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Nature on the Use of AI Tools and Academic Achievement in Mathematics

Irish Joyce S. Arce

Benguet State University, Philippines, 0009-0006-2108-8189
Corresponding author: Irish Joyce S. Arce (irishjoyce5574@e.ubaguio.edu)

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Abstract

This study investigates the nature of AI tool use and its relationship to the academic achievement of senior high school STEM students in Mathematics. Guided by a quantitative descriptive-correlational design, the research surveyed students to examine their extent of AI use in completing tasks and administered an achievement test to measure performance. Results revealed that students primarily used AI tools as a scaffold to enhance independent learning and reinforce mastery of mathematical concepts, rather than solely as a crutch for task completion. Analysis showed that scaffolded use exhibited a weak positive correlation with achievement, while crutch-based use displayed a weak negative correlation. However, both relationships were found to be not significant. These findings indicate that AI tools, when used strategically, may support student learning, but overreliance could hinder problem-solving and critical thinking. The study underscores the importance of promoting responsible and balanced AI use in mathematics classrooms, ensuring that technology serves as a supplement rather than a substitute for cognitive engagement. Recommendations are offered for educators to integrate AI in ways that reinforce higher-order skills and for future researchers to examine its long-term influence on learning outcomes.

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Introduction

In the rapidly evolving landscape of education, technological advancements have significantly influenced teaching and learning practices. Among these advancements, artificial intelligence (AI) tools have emerged as prominent resources, reshaping how students approach academic tasks. AI tools, such as mathematical solvers, tutoring platforms, and content generators, provide opportunities for personalized learning and increased efficiency in task completion. However, their widespread accessibility raises concerns about the student's dependency on AI tools and the potential implications for academic development.

In the context of Senior High School STEM (Science, Technology, Engineering, and Mathematics) students, Mathematics is a core subject that fosters critical and problem-solving skills essential for their academic and professional pursuits. Activities in this subject such as homework, performance tasks, or even reviewing in preparation for the exams require higher-order thinking, conceptual understanding, and application of learned concepts. While AI tools offer support in addressing complex problems, an overreliance on AI tools may hinder students' ability to develop independent critical thinking and problem- solving skills.

AI tools such as Photomath, Wolfram Alpha, and ChatGPT have become popular among students for their ability to break down complex equations and provide step-by-step solutions. These tools are particularly useful for students who struggle with abstract mathematical concepts as they offer personalized support and immediate feedback. Research has shown that AI tools, when effectively implemented, can provide personalized learning experiences, helping students understand complex mathematical concepts at their own pace (Liu & Liao, 2020). These tools allow students to visualize problems, break them into manageable steps, and receive instant solutions and explanations, making mathematics more accessible and less intimidating. In this way, AI can potentially improve student engagement and learning outcomes by offering support tailored to individual needs (Baker & Siemens, 2014).

However, concerns have emerged about overreliance. Limniou and Smith (2021) argue that while AI enhances efficiency, excessive use reduces independent problem-solving and critical thinking. Fischer, Lundin, and Lindberg (2020) similarly caution that dependency may weaken higher-order reasoning, even though AI improves personalization and engagement internationally. In the Philippines, adoption is still developing. Sarmiento (2020) notes that limited access, internet connectivity issues, and lack of teacher training hinder widespread use. Department of Education CAR (2020) adds that private and urban schools benefit more than rural ones, creating uneven opportunities. Nonetheless, the National Economic and Development Authority (2017) stresses that AI can help strengthen STEM education to prepare students for future demands.

At the local level, Baguio City schools are beginning to adopt AI tools. VanLehn (2019) explains that intelligent tutors can provide targeted support to help students master mathematics. Bucad (2021) warns that students who depend too much on AI risk losing abstract reasoning skills. Similarly, Sarmiento (2020) emphasizes that excessive use discourages independent problem-solving. Gomez and de Guzman (2021) observe that adoption remains inconsistent, limited by accessibility and teacher readiness.

The National Council of Teachers of Mathematics (2024) underscores AI's contribution in helping students break down and understand complex mathematical concepts. Opesemowo (2024) highlights advancements in adaptive assessment and real-time feedback, which adjust to student weaknesses. Xu and Ouyang (2022), however, argue that AI must be balanced with traditional instruction to preserve cognitive skills. Kelley et al. (2024) warn that students who rely too heavily on AI develop only surface-level understanding. Wang et al. (2024) note a clear distinction between scaffolded use, which supports independent reasoning, and crutch-based use, which bypasses it.

