, reasoning, contextualization, and reliability.	Practical implementation barriers and perceived technological limitations were interconnected.
No significant association between perceptions and limitations	Teachers remained favorable toward AI while acknowledging its weaknesses.	Positive attitudes and critical evaluation could coexist.

Discussion:

The present study examined public secondary school mathematics teachers' perceptions, implementation challenges, and perceived limitations regarding the use of artificial intelligence (AI) in mathematics instruction. Overall, the findings indicate that teachers recognized AI as a valuable instructional resource while simultaneously acknowledging practical, pedagogical, and ethical concerns associated with its classroom integration. Rather than reflecting contradictory views, these findings suggest that teachers adopted a balanced perspective toward AI—appreciating its potential to enhance instruction while recognizing that its effectiveness depends on responsible implementation, institutional support, and continued teacher oversight.

Teachers reported highly favorable perceptions of AI, indicating that they generally viewed AI tools as useful in supporting mathematics instruction. Participants described AI as helpful in preparing lesson plans, generating instructional materials, producing examples, and facilitating differentiated instruction. These perceptions suggest that teachers recognize AI as a tool capable of improving instructional efficiency without diminishing the importance of professional judgment.

This finding supports the Technology Acceptance Model (Davis, 1989), which proposes that technology adoption is largely influenced by users' perceptions of usefulness and ease of use. When teachers perceive AI as capable of enhancing instructional performance, they become more willing to explore its classroom applications. Likewise, the Unified Theory of Acceptance and Use of Technology explains that positive expectations regarding performance, together with facilitating conditions, encourage technology adoption (Venkatesh et al., 2003). The generally favorable perceptions observed in this study therefore indicate openness among mathematics teachers to exploring AI-supported instruction.

The findings are consistent with Alwaqdani (2024), who reported that teachers viewed AI as a promising educational technology despite expressing concerns regarding implementation and ethical considerations. Similarly, Chen et al. (2020) emphasized that AI has considerable potential to improve educational processes by supporting personalized instruction, assessment, and learning analytics. In mathematics education specifically, Yi et al. (2024) found that AI-assisted instruction can improve learning outcomes when integrated within sound pedagogical practices rather than used as an autonomous instructional solution.

The qualitative findings further illustrate why teachers viewed AI positively. Participants emphasized that AI reduced preparation time, generated multiple instructional examples, and supported the development of learning materials tailored to students' varying needs. These experiences suggest that teachers perceived AI as an instructional assistant capable of enhancing productivity while allowing them to devote greater attention to classroom interaction and student learning.

INTERNATIONAL MULTIDISCIPLINARY JOURNAL OF RESEARCH
FOR INNOVATION, SUSTAINABILITY AND EXCELLENCE
Published by: RISEJOURNALS.ORG | Online ISSN: 3028-032X | Print ISSN: 3028-0370
VOLUME 4, ISSUE NO. 7

Although teachers expressed favorable perceptions of AI, they also reported substantial implementation challenges. The positive association between teachers’ perceptions and implementation challenges indicates that favorable attitudes toward AI can coexist with recognition of practical barriers. Because the study did not directly measure the frequency or intensity of AI use, the mechanism underlying this relationship cannot be determined from the present findings.

Participants consistently identified unstable internet connectivity, inadequate access to digital devices, limited institutional support, subscription costs, insufficient professional development opportunities, and time constraints as barriers to effective AI integration. These findings demonstrate that successful implementation depends not only on teachers' willingness to adopt AI but also on the availability of enabling institutional conditions.

These findings are consistent with the Unified Theory of Acceptance and Use of Technology, which emphasizes facilitating conditions as an important determinant of technology use (Venkatesh et al., 2003). Teachers may recognize the value of AI, yet practical constraints can limit their ability to integrate it consistently into classroom practice. Likewise, the OECD (2021) noted that digital transformation in education depends on investments in infrastructure, teacher capacity building, and institutional readiness rather than technology alone.

The qualitative findings reinforce this interpretation by demonstrating that teachers often encountered challenges beyond their individual control. Participants described unreliable internet connectivity, inconsistent access to AI platforms, and limited opportunities for formal training. These experiences highlight that teacher readiness must be accompanied by sustained institutional investment in technological infrastructure and professional learning if AI is to be integrated effectively into mathematics education.

The study found no statistically significant relationship between teachers' perceptions and perceived limitations of AI. This finding suggests that teachers' appreciation of AI's instructional potential did not prevent them from recognizing its inherent limitations. In other words, teachers were capable of maintaining positive attitudes toward AI while critically evaluating its weaknesses.

