

Attitude and Utilization of Generative AI as a Learning Tool among Pre-Service Mathematics Teachers

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Abstract

This study examined the attitudes and utilization of generative artificial intelligence (AI) as a learning tool among pre-service mathematics teachers. Employing a descriptive-correlational research design, data were collected from 71 respondents through a structured survey instrument to determine their perceptions of generative AI and the frequency of its use in learning mathematics. Findings revealed that respondents demonstrated a moderately positive attitude toward generative AI across cognitive, affective, and behavioral dimensions. In terms of utilization, participants commonly used generative AI tools for step-by-step explanations, clarification of mathematical concepts, and assistance in solving mathematical problems. However, integration of these tools into regular study routines remained limited. Correlation analysis showed a significant moderate positive relationship between attitudes and frequency of use, indicating that more favorable perceptions are associated with higher levels of engagement with generative AI in academic tasks. Respondents also perceived the curriculum as moderately supportive in developing competencies for effective AI utilization, particularly in enhancing problem-solving skills, critical thinking, and conceptual understanding. Nevertheless, some hesitation was noted in encouraging peer use, reflecting concerns about appropriate and responsible application. In general, the study highlights the need for structured integration of generative AI in mathematics education. It is recommended that teacher education institutions provide targeted training, clear guidelines, and pedagogical strategies to strengthen technological competence, critical thinking, and ethical use of AI. Future research may further examine its long-term effects on learning outcomes and professional readiness.

Keywords: Attitude, Generative AI, Learning tool, Utilization

Introduction

Teachers play a crucial role in guiding students and unlocking their potential through effective instruction. In mathematics education, learning begins with foundational concepts and progresses to advanced topics such as algebra and calculus. Traditional teaching methods, relying on direct instruction and rote memorization, have traditionally focused on manual calculations and standardized assessments. While these approaches provide structure, they may limit opportunities for student engagement, critical thinking, and deeper conceptual understanding. (Ball et al., 2008) With advancements in technology, mathematics education has undergone a significant transformation. Interactive software, online resources, and educational applications now allow students to learn at their own pace, collaborate with peers, and access learning resources beyond the classroom. More recently, the emergence of generative AI has further transformed mathematics education by enabling students to receive immediate feedback, generate step-by-step solutions, and explore mathematical concepts interactively. These capabilities position generative AI as a promising learning tool that can support personalized and student-centered mathematics instruction (Nye, 2015).

In classroom settings, students' attitudes toward mathematics strongly influence their engagement and motivation. Likewise, attitudes toward generative AI shape how learners accept, utilize, and benefit from AI-supported learning environments (Wang & Li, 2025). These attitudes encompass cognitive, affective, and behavioral dimensions that influence students' willingness to adopt emerging technologies. For pre-service mathematics teachers, generative AI serves not only as a learning aid but also as a prospective instructional tool that they may eventually integrate into their own teaching practice. Consequently, understanding their attitudes toward AI is essential for promoting its effective and responsible integration into mathematics education (Liu, 2026). Holmes et al. (2019) emphasized that although artificial intelligence has the potential to personalize learning and improve instructional support, educators must ensure that learners continue to develop critical thinking and independent problem-solving skills. Likewise, Treve (2026) argued that the increasing datafication of education requires institutions to establish ethical frameworks for the responsible use of AI technologies.

According to Eagly & Chaiken (1993), attitudes consist of cognitive, affective, and behavioral components that influence individuals' intentions and actual behavior. Similarly, Bohner & Dickel (2011) explained that positive attitudes often predict behavioral intentions toward adopting new technologies. Although previous studies have highlighted the potential of generative AI in enhancing teaching and learning, limited research has specifically examined the relationship between pre-service mathematics teachers' attitudes toward generative AI and their utilization of the technology as a learning tool in mathematics education (Alreiahi & Alrwaished, 2025). Furthermore, there remains limited evidence on how cognitive, affective, and behavioral attitudes influence the responsible and meaningful use of generative AI among future mathematics teachers. Addressing this gap is essential for informing teacher education programs and promoting effective AI integration in mathematics instruction. Given this context, this study aims to examine the relationship between pre-service mathematics teachers' attitudes toward generative AI (cognitive, affective, and behavioral) and their utilization of the technology as a learning tool in mathematics. As a correlational study, it seeks to provide evidence that can support the responsible integration of generative AI into mathematics teacher education and instructional practice.