Similar dependency issues are found in other disciplines. Chen et al. (2020) reveal that students using AI-based grammar checkers in language learning struggle to detect errors independently. In medicine, Topol (2019) points out that AI enhances diagnostics, but Reddy, Fox, and Purohit (2021) warn that overdependence can weaken diagnostic reasoning. In arts, McCarthy (2022) and Jones and Brown (2023) discuss how AI-generated works raise issues of originality, authorship, and devaluation of creativity. In engineering, Zou (2024) explains that AI enhances design and predictive analytics but stresses the need for integration with industry to build practical and innovative skills.

Overall, Bucad (2021) and Sarmiento (2020) stress the risks of dependency in mathematics education. Xu and Ouyang (2022) found in China that students relying heavily on AI retained fewer concepts than those who used it only as a supplement. These findings show that while AI can be a scaffold for learning, it also risks becoming a crutch. Although research exists internationally and nationally, few studies focus on Senior High School STEM students in Baguio City. This study therefore addresses the gap by exploring whether AI tools support or hinder the development of critical thinking and academic achievement in mathematics.

Conceptual Framework

The integration of AI tools has reshaped education, especially in mathematics, where problem-solving and conceptual understanding are central. This study is anchored on the idea that students' use of AI tools, either as scaffolds that enhance learning or as crutches that replace independent thinking, affects their academic achievement in General Mathematics under the STEM strand. Academic achievement, as defined by Airasian (2005), refers to the attainment of learning outcomes measured through grades, test scores, and assessments. In this study, it is represented by students' scores in an achievement test on Calculus and Statistics, based on DepEd's K to 12 grading standards.

AI tools are digital technologies that simulate human intelligence to assist learning. These include AI-based platforms, calculators, problem solvers, and tutoring applications. Their use is classified into scaffolded AI, where tools enhance understanding and problem-solving and crutch-based AI, where tools substitute for reasoning. The extent of use is measured by frequency: never, rarely, sometimes, and always.

In the Philippines, Dizon and Reyes (2023) observed that students switch between scaffolded and crutch-based use depending on task difficulty. Capinding (2023) and Santos and Cruz (2024) reported that many Filipino learners use Photomath mainly to verify answers or deepen understanding, suggesting scaffolded use. Shearman (2024), Holmes et al. (2019), and Lin, Huang, and Lu (2023) emphasize that strategic AI integration strengthens critical thinking and problem-solving. Martinez and Zhao (2022) and Kroeger & Brown (2021) also confirm AI's effectiveness when reinforcing not replacing the learning process. On the other hand, Al-Zahrani (2024), and Akinwalere and Ivanov (2022) caution that excessive dependence undermines retention and higher-order skills.

Bancoro (2024) found no significant correlation between AI use and performance among Negros Oriental State University students, despite moderate availability. Nguyen and Duong (2023) and Raza et al. (2023) reported similar findings, noting that AI improves convenience but has limited academic impact unless paired with active engagement. The Digital Education Council (2024) adds that in the Philippines, AI's benefits depend largely on teacher guidance and student study habits.

Broader studies echo these mixed results. Dong et al. (2025) and Vieriu and Petrea (2025) concluded that AI's academic effects are small and context-dependent. Adewale et al. (2024), in a systematic review, found that while AI supports open and distance learning, significant gains in achievement are rare without strong cognitive engagement. These insights shape this study's framework: AI tools can support mathematics learning when used as scaffolds, but crutch-based use risks diminishing achievement. Thus, the study considers nature of AI use (scaffold vs. crutch) and extent of AI use (frequency) as independent variables, academic achievement as the dependent variable, and critical thinking and problem-solving skills as intervening variables.

Schematic Illustration of the Study

The study employs a systems model to illustrate the interaction of variables. The independent variables are the nature (scaffolded or crutch-based, measured via Likert scale) and extent (never, rarely, sometimes, always) of AI tool use. The dependent variable is academic achievement, assessed through a Calculus and Statistics test aligned with DepEd standards. The intervening variables are critical thinking and problem-solving skills, measured through test performance and a self-reported survey of analytical reasoning.