The qualitative findings provide important context for this result. Participants acknowledged that AI occasionally generated inaccurate mathematical solutions, oversimplified explanations, or responses that lacked contextual appropriateness for learners. Teachers also expressed concern regarding students' overreliance on AI, the possibility of diminished critical thinking, and issues related to academic integrity, privacy, and ethical use. Rather than rejecting AI because of these limitations, participants emphasized the importance of carefully reviewing AI-generated content before incorporating it into classroom instruction.

These findings support recent discussions emphasizing that AI should augment rather than replace teacher expertise. Kasneci et al. (2023) argued that although generative AI creates new opportunities for teaching and learning, it also introduces risks related to misinformation, bias, learner dependency, and reduced opportunities for higher-order thinking. Similarly, Miao and Holmes (2023) emphasized that AI should be implemented within human-centered educational frameworks that prioritize teacher agency, ethical responsibility, transparency, and learner well-being.

The findings also align with the Technological Pedagogical Content Knowledge (TPACK) framework (Mishra & Koehler, 2006), which emphasizes that effective technology integration depends on teachers' ability to combine technological, pedagogical, and content knowledge. Mathematics teachers must therefore evaluate the accuracy and instructional appropriateness of AI-generated content while ensuring alignment with curricular standards and students' developmental needs. As Mishra et al. (2023) argued, teachers' roles increasingly extend beyond technology users to include designers, evaluators, and ethical decision-makers in AI-supported learning environments.

Taken together, the findings suggest that successful AI integration requires more than positive teacher attitudes or access to emerging technologies. Effective implementation depends on a combination of teacher competence, institutional support, ethical governance, and sound pedagogical practice. AI should be viewed as a complementary instructional resource that enhances teachers' professional work rather than replacing the expertise required for effective mathematics instruction.

For schools and education authorities, these findings underscore the importance of investing in reliable technological infrastructure, expanding access to AI-related professional development, and establishing institutional guidelines for the responsible use of AI. Professional learning initiatives should extend beyond technical operation to include prompt design, verification of AI-generated outputs, ethical decision-making, data privacy, and strategies for integrating AI into inquiry-based and problem-centered mathematics instruction.

The findings likewise support the AI Competency Framework for Teachers, which identifies AI literacy, ethical awareness, pedagogical competence, and continuous professional learning as essential competencies for educators (Miao & Cukurova, 2024). Strengthening these competencies may enable teachers to maximize AI's instructional benefits while minimizing potential risks associated with its use.

Limitations and future research

Several limitations should be considered when interpreting the findings. First, the study was conducted among public secondary school mathematics teachers in one schools division in Negros Occidental; consequently, the findings may not be generalizable to other educational contexts. Second, the study relied primarily on self-reported perceptions and experiences, which may be influenced by individual interpretation and social desirability. Third, the descriptive-correlational design identifies associations among variables but does not establish causal relationships.

The study did not directly measure the frequency, intensity, or quality of teachers’ AI use. Consequently, favorable perceptions and reported challenges should not be interpreted as evidence of actual classroom adoption or AI competence. Although the attempted census achieved an 83.8% response rate, nonresponse bias remains possible. In addition, the qualitative participants were purposively selected from survey respondents, and the findings relied on self-reported experiences rather than direct classroom observation.

Future research may examine AI integration across different subject areas, educational levels, and geographical settings to determine whether similar patterns emerge in other contexts. Longitudinal and classroom-based studies may likewise provide deeper insights into how AI influences instructional practices, teacher decision-making, and student learning outcomes over time. Experimental and intervention studies evaluating the effectiveness of AI-supported professional development programs would also contribute valuable evidence for informing educational policy and practice.

Conclusion:

This study examined public secondary school mathematics teachers' perceptions, implementation challenges, and perceived limitations regarding the use of artificial intelligence (AI) in mathematics instruction. The findings indicate that teachers generally viewed AI as a valuable instructional resource capable of supporting lesson preparation, instructional material development, differentiated instruction, and classroom efficiency. At the same time, they recognized that the successful integration of AI depends on more than favorable attitudes toward technology. Teachers identified practical barriers, including limited technological infrastructure, inconsistent internet connectivity, insufficient professional development, and institutional constraints, as well as concerns regarding the accuracy, reliability, ethical use, and educational appropriateness of AI-generated content.

The positive association between teachers’ perceptions and implementation challenges indicates that favorable views of AI can coexist with recognition of substantial implementation barriers. Because actual AI engagement was not directly measured, the study cannot determine the mechanism underlying this relationship.

These findings underscore the importance of adopting a human-centered approach to AI integration in mathematics education. Effective implementation requires investments in reliable digital infrastructure, sustained professional development, institutional policies for responsible AI use, and opportunities for teachers to strengthen their technological, pedagogical, and ethical competencies. Equally important is the continued exercise of teacher judgment in evaluating AI-generated content, ensuring curricular alignment, and fostering students' critical thinking and mathematical reasoning.