The findings of this study are expected to contribute to mathematics teacher education by providing evidence on how pre-service mathematics teachers' attitudes influence their utilization of generative AI as a learning tool. The results may assist teacher educators and

curriculum developers in designing instructional strategies that foster responsible, ethical, and meaningful AI integration while strengthening students' technological and pedagogical competencies. Ultimately, the study may help prepare pre-service mathematics teachers to utilize generative AI effectively in supporting student learning and enhancing instructional readiness in future classroom practice.

Objectives

This study examined the attitudes toward and utilization of generative AI as a learning tool among pre-service mathematics teachers enrolled during the Academic Year 2024–2025. Specifically, the study sought to:

1. Determine the respondents' attitude towards generative AI as a learning tool in Mathematics along the following dimensions:

- 1.1. Cognitive,
- 1.2. Behavioral, and
- 1.3. Affective.

2. Assess the respondents' extent of utilization of generative AI in learning mathematical concepts.

3. Examine the relationship between the respondents' attitudes toward generative AI and their utilization of the technology using correlational analysis; and

4. Develop an evidence-based action plan grounded on the empirical findings of the study to support the effective integration of generative AI into mathematics instruction

Methodology

Research Design

This study employed a quantitative correlational research design to examine the relationship between the attitudes and utilization of generative AI as a learning tool among pre-service mathematics teachers. The quantitative approach was particularly suitable because it aligned with the study's objectives of systematically assessing both attitudes and usage patterns, while the correlational design enabled the examination of the relationship between these variables through Pearson's product-moment correlation coefficient (Pearson r) (Creswell, 2014). By employing statistical methods, the study provided measurable evidence regarding the prevalence of AI tool usage and the factors that influenced students' attitudes. This approach enabled the identification of trends and relationships, offering valuable insights that could inform the integration of AI into mathematics education. The structured nature of quantitative research ensured that the findings were reliable and generalizable, allowing for a comprehensive analysis of how teacher education students engaged with AI as a learning tool.

Respondents

The study employed stratified random sampling, with the respondents stratified according to year level to ensure proportional representation of first-, second-, third-, and fourth-year Bachelor of Secondary Education major in Mathematics students. A total of 71 students currently enrolled in the Bachelor of Secondary Education major in Mathematics during the Academic Year 2024–2025, who had access to generative AI tools, participated in the study. This approach ensured that the participants were suitable for the study's focus.

The finalized questionnaire was distributed online via Google Forms, providing easy access to participants. Along with the survey link, instructions and informed consent forms were shared, emphasizing voluntary participation. The students were given one week to complete the survey, with follow-up reminders sent after three days to those who had not yet responded.

Instrumentation

The survey questionnaire consisted of two sections: attitudes toward generative AI and utilization of generative AI tools. The first section measured attitudes using 15 statements (five items each for the cognitive, behavioral, and affective dimensions) rated on a four-point Likert scale, while the second section examined the respondents' frequency of utilizing generative AI in learning mathematical concepts using 10 items on the same scale. This closed-ended format allowed for the systematic analysis of students' attitudes toward and utilization of generative AI as a learning tool in mathematics.

Prior to its administration, the questionnaire underwent content validation by experts in mathematics education and educational technology to ensure the relevance, clarity, and appropriateness of the items. A pilot test was likewise conducted to establish the reliability of the instrument. The computed Cronbach's alpha coefficient of 0.91 indicated acceptable internal consistency.