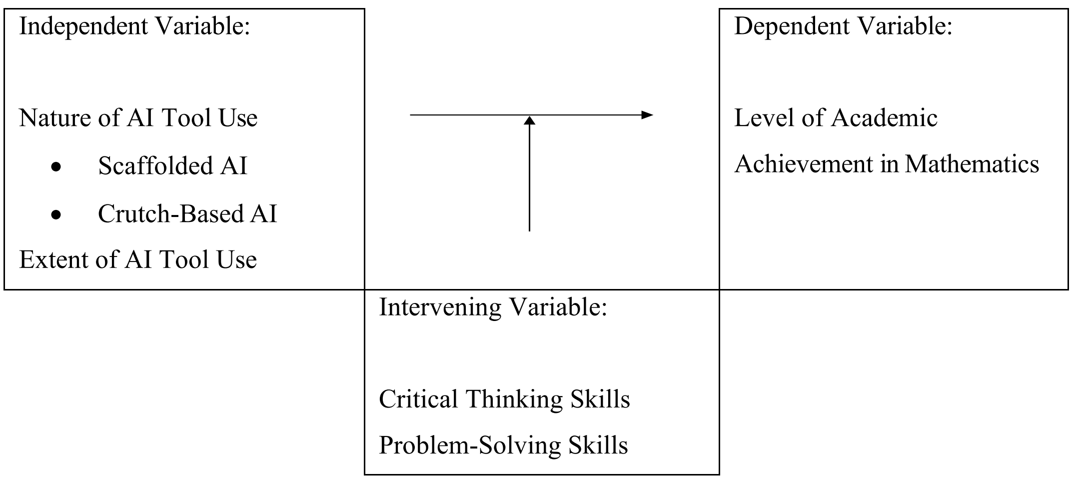

Figure 1. Paradigm of the Study

Statement of the Problem

The study aimed to examine the relationship between the nature and extent of artificial intelligence tool use and the academic achievement of STEM students in Mathematics. Specifically, the study sought to address the following objectives:

1. What is the nature of students' use of AI tools in their learning engagement in Mathematics?
2. What extent do students use AI tools to complete mathematics tasks?
3. What is the effect of the nature of AI tools used in the mathematics achievement of the student?
4. What is the effect of the extent use of AI tools in the mathematics achievement of the students?

Methodology

Research Design

This study employed a quantitative descriptive-correlational design to examine the relationship between the nature and extent of AI tool use and students' mathematics achievement. The design enabled the analysis of test scores in Calculus and Statistics alongside self-reported AI usage patterns, without inferring cause-and-effect. Descriptive analysis determined the nature and extent of AI use and levels of achievement, while correlational analysis assessed possible relationships between AI tool reliance and academic outcomes.

Population and Locale of the Study

The study was conducted at the University of Baguio, Philippines, among Senior High School STEM students enrolled in General Mathematics in the academic year 2024–2025. Using multi-stage random sampling, one section was allocated for reliability testing and 554 students were eligible. Cochran's formula determined a sample size of 228, though 202 valid responses were retained after data cleaning. This ensured statistical sufficiency and representation. The breakdown of the sample size is presented in Table 1.

Table 1. Number of Sample of Respondents

Section	Total number of students	Randomly selected sections	Proportional Sample respondents
A	43		
B	43	B	39
C	44	C	40
D	44		
E	41		
F	42	F	38
G	42	G	38
H	44		
I	43		

Section	Total number of students	Randomly selected sections	Proportional Sample respondents
J	43		
K	42	K	38
L	44		
M	39	M	35
Overall	554		228

Data Collection Instrumentation

Data were collected using a researcher-made survey questionnaire and a mathematics achievement test. The survey included demographic questions, Likert-scale items to assess nature (scaffold vs. crutch) and extent (never, rarely, sometimes, always) of AI tool use, and a checklist of AI platforms and their perceived benefits. The achievement test, validated by three mathematics teachers, covered Calculus, Statistics, and Probability, measuring problem-solving skills and conceptual understanding. It obtained a validity score of 0.76 and high reliability (Cronbach's $\alpha = 0.91$).