By providing empirical evidence from public secondary schools in the Schools Division of Escalante City, Negros Occidental, this study contributes to the growing body of literature on AI in education, particularly within the Philippine context where research on mathematics teachers' experiences remains limited. The findings offer practical insights for school leaders, teacher educators, and policymakers seeking to support the responsible integration of AI into mathematics instruction while preserving the central role of teachers in facilitating meaningful learning.

Future research should investigate how AI influences classroom practices and student learning outcomes across different educational settings and subject areas. Longitudinal and intervention-based studies may further clarify how professional development, institutional support, and evolving AI technologies shape teachers' instructional practices over time.

References:

Alwaqdani, M. (2024). Investigating teachers’ perceptions of artificial intelligence tools in education: Potential and difficulties. *Education and Information Technologies*, *30*(3), 2737–2755. https://doi.org/10.1007/s10639-024-12903-9

Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology*, *3*(2), 77–101. https://doi.org/10.1191/1478088706qp063oa

Chen, L., Chen, P., & Lin, Z. (2020). Artificial intelligence in education: A review. *IEEE Access*, *8*, 75264–75278. https://doi.org/10.1109/access.2020.2988510

Creswell, J. W., & Clark, V. L. P. (2017). *Designing and conducting mixed methods research*. SAGE Publications.

Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly*, *13*(3), 319–340. https://doi.org/10.2307/249008

Guadalquiver, N. (2025a, April 2). Negros Occidental stakeholders explore future of AI in education. *Philippine News Agency*. https://www.pna.gov.ph/articles/1247358

Guadalquiver, N. (2025b, April 9). Negros Occidental to establish AI education training hub. *Philippine News Agency*.

Kasneci, E., Sessler, K., Küchemann, S., Bannert, M., Dementieva, D., Fischer, F., Gasser, U., Groh, G., Günnemann, S., Hüllermeier, E., Krusche, S., Kutyniok, G., Michaeli, T., Nerdel, C., Pfeffer, J., Poquet, O., Sailer, M., Schmidt, A., Seidel, T., … Kasneci, G. (2023). ChatGPT for good? On opportunities and challenges of large language models for education. *Learning and Individual Differences*, *103*, 102274. https://doi.org/10.1016/j.lindif.2023.102274

Miao, F., & Cukurova, M. (2024). *AI competency framework for teachers*. UNESCO.

Miao, F., & Holmes, W. (2023). *Guidance for generative AI in education and research*. UNESCO. https://doi.org/10.54675/ewzm9535

Mishra, P., & Koehler, M. J. (2006). Technological pedagogical content knowledge: A framework for teacher knowledge. *Teachers College Record: The Voice of Scholarship in Education*, *108*(6), 1017–1054. https://doi.org/10.1111/j.1467-9620.2006.00684.x

Mishra, P., Warr, M., & Islam, R. (2023). TPACK in the age of ChatGPT and Generative AI. *Journal of Digital Learning in Teacher Education*, *39*(4), 235–251. https://doi.org/10.1080/21532974.2023.2247480

OECD. (2021). *OECD digital education outlook 2021*. OECD Publishing. https://doi.org/10.1787/589b283f-en

Schober, P., Boer, C., & Schwarte, L. A. (2018). Correlation coefficients: Appropriate use and interpretation. *Anesthesia & Analgesia*, *126*(5), 1763–1768. https://doi.org/10.1213/ane.0000000000002864

Taber, K. S. (2017). The use of Cronbach’s alpha when developing and reporting research instruments in science education. *Research in Science Education*, *48*(6), 1273–1296. https://doi.org/10.1007/s11165-016-9602-2

Venkatesh, V., Morris, M. G., Davis, G. B., & Davis, F. D. (2003). User acceptance of information technology: Toward a unified view. *MIS Quarterly*, *27*(3), 425–478. https://doi.org/10.2307/30036540

Yi, L., Liu, D., Jiang, T., & Xian, Y. (2024). The effectiveness of AI on K-12 students' mathematics learning: A systematic review and meta-analysis. *International Journal of Science and Mathematics Education*, *23*(4), 1105–1126. https://doi.org/10.1007/s10763-024-10499-7

Zawacki-Richter, O., Marín, V. I., Bond, M., & Gouverneur, F. (2019). Systematic review of research on artificial intelligence applications in higher education – where are the educators? *International Journal of Educational Technology in Higher Education*, *16*(1). https://doi.org/10.1186/s41239-019-0171-0