To interpret the computed mean scores, we utilized the following mean ranges along with corresponding verbal interpretations:

Scale Point	Mean Ranges	Interpretation
4	3.51 – 4.00	Positive/Highly Utilized
3	2.51 – 3.50	Moderately Positive /Moderately Utilized
2	1.51 – 2.50	Moderately Negative/Slightly Utilized
1	1.00 – 1.50	Negative/Least Utilized

Data Collection Procedure

A formal letter was addressed to the Dean and University President requesting permission to conduct the study among Bachelor of Secondary Education major in Mathematics students. Upon approval, the researcher coordinated with the appropriate university offices and the department secretary regarding the administration of the survey.

The questionnaire was administered online through Google Forms. The survey link, informed consent form, and instructions were disseminated to the respondents through their official communication channels. Participation was voluntary, and respondents were assured that their responses would remain confidential and would be used solely for research purposes. The students were given one week to complete the questionnaire, and reminder messages were sent after three days to those who had not yet responded to improve the response rate.

Results

1. Attitude towards Generative AI as a Learning Tool in Mathematics

This part of the study determined the respondents' attitude towards generative AI as a learning tool in Mathematics in terms of cognitive, behavioral and affective dimensions. These are found on the succeeding tables.

1.1 Cognitive

Table 1 presents the respondents' attitudes toward generative AI as a learning tool in mathematics in terms of the cognitive dimension. It shows the computed mean and standard deviation for each statement, together with their corresponding descriptive interpretations. The mean scores ranged from 3.38 to 3.49, with all items receiving a descriptive interpretation of Moderately Positive. The highest mean score (Mean = 3.49, S.D. = 0.58) was obtained for the statement, "Improve my ability to understand complex mathematical concepts." This finding indicates that the respondents generally hold a moderately positive cognitive attitude toward the use of generative AI in enhancing their understanding of complex mathematical

concepts. Although the score did not reach the Positive category, it suggests that the respondents recognize the potential of generative AI to support conceptual understanding and facilitate mathematics learning.

Table 1 Attitude towards Generative AI as a Learning Tool in Mathematics in Terms of Cognitive Dimension

Item Statements	Mean	Standard Deviation	Descriptive Interpretation
1. Improve my ability to understand complex mathematical concepts.	3.49	0.58	Moderately Positive
2. Enhance my ability to analyze and apply mathematical principles effectively.	3.39	0.72	Moderately Positive
3. Help me identify patterns and relationships in mathematical problems, improving my problem-solving skills.	3.45	0.62	Moderately Positive
4. Provide innovative and efficient ways to study Mathematics.	3.41	0.68	Moderately Positive
5. Bridge learning gaps in Mathematics by offering personalized learning support.	3.38	0.64	Moderately Positive
Overall	3.43	0.53	Moderately Positive

The respondents' moderately positive cognitive attitudes suggest that they recognize the educational value of generative AI in supporting conceptual understanding and mathematical reasoning. Holmes et al. (2019) noted that AI can personalize instruction and provide adaptive learning experiences, while Zawacki-Richter et al. (2019) concluded that AI applications have considerable potential to improve learning outcomes in higher education. These findings support the present study, which indicates that pre-service mathematics teachers perceive AI as beneficial for understanding mathematical concepts.

Conversely, the lowest mean score (Mean = 3.38, S.D. = 0.64), although still interpreted as Moderately Positive, was obtained for the statement, "Bridge learning gaps in Mathematics by offering personalized learning support." This result suggests that while the respondents acknowledge the personalized learning capabilities of generative AI, they may not yet fully recognize or experience its potential to address individual learning needs. This relatively lower rating may also indicate the need for greater exposure to AI tools that provide adaptive and personalized instructional support. Previous studies similarly caution that the educational benefits of AI depend on its appropriate and guided use. Holmes et al. (2019) noted that excessive reliance on AI may reduce students' active participation and independent problem-solving. This finding underscores the importance of teacher guidance in ensuring that generative AI serves as a tool for meaningful learning rather than merely providing convenient answers.