Data Collection Procedure

The data collection process began with securing approval from the University of Baguio's administration and obtaining informed consent from student participants. To ensure validity, the instruments were reviewed by a Mathematics teacher, followed by pilot testing: the Likert-scale questionnaire with Grade 11 STEM students and the achievement test with Grade 12 STEM students. Reliability was established through Cronbach's Alpha for the Likert scale and item analysis, including the difficulty index, for the achievement test. Necessary revisions were made based on the results.

The finalized instruments were administered to the selected Grade 11 STEM students during their free periods. Responses were then encoded and analyzed using Microsoft Excel. Descriptive statistics (mean and standard deviation), the t-test for independent samples, and Pearson's correlation coefficient were applied to examine the relationship between AI tool use and mathematics achievement. The findings were summarized, and recommendations were formulated to guide the integration of AI tools in Mathematics education.

Data Analysis

The collected data were systematically analyzed using descriptive and inferential statistics to address the study objectives. For SOP 1, the nature of AI tool use was described through frequency and percentage distribution of survey responses. For SOP 2, the extent of AI tool use was determined using means and standard deviations, with responses categorized into always, sometimes, rarely, or never, based on a four-point scale.

For SOP 3, mathematics achievement was analyzed by calculating frequency of students within each level of academic achievement. Raw scores from the achievement test were converted to numerical grades based on

DepEd grading standards (Department of Education, 2012) to align interpretations with national benchmarks. The classification was shown in Table 3.

Table 2. Categorization of the Extent Use of AI tools

Point	Scale Range	Interpretation	Scaffolded AI Use (support-based)	Crutch-based AI Use (over-reliance)
4	3.25- 4.00	Always *Uses AI in nearly every task*	Highly Strategic Use of AI- AI is used as an enhancement to learn, supporting understanding while maintaining problem-solving independence.	Highly Over-Reliant on AI- AI is relied upon excessively, often replacing independent thinking in problem-solving.
3	2.50- 3.24	Sometimes *Uses AI tools periodically*	Moderate AI Use- AI is used as a supplementary tool, enhancing but not replacing traditional problem-solving.	Moderate Over-Reliance on AI- AI use begins to replace independent problem-solving in more challenging tasks.
2	1.75- 2.49	Rarely *Uses AI tools occasionally*	Limited AI Use- AI is used only when needed for complex topics, ensuring conceptual understanding.	Limited Over- Reliance on AI- AI is used occasionally but primarily for quick answers rather than learning.
1	1.00- 1.74	Never *Do not use AI tools*	No AI Use- Fully relies on traditional learning methods but remains open to AI if needed.	Not Dependent on AI- Avoids AI use entirely, possibly due to lack of access or distrust in AI tools.

Table 3. Score Ranges and Corresponding Academic Achievement Levels

Actual Score	Numerical Grade	Level of Academic Achievement
50	100	Advanced (A)
49	98	
48	97	
47	96	
46	95	
45	93	
44	92	
43	91	
42	90	
41	88	Proficient (P)
40	87	
39	86	
38	85	

Actual Score	Numerical Grade	Level of Academic Achievement
37	83	Approaching Proficient (AP)
36	82	
35	81	
34	80	
33	78	Developing (D)
32	77	
31	76	
30	75	
29 and below	Below 75	Beginning (B)

The t-test for two independent samples were used to determine the effect of the nature of AI tools use and mathematics achievement following the interpretation in Table 4. For SOP 4, the effect between the extent of AI tools use and mathematics achievement was examined by analyzing their means. Pearson's correlation coefficient was applied to assess the strength and direction of these relationships. Interpretation of the correlation strength followed Wahyuni & Purwanto (2020), using the scale in Table 4.

Table 4**.** Level of Effect on the Nature and Extent of AI Tools in Mathematics Achievement

Range (±)	Level	Description
0.80-1.00	Very Strong	AI tools significantly enhance mathematics achievement when relationship is statistically significant.
0.60-0.79	Strong	AI tools contribute positively to learning, but only if statistically significant.
0.40-0.59	Moderate	AI tools provide moderate support in learning, if statistically significant.
0.20-0.39	Weak	AI tools have a weak but notable effect if statistically significant.
0.00-0.19	Very Weak or No Significant Effect	AI tools have little to no meaningful effect on mathematics achievement, not statistically significant.