In general, the respondents demonstrated a Moderately Positive cognitive attitude toward generative AI as a learning tool in mathematics (Mean = 3.43, S.D. = 0.53). This indicates that they generally perceive generative AI as beneficial for enhancing conceptual understanding, supporting mathematical reasoning, and facilitating problem-solving. Taken together, the present findings and previous studies suggest that although students recognize the cognitive advantages of generative AI, maximizing these benefits requires its thoughtful and responsible integration into mathematics instruction.

1.2 Behavioral

Table 2 presents the respondents' attitudes toward generative AI as a learning tool in mathematics in terms of the behavioral dimension. It presents the computed mean and standard deviation for each statement together with their corresponding descriptive interpretations.

The mean scores ranged from 2.89 to 3.34, with all items receiving a descriptive interpretation of Moderately Positive. The highest mean score (Mean = 3.34, S.D. = 0.73) was obtained for the statement, "Check AI-generated solutions to verify my own understanding." This finding indicates that the respondents generally demonstrate a positive behavioral tendency to use generative AI as a means of validating and reinforcing their understanding of mathematical concepts rather than relying solely on AI-generated answers.

Table 2 Attitude towards Generative AI as a Learning Tool in Mathematics in Terms of Behavioral Dimension

Item Statements	Mean	Standard Deviation	Descriptive Interpretation
1. Seek AI-generated explanations when facing problem-solving challenges.	3.28	0.63	Moderately Positive
2. Use AI tools as a regular part of study routines.	2.96	0.70	Moderately Positive
3. Encourage classmates to integrate AI-powered learning tools into their studies.	2.89	0.72	Moderately Positive
4. Check AI-generated solutions to verify my own understanding.	3.34	0.73	Moderately Positive
5. Apply AI assistance selectively to reinforce problem-solving skills.	3.23	0.72	Moderately Positive
Overall	3.14	0.54	Moderately Positive

These findings suggest that generative AI can support active learning by encouraging students to evaluate their own work and refine their problem-solving approaches. The findings also demonstrate that respondents use generative AI to verify their understanding of mathematical concepts rather than relying exclusively on AI-generated answers.

This aligns with Holmes et al. (2019), who emphasized that AI should function as instructional support rather than a replacement for human reasoning. Likewise, Watson & Watson (2007) highlighted that, educational technologies are most effective when integrated purposefully into learning activities. Conversely, the lowest mean score (Mean = 2.89, S.D. = 0.72), although still interpreted as Moderately Positive, was recorded for the statement, "Encourage classmates to integrate AI-powered learning tools into their studies." This result suggests that while the respondents are personally receptive to using generative AI, they are comparatively less inclined to promote its use among their peers. Such hesitation may reflect varying levels of confidence in AI tools or uncertainty regarding their appropriate application in collaborative learning environments.

Previous studies likewise suggest that students' behavioral adoption of AI is influenced by the extent to which they understand its appropriate educational use. Holmes et al. (2019) emphasized that AI is most effective when integrated with teacher guidance that promotes active learning and responsible use. This finding implies that strengthening students' confidence in the responsible use of generative AI may also encourage greater collaboration and peer advocacy in mathematics learning.

Overall, the respondents demonstrated a Moderately Positive behavioral attitude toward generative AI as a learning tool in mathematics (Mean = 3.14, S.D. = 0.54). This indicates that they generally exhibit favorable behavioral intentions and practices in using AI to support their

mathematics learning, particularly for verifying solutions and reinforcing their understanding. However, the relatively lower rating for encouraging peers to use AI suggests that opportunities remain to strengthen collaborative and responsible AI practices. All these findings indicate that although students are willing to integrate generative AI into their own learning, continued guidance and structured classroom experiences are needed to foster more consistent and meaningful behavioral engagement with AI technologies.