Item analysis of the achievement test was conducted using the difficulty index, with average-level items retained and revisions made to overly easy or difficult items. Reliability was assessed through Cronbach's alpha for both the Likert-scale questionnaire and the achievement test, while content validity was established through expert review. Results were presented in tables with descriptive and inferential statistics to illustrate the findings clearly.

Research Ethics

Ethical standards were strictly observed throughout the conduct of the study. Prior to data collection, formal approval was secured from the administration of the University of Baguio. Participants were informed of the study's objectives, procedures, and their rights, including the freedom to withdraw at any point without penalty. Informed consent forms were distributed, ensuring voluntary participation. To safeguard participants' welfare, all responses were treated with strict confidentiality. No identifying information was disclosed, and data were encoded and stored securely. Anonymity was maintained in reporting, ensuring that results reflected group trends rather than individual performance. The safety and well-being of student participants were prioritized by conducting the survey and tests during their free periods to minimize disruption and stress. Furthermore, the instruments underwent expert validation and pilot testing to ensure fairness, accuracy, and appropriateness. The research adhered to established ethical principles, protecting participants' rights while ensuring the integrity of the findings.

Results

Nature on the Use of AI Tools in Mathematics of Senior High School STEM Students

Table 5 shows the frequency distribution of the nature of using AI tools among senior high school STEM students in Mathematics. The nature of using AI tools among senior high school STEM students in Mathematics is scaffolded. Result shows that about 180 students, or 89.11% use scaffolded AI, while only 22 students , or 10.89% used crutch- based AI.

Table 5. Nature of Students' Use of AI Tools in Mathematics

Nature on Use of AI Tools	Frequency (f)	Percentage (%)
1. Scaffolded AI	180	89.11
2. Crutch-based AI	22	10.89
Total	202	100

Extent of AI Tool Usage in Completing Mathematics Task

Table 6 presents the extent of AI tool use in completing mathematics tasks. The overall mean was 2.10, was interpreted as rarely. Scaffolded AI had a composite mean of 2. 40 and interpreted as rarely, while cutch-based AI obtained a composite mean of 1.80 and also interpreted as rarely.

Table 6. Extent of AI Tools Use in Completing Mathematics Task

Extent on Use of AI Tools as Scaffolded AI	N=202	
In learning Calculus and Statistics, I use AI tools …	M	DE
1. when I struggle to understand a concept, but I still try to solve problems on my own first.	2.41	R
2. to check if my answers are correct after solving problems independently.	2.60	S
3. to explore different methods for solving a problem and compare which one works best for me.	2.40	R
4. to help me visualize and break down complex Calculus and Statistics concepts into simpler steps.	2.51	S
5. to practice solving problems so I can perform better in assessments like quizzes, major exams, and performance tasks.	2.48	R

Extent on Use of AI Tools as Scaffolded AI	N=202	
6. because it boosts my confidence in solving Calculus and Statistics problems.	1.78	R
7. as a guide to deepen my understanding of mathematical concepts.	2.65	S
8. to improve my problem-solving skills rather than just obtaining the correct answer.	2.36	R
Composite Mean	2.40	R
Extent on Use of AI Tools as Crutch-Based AI		
1. as my first option whenever I encounter a difficult problem, without trying to solve it myself.	1.97	R
2. to get instant solutions without attempting to understand the process.	1.71	N
3. to quickly generate answers rather than solving the problem myself.	1.73	N
4. because I find it difficult to solve math problems without AI assistance.	1.84	R
5. because it allows me to complete tasks faster, even if I don't fully understand the concepts.	1.81	R
6. because I feel dependent on AI tools to answer math-related questions like assignments and performance tasks.	1.66	N
7. because I consider AI tools essential for my success in Mathematics.	1.86	R
Composite Mean	1.80	R
Overall Mean	2.10	R

Legend: N= sample size. M= mean. DE= descriptive equivalent. 2.50-3.24= Sometimes (S). 1.75-2.49= Rarely (R). 1.00- 1.74= Never (N)

Effect of the Nature of AI Tools Use in Mathematics Achievement of Student

Table 7 presents the effect of the nature of AI tool use on students' mathematics achievement. Scaffolded AI users obtained a mean score of 77.88, while crutch-based AI users obtained 77.32. Both fall under the developing level. The computed t-value of 0.570 with a p-value of 0.569 indicates no statistically significant difference.

Table 7. Effect of the Nature of AI Tools on Mathematics Achievement

Nature of Use	Level of Mathematics Achievement						t	p
	P	AP	D	B	Mean	DE		
Scaffolded AI	3	36	56	85	77.88	D	0.570	0.569
Crutch-based AI	-	4	8	10	77.32	D		

Legend: P = proficient. AP = approaching proficiency. D = developing. B = beginning. DE = descriptive equivalent. t = t-test for two independent samples. p = probability (Sig.) value.

Effect of the Extent Use of AI Tools on Mathematics Achievement of Students

Table 8 shows the relationship between the extent of AI tool use and mathematics achievement. The overall Pearson correlation coefficient of 0.009 with a p-value of 0.895 suggests a very weak positive relationship that is not statistically significant.

Table 8. Effect of Extent Use of AI Tools in Mathematics Achievement

	Extent of Use					
	Scaffolded AI		Crutch-based AI		Overall	
Mathematics	r	p	r	p	r	p
Achievement	0.045	0.529	-0.036	0.611	0.009	0.895

Legend: r = Pearson correlation coefficient. p = probability (Sig.) value. r (±0.000 - ± 0.199) = very weak or no relationship thus, very weak or not significant. p (> 0.05) = not statistically significant.

Discussion

The results show that most students use AI as a scaffolded, support-based tool, integrating it into their tasks after exerting independent effort. For example, in Calculus, a student solved a limit problem step-by-step before checking with AI, while in Statistics, another student constructed a frequency distribution and histogram manually before refining the graph with AI. In these cases, AI served as confirmation and visualization aid rather than the primary solver, fostering independence similar to how a teacher provides temporary guidance. In contrast, crutch-based AI use was observed in only 22 students (10.89%), who relied on AI for immediate solutions without attempting the task first. For instance, pasting an entire math problem into AI and copying the answer. While this ensures timely submission, it undermines problem-solving and reasoning, limiting deeper learning. Some students also exhibited situational switching, shifting between scaffolded and crutch-based use depending on academic pressure or time constraints.

These findings align with prior studies. Dizon and Reyes (2023) noted Filipino students alternate between AI for deeper understanding and convenience depending on task complexity and pressure. Shearman (2024) and Holmes et al. (2019) highlighted that scaffolded AI fosters critical thinking and comprehension, while Lin, Huang, and Lu (2023) emphasized its role in strengthening conceptual understanding. Similarly, Kroeger & Brown (2021) and Martinez and Zhao (2022) concluded that AI is most beneficial when reinforcing, not replacing, learning. However, literature also warns against overdependence. Al-Zahrani (2024) and the Digital Education Council (2024) cautioned that reliance on AI may weaken critical thinking, and Akinwalere and Ivanov (2022) stressed that it can hinder long-term retention of mathematical knowledge. Overall, the study reveals a promising trend of constructive AI use, where most students employ AI as a scaffold for learning rather than a shortcut. This underscores the importance of teachers promoting scaffolded AI integration in classrooms modeling reflective use, encouraging critical thinking, and helping students avoid overdependence, especially under pressure.

The extent to which students use AI tools to complete mathematics tasks in Calculus and Statistics, as gleaned from Table 6 imply that, in general, students do not heavily rely on AI tools in their daily mathematics tasks. Their use of AI is occasional, situational, and often depends on topic difficulty. For scaffolded AI use, the composite means of 2.40 (rarely) suggests that students are beginning to integrate AI tools cautiously, using them mainly to deepen conceptual understanding. For example, students may consult ChatGPT or Photomath to clarify complex topics like limits or use Gauthmath to check answers after independently solving Statistics problems. Others turn to visualization tools such as Desmos or GeoGebra to make abstract concepts more tangible. These practices reflect initiative and responsibility, showing that students view AI as a support system rather than a substitute. However, other scaffolded uses such as test preparation, exploring alternative methods, or boosting confidence remained less frequent, possibly due to unfamiliarity or uncertainty about whether such tools are permitted. By contrast, crutch-based AI use yielded a lower composite mean of 1.80 (rarely), with several items falling under the "never" category. This indicates a strong avoidance of misusing AI for shortcuts. Most students attempt problems manually before turning to AI, valuing long-term learning over immediate task completion. While some admitted to occasional dependency during deadlines or heavy workloads, the overall pattern reflects a desire for independence.