1.3 Affective

Table 3 presents the respondents' attitudes toward generative AI as a learning tool in mathematics in terms of the affective dimension. It presents the computed mean and standard deviation for each statement together with their corresponding descriptive interpretations.

The mean scores ranged from 3.00 to 3.28, with all items receiving a descriptive interpretation of Moderately Positive. The highest mean score (Mean = 3.28, S.D. = 0.72) was obtained for the statement, "Increase my enthusiasm for exploring new problem-solving techniques." This finding indicates that the respondents generally perceive generative AI as an engaging learning tool that stimulates their interest and enthusiasm for exploring different approaches to mathematical problem-solving.

Table 3 Attitude towards Generative AI as a Learning Tool in Mathematics in Terms of Affective Dimension

Item Statements	Mean	Standard Deviation	Descriptive Interpretation
1. Feel more confident solving mathematical problems with AI assistance.	3.00	0.63	Moderately Positive
2. Make me more curious about discovering new mathematical strategies.	3.24	0.72	Moderately Positive
3. Appreciate AI's interactive feedback, which enhances my motivation to study Mathematics.	3.15	0.64	Moderately Positive
4. Make me less anxious when verifying and checking mathematical solutions.	3.15	0.64	Moderately Positive
5. Increase my enthusiasm for exploring new problem-solving techniques.	3.28	0.72	Moderately Positive
Overall	3.17	0.54	Moderately Positive

The respondents' moderately positive affective attitudes indicate that generative AI promotes curiosity and engagement in mathematics learning. Hattie (2009) emphasized that students' motivation and engagement substantially influence academic achievement. Likewise, Kolb (1984) explained that meaningful learning occurs when learners actively engage with experiences and reflect on them. These perspectives support the observed motivational benefits associated with AI-assisted learning.

Conversely, the lowest mean score (Mean = 3.00, S.D. = 0.63), although still interpreted as Moderately Positive, was obtained for the statement, "Feel more confident solving mathematical problems with AI assistance." This finding suggests that while the respondents generally exhibit positive feelings toward generative AI, they remain somewhat cautious about relying on it to build their confidence in solving mathematical problems. This may indicate that students are still developing trust in AI as a learning support tool and may require additional experience and guidance to use it effectively.

Generally, the respondents demonstrated a Moderately Positive affective attitude toward generative AI as a learning tool in mathematics (Mean = 3.17, S.D. = 0.54). This

indicates that they generally view generative AI as a motivating and engaging resource that stimulates curiosity, reduces anxiety, and encourages the exploration of different mathematical problem-solving strategies. However, the relatively lower level of confidence in using AI suggests that pre-service mathematics teachers would benefit from additional opportunities to develop confidence and competence in utilizing AI effectively. Overall, the findings underscore the importance of providing guided learning experiences that foster positive attitudes while promoting the responsible and meaningful use of generative AI in mathematics education.

2. Extent of Utilization of Generative AI in Learning Mathematical Concepts

Table 4 presents the respondents' extent of utilization of generative AI in learning mathematical concepts. It shows the computed mean and standard deviation for each statement together with their corresponding descriptive interpretations.

The mean scores indicate that the respondents moderately utilized generative AI across all learning activities. The two highest-rated items were "Review step-by-step explanations to understand different problem-solving approaches" (Mean = 3.55, S.D. = 0.65) and "Seek explanations when struggling with mathematical concepts" (Mean = 3.49, S.D. = 0.63), with descriptive interpretations of Highly Utilized and Moderately Utilized, respectively. The present findings suggest that effective integration of AI requires institutional support and intentional instructional planning. The high utilization of step-by-step explanations indicates that students value AI's ability to simplify complex mathematical procedures, thereby facilitating conceptual understanding and problem-solving. These findings suggest that respondents primarily use generative AI to obtain explanations, verify understanding, and support independent learning in mathematics.