These findings parallel both international and local trends. Holmes, Bialik, and Fadel (2019) emphasized that AI is most effective when used to support deeper learning rather than as a shortcut. Similarly, Al-Zahrani (2024) and Tchounikine (2020) highlighted that AI enhances conceptual understanding when learners engage critically but yields limited benefits with passive use. Locally, Capinding (2023) observed that Filipino students mainly use AI apps like Photomath to verify solutions after independent attempts, while Santos and Cruz (2024) noted a cautious, supplement-oriented approach among Filipino learners. Taken together, these results affirm that students both in the Philippines and internationally tend to use AI responsibly as a scaffold to learning rather than as a crutch for shortcuts. This suggests a growing awareness of AI's potential as a supportive educational tool, while also underscoring the need for teacher guidance to help students maximize its benefits for critical thinking and problem-solving.

Table 7 presents the effect of the nature of AI tool use on students' mathematics achievement depending on the nature of AI tools use. Both mean scores fall under the developing level, indicating that students demonstrated only partial mastery of mathematical competencies, particularly in Calculus and Statistics topics such as limits and probability distributions. At this level, students can perform tasks with some guidance but still struggle with consistency, independence, and procedural fluency. While scaffolded AI appears to help students review procedures, explore methods, and verify answers, it does not necessarily ensure deeper understanding or accuracy.

Among the 180 students who used AI as a scaffold, the majority were classified as developing (56) and beginning (85), with only 36 in approaching proficient and 3 in proficient. This distribution suggests that while students attempt to apply concepts, their understanding often remains shallow, as reflected in incomplete solutions and frequent inaccuracies in the achievement test. Some exhibited passive AI use, weakening retention and limiting conceptual clarity. Nevertheless, the small group of proficient students demonstrated the potential of scaffolded AI, showing accurate computations, complete solutions, and strong analytical skills on evidence that AI can serve as a meaningful supplementary tool when used responsibly. By contrast, the 22 students who used AI primarily as a crutch showed lower performance: 10 were at the beginning level, 8 developing, and 4 approaching proficient, with none reaching the proficient category. Many of these students relied on AI for direct answers through tools such as Photomath or GeoGebra, bypassing the problem-solving process. This over-reliance likely explains their weak performance on multi-step problems and frequent conceptual errors.

The computed t-value ($t = 0.570$, $p = 0.569$) indicates no statistically significant difference between scaffolded and crutch-based groups. This suggests that the nature of AI use alone does not significantly affect mathematics achievement. One explanation lies in the specific test topics on limits, probability distributions, and histograms which are cognitively demanding and require deeper conceptual understanding. Even scaffolded use may fall short without consistent practice, teacher feedback, and active engagement.

These findings align with existing literature. Tchounikine (2020) emphasized that AI promotes deeper understanding when used as scaffolding, while Holmes et al. (2019) found that strategic AI use enhances performance through cognitive engagement. However, similar to this study's results, both highlight that AI alone is insufficient without sustained learning efforts. The Digital Education Council (2024) likewise noted that AI access improves opportunities but has no significant effect on achievement without teacher intervention. Locally, Bancoro (2024) also reported no significant relationship between AI usage and academic achievement among Business Administration students. International studies by Nguyen and Duong (2023) and Raza et al. (2023) further support this, showing that while AI offers convenience and reduces workload, academic outcomes improve only when paired with active learning strategies and critical engagement. Overall, the findings reveal that AI tools, whether scaffolded or crutch-based, are not sole determinants of mathematics achievement. Their impact depends on how students are guided to use them. Scaffolded AI offers a more constructive framework, but its benefits must be reinforced through well-designed instruction, active practice, and teacher support. AI tools can serve as valuable allies in mathematics education, but they cannot replace the foundational elements of effective teaching, student effort, and critical thinking.