Table 4 Extent of Utilization of Generative AI in Learning Mathematical Concepts

Item Statements	Mean	Standard Deviation	Descriptive Interpretation
1. Seek explanations when struggling with mathematical concepts.	3.49	0.63	Moderately Utilized
2. Solve complex equations and word problems using advanced techniques.	3.20	0.68	Moderately Utilized
3. Explore simulations and visualizations to improve my understanding of abstract concepts.	3.32	0.60	Moderately Utilized
4. Receive feedback to refine my problem-solving skills.	3.23	0.84	Moderately Utilized
5. Compare generated solutions with my own to check for accuracy.	3.39	0.68	Moderately Utilized
6. Integrate learning tools into my regular Mathematics study routine.	3.07	0.79	Moderately Utilized
7. Use tutoring systems for additional learning support.	3.15	0.82	Moderately Utilized
8. Practice solving problem sets for mastery.	3.38	0.79	Moderately Utilized
9. Review step-by-step explanations to understand different problem-solving approaches.	3.55	0.65	Moderately Utilized
10. Share recommended strategies with classmates to enhance collaborative learning.	3.31	0.72	Moderately Utilized
Overall	3.31	0.54	Moderately Utilized

Conversely, the two lowest-rated items were "Integrate learning tools into my regular Mathematics study routine" (Mean = 3.07, S.D. = 0.79) and "Use tutoring systems for additional learning support" (Mean = 3.15, S.D. = 0.82), both interpreted as Moderately Utilized. Although these findings indicate that the respondents use generative AI in their mathematics learning, they also suggest that AI has not yet been fully integrated into their regular study habits. The relatively lower utilization of AI for routine learning activities may reflect limited opportunities for structured classroom integration or insufficient guidance on incorporating AI into daily academic practices.

These findings emphasize that the effective integration of AI requires both institutional support and intentional instructional planning. Successful AI implementation depends on curriculum alignment and well-designed learning activities that encourage sustained use of AI technologies. Collectively, while students recognize the usefulness of generative AI, they may require greater instructional support to incorporate AI more consistently into their regular learning routines (Holmes et al. (2019).

In general, the respondents demonstrated a Moderately Utilized level of generative AI use in learning mathematical concepts (Mean = 3.31, SD = 0.54). The findings indicate that students primarily utilize generative AI to obtain explanations, review step-by-step solutions, and support mathematical problem-solving. However, its comparatively lower utilization for routine study and extended tutoring suggests that AI remains a supplementary learning resource rather than an integral component of students' daily learning practices. These findings underscore the need for structured instructional strategies that promote the responsible, consistent, and meaningful integration of generative AI into mathematics learning.

3. Relationship between the Respondents' Attitude and Utilization of Generative AI as a Learning Tool in Mathematics

Table 5 presents the relationship between the respondents' attitude and utilization of generative AI as a learning tool in Mathematics. The correlation of the variables was tested using the Pearson r formula.

Table 5 Relationship between the respondents' attitude and utilization of generative AI as a learning tool in mathematics

Variables	Computed r	p value	Decision on H_0	Interpretation
Attitude and Utilization of Generative AI as a Learning Tool in Mathematics	.69	$p < .001$	Reject H_0	Significant Positive Correlation

Table 5 presents the relationship between the respondents' attitudes toward and utilization of generative AI as a learning tool in mathematics. The results revealed a significant positive correlation between the two variables ($r = .69$, $p < .001$), leading to the rejection of the null hypothesis. This finding indicates that respondents with more positive attitudes toward generative AI also tended to demonstrate higher levels of utilization in learning mathematics.

This finding suggests that students who perceive generative AI as useful, accessible, and relevant to their academic needs are more likely to incorporate it into their mathematics learning activities. Positive attitudes appear to encourage more frequent and meaningful utilization of AI, particularly for problem-solving, obtaining explanations, and supporting independent learning.