Table 8 shows the effect of the extent of AI tool use on the mathematics achievement of students. The overall Pearson correlation coefficient of 0.009 with a p-value of 0.895 indicates a very weak positive relationship that is not statistically significant. The results suggest that the frequency of AI tool use does not have a meaningful or consistent connection to mathematics achievement. Students' scores neither reliably increased nor decreased in relation to their AI use, indicating that mere frequency of use is not a determinant of success.

For students using AI tools as a scaffold, the Pearson correlation coefficient was $r = 0.045$ with $p = 0.529$, reflecting a very weak positive but non-significant relationship. This implies a slight tendency for performance to improve with scaffolded use, yet not strong or reliable enough to confirm any real effect. Although scaffolded use aligns with more strategic behaviors such as verifying steps or supporting conceptual understanding, this did not consistently translate into higher achievement scores. Conversely, students who relied on AI tools in a crutch-based manner had $r = -0.036$ with $p = 0.611$, a very weak negative and non-significant relationship. This indicates a slight tendency for performance to decline as crutch-based use increased, but again without statistical confirmation. Thus, while shortcut-based reliance on AI may appear detrimental, it does not alone strongly predict lower performance.

Analysis of achievement test responses provides further nuance. Students reporting scaffolded AI use, typically in the "sometimes" category, often showed greater independence in solving problems and, in some cases, produced complete and accurate solutions. By contrast, crutch-based users more frequently left items blank or made procedural errors, indicating over-reliance and limited conceptual engagement. This reinforces the idea that the quality and purpose of AI use, rather than its frequency, matter most for learning outcomes.

These results are consistent with prior research. Bancoro (2024) likewise found no significant relationship between AI use and academic performance among Business Administration students at Negros Oriental State University ($r = 0.0404$, $p = 0.4916$). A meta-analysis by Dong et al. (2025) also reported that AI integration often produces small and statistically insignificant effects on achievement. Similarly, Vieriu and Petrea (2025) observed wide variation in AI's impact, with no consistent academic benefits, while Adewale et al. (2024) concluded that AI adoption in open and distance learning showed mixed outcomes, with some applications aiding achievement and others showing no effect.

Taken together, these findings indicate that AI tools, regardless of frequency of use, are not inherently linked to academic success. Instead, their educational value depends on how purposefully and critically they are integrated into learning. While scaffolded AI use appears to foster more independent engagement, crutch-based reliance may undermine problem-solving confidence. This underscores the need for guided, reflective, and goal-oriented use of AI in mathematics education to maximize meaningful learning outcomes.

Conclusion

Based on the findings of the study, the following conclusions were drawn. First, the scaffolded nature of AI tool use demonstrates that students primarily utilized these technologies to deconstruct complex mathematical problems into simpler concepts and to follow step-by-step processes that facilitate their comprehension of mathematical tasks. This indicates a positive engagement with AI tools as supports for learning rather than as shortcuts. Second, students did not exhibit heavy reliance on AI tools in their mathematics classes; rather, they employed them selectively, particularly when confronted with difficult mathematical concepts. This purposeful use reflects that students sought to verify their answers and strengthen their understanding while still maintaining independent problem-solving skills, thereby avoiding excessive dependence on technology. Third, the study revealed that the nature of AI tool use did not have a direct effect on academic achievement, suggesting that the supportive or task-based use of AI tools does not automatically translate into improved performance in mathematics. Lastly, the extent of AI tool uses likewise did not demonstrate a significant correlation with higher academic achievement, indicating that the quality of students' engagement, critical thinking, and active learning strategies may play a more critical role in influencing mathematics performance than the frequency of AI tool utilization.

Recommendations

Accordingly, anchored on the conclusions drawn, several recommendations are forwarded. First, teachers may intentionally integrate scaffolded AI into mathematics instruction in a manner that complements traditional teaching strategies. This integration should be implemented through carefully designed learning activities that promote conceptual understanding and strengthen problem-solving skills, thereby ensuring that AI is utilized to deepen learning rather than to merely accomplish tasks. Second, schools may consider establishing an AI-assisted

Mathematics Laboratory class, where students can solve mathematical problems with the aid of AI tools. Such a laboratory may be structured to provide a supportive learning environment that enhances mathematics performance, promotes guided and responsible AI use, and fosters the development of critical thinking and independent learning among students.

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