The significant positive relationship between attitude and utilization suggests that favorable perceptions encourage greater use of generative AI in mathematics learning. This

finding is consistent with Bohner & Dickel (2011), who explained that attitudes influence behavioral intentions, and with Eagly & Chaiken (1993), who proposed that cognitive, affective, and behavioral components collectively shape individuals' actions.

Likewise, Zawacki-Richter et al. (2019) emphasized that successful AI integration depends not only on technological availability but also on users' acceptance and readiness. Zawacki-Richter et al. (2019) similarly emphasized that students' engagement with AI is shaped not only by their attitudes but also by the instructional support provided during its implementation. Collectively, these studies reinforce the present finding that positive attitudes, coupled with appropriate educational support, promote more meaningful and sustained utilization of generative AI.

The findings further imply that structured learning experiences may strengthen both students' attitudes toward and utilization of generative AI. Opportunities for guided practice, teacher facilitation, and curriculum-integrated AI activities can foster greater confidence and encourage students to use AI responsibly as part of their mathematics learning. This relationship highlights the importance of developing instructional strategies that not only increase students' access to AI technologies but also cultivate positive attitudes that support their effective and ethical use.

The significant strong positive relationship between attitude and utilization demonstrates that students' perceptions of generative AI play an important role in determining how they engage with the technology in mathematics learning. This finding directly supports the development of the proposed action plan, which focuses on strengthening positive attitudes, promoting responsible AI utilization, and providing structured learning experiences that encourage meaningful integration of generative AI into mathematics instruction.

4. Evidence-Based Action Plan to Support the Effective Integration of Generative AI into Mathematics Instruction

Based on the findings of the study, an evidence-based action plan was developed to support the effective integration of generative AI into mathematics instruction. The proposed plan addresses the key findings that pre-service mathematics teachers demonstrated moderately positive attitudes toward generative AI, moderate levels of utilization, and a significant positive relationship between attitude and utilization. Specifically, the activities are designed to promote the regular and responsible use of generative AI, strengthen students' confidence and competence in using AI as a learning tool, and encourage its meaningful integration into mathematics learning.

Table 6 Evidence-Based Action Plan to Support the Effective Integration of Generative AI into Mathematics Instruction

Objectives	Activities	Description	Strategies
1. To develop an action plan that will encourage regular and meaningful use of AI in learning, foster collaborate through AI use and equip students with responsible AI usage skills.	AI ThinkLab: Smart Solutions in Action	A weekly classroom segment where students use AI tools like ChatGPT, Grammarly, or Canva Magic Write to solve real-world academic or subject-based problems.	• Integrate AI tools into lesson plans for research, writing, and design tasks. • Provide guided practice sessions using school-approved AI tools. • Encourage reflection logs on how AI improved their learning process.
	Team ThinkBot	Group-based tasks where students collaborate using AI tools (e.g., Google Bard, ChatGPT, or Gemini) to brainstorm solutions or create outputs.	• Assign mixed-ability teams to promote peer learning. • Use shared AI documents or collaborative spaces like Notion AI or Google Docs with AI assist. • Evaluate both collaboration and product AI-enhanced output.
	Trust the Tech, Check the Fact	An awareness campaign and activity where students verify AI-generated outputs using credible sources.	• Assign fact-checking challenges on AI-produced content. • Use infographic creation to highlight responsible use tips. • Display student-created posters or digital campaigns across campus.

The proposed action plan provides a structured and evidence-based framework for supporting the effective integration of generative AI into mathematics instruction. It was developed directly from the empirical findings of the study, particularly the respondents' moderately positive attitudes toward generative AI, their moderate level of utilization, and the significant positive relationship between attitude and utilization. These findings indicate that although pre-service mathematics teachers recognize the educational value of generative AI, its use has not yet become a regular component of their learning practices.

Accordingly, the proposed activities focus on three complementary areas: promoting the regular use of generative AI through guided classroom learning experiences (AI ThinkLab), strengthening collaborative learning through AI-assisted group activities (Team ThinkBot), and developing responsible AI practices through critical evaluation and verification of AI-generated outputs (Trust the Tech, Check the Fact). Collectively, these activities are intended to strengthen students' confidence, AI literacy, and responsible utilization of generative AI while supporting its meaningful integration into mathematics instruction.

Discussions

The findings revealed that BSEd Mathematics students demonstrated a moderately positive attitude toward the use of generative AI as a learning tool. They acknowledged its usefulness in enhancing understanding of mathematical concepts, supporting problem-solving, and increasing learning motivation. Despite this favorable disposition, their actual utilization of generative AI remained at a moderate level, indicating that these tools are not yet fully embedded in their regular study practices. This aligns with recent evidence showing that while mathematics students maintain highly positive attitudes toward AI-assisted problem solving, their depth of actual utilization remains insufficient (Sixian et al., 2026). The computed Pearson r value of 0.69 further indicated a significant moderate positive relationship between attitude and utilization, suggesting that more positive perceptions are associated with higher levels of AI use in academic tasks. In relation to existing literature, these results are generally consistent with studies reporting that positive attitudes toward educational technologies tend to facilitate greater adoption and use among learners (Lin & Jiang, 2025). However, while prior research often highlights more seamless integration of AI tools in learning environments, the present findings suggest a more cautious and gradual adoption among pre-service mathematics teachers, possibly due to limited training or uncertainty in appropriate academic use. This hesitation is frequently observed among mathematics educators and pre-service populations due to disciplinary demands for precision, lack of formal AI literacy training, and ethical anxieties (Hossein-Mohand et al., 2026). To strengthen this relationship, the researchers proposed a plan of activities, including seminars, workshops, and guided learning sessions, aimed at enhancing AI literacy and promoting responsible and effective use of generative AI in mathematics learning.

Conclusion and suggestions

This study concludes that pre-service mathematics teachers demonstrate a moderately positive attitude toward generative artificial intelligence (AI) as a learning tool and a moderate level of utilization in learning mathematics. Furthermore, a significant positive relationship was found between students' attitudes and their utilization of generative AI, indicating that more favorable attitudes are associated with greater use of AI in mathematics learning. These findings contribute to mathematics teacher education by providing empirical evidence that supports the role of positive attitudes in promoting the meaningful utilization of generative AI to enhance conceptual understanding, problem-solving, and independent learning. At the same time, the moderate level of utilization suggests that although students recognize the educational value of generative AI, its integration into their regular learning practices remains limited and requires further instructional support.

Based on these findings, it is recommended that the College of Teacher Education implement structured faculty and student development programs that strengthen AI literacy, promote the responsible and ethical use of generative AI, and encourage its meaningful integration into mathematics instruction. Faculty members should collaborate in developing instructional strategies and learning activities that provide students with guided opportunities to utilize generative AI effectively and responsibly. Likewise, the proposed evidence-based action plan should be implemented and periodically evaluated to determine its effectiveness in improving students' attitudes toward and consistent utilization of generative AI. Future studies may extend the present research by examining additional variables, such as academic performance, digital readiness, self-regulated learning, and technology acceptance, to further explain the role of generative AI in mathematics education and teacher preparation.

New knowledge and the effects on society and communities

This study contributes to the growing body of knowledge on the relationship between pre-service mathematics teachers' attitudes toward generative AI and their utilization of the technology as a learning tool. The findings underscore the importance of equipping future teachers with the knowledge, skills, and ethical awareness needed to utilize generative AI effectively and responsibly. By strengthening AI literacy and promoting its meaningful integration into teacher education, educational institutions can prepare technologically competent educators who are capable of fostering innovative, student-centered, and ethically grounded learning environments. Ultimately, empowering pre-service mathematics teachers to integrate generative AI responsibly into classroom practice can cultivate learners who use technology critically, creatively, and ethically, thereby contributing to the advancement of mathematics education and the broader goals of a digitally empowered society.

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