DAVAO RESEARCH JOURNAL
https://davaoresearchjournal.ph

ORIGINAL RESEARCH ARTICLE

Artificial Intelligence (AI) utilization as a mediator between students' study attitude and mathematics achievement

Lysander E. Roquero*, Rain Jhon U. Rollon, and Gemar B. Magbutong

Davao de Oro State College, Compostela, Davao de Oro,8803 Philippines, ORCID, Lysander Roquero https://orcid.org/0009-0005-5481-7707, Rain Jhon Rollon https://orcid.org/0009-0003-7627-9407, Gemar B. Magbutong https://orcid.org/0009-0004-6945-3486

*Corresponding author: *lysander.roquero@ddosc.edu.ph*

ABSTRACT

Artificial Intelligence (AI) integration in education has sparked interest in its effect on student learning. This study examined AI utilization as a mediator in the relationship between students' study attitude and mathematics achievement, involving 323 BSED Mathematics students across four campuses of Davao de Oro State College, of whom 195 were identified as AI users. A quantitative, descriptive-correlational design was employed, with data collected through stratified random sampling. An adapted questionnaire measured study attitude (17 items) and AI utilization (25 items), while mathematics grades from the first semester of the academic year 2024–2025 served as indicators of academic performance. Statistical analyses included mean, standard deviation, Pearson correlation, and Sobel's Test. Findings revealed that students generally demonstrated high levels of study attitude, whereas AI utilization was moderate. Mathematics achievement was classified as very satisfactory. Despite these positive indicators, the relationship between AI utilization and mathematics achievement was weak and non-significant, and mediation analysis showed no significant mediating effect of AI utilization. In conclusion, the study indicates that although students exhibited strong study attitudes and satisfactory mathematics performance, AI utilization did not significantly influence achievement or mediate the relationship between study attitude and performance. This suggests that students' learning attitudes remain more influential than AI use, while AI tools function primarily as supplementary support. Strengthening students' study habits and attitudes should remain a priority in enhancing learning outcomes. Further research is recommended to determine the conditions under which AI may more effectively contribute to academic performance and inform broader educational strategies.

Keywords: *AI utilization, higher education, mathematics achievement, mediation, students' study attitude*

Submitted: 07 Aug 2025
Revised: 10 Dec 2025
Accepted: 12 Dec 2025
Published: 23 Dec 2025

OPEN ACCESS

How to cite: Roquero, L. E., Rollon, R. J. U., and Magbutong, G. B. (2025). Artificial Intelligence (AI) utilization as a mediator between students' study attitude and mathematics achievement. *Davao Research Journal*, 16 (4), 98-105. https://doi.org/10.59120/drj.v16i4.480

INTRODUCTION

Mathematics is not easy for all students, as they find it hard to grasp the concepts, deconstruct and solve them accurately. Such challenges frequently result in a lack of interest, frustration, or even an early end of learning (Velez et al., 2023; Nolasco, 2025). Meanwhile, the emergence of Artificial Intelligence (AI) in the educational context has brought about some opportunities and challenges. Although AI can provide personalized learning, interactive problem-solving, and adaptive materials, the prevalence of AI technology is used by students as a shortcut to learning, which may only cover up the learning gaps and not improve the conceptualization of materials (Afidchao et al., 2023; Callaman and Itaas, 2020). This creates questions as to the interaction between the use of AI and the attitudes of students towards study to determine their mathematical performance.

Global tests reveal the prevalence of mathematics learning challenges. As an example, in 2022, PISA showed that 31 percent of students in OECD nations did not even reach minimum proficiency (OECD, 2023). Additionally, NAEP showed that 40% of eighth-grade learners in America were finding it impossible to meet simple arithmetic standards (EdTrust, 2024). It has been found that the attitude of students to mathematics is a strong predictor of achievement. In such countries as Fiji and Tanzania, the negative attitudes are accompanied by the low performance due to the poorly designed curricula (Chand et al., 2021; Mazana et al., 2020), but positive attitudes encourage engagement and can lead to better performance (Mazana et al., 2018; Hwang and Son, 2021). These trends throughout the world indicate the necessity of the interventions that focus on motivation as well as conceptual knowledge.

The achievement in mathematics in the Philippines is a major concern. Another troublesome aspect of 2020 is the fact that 53.01% of students showed low performance, which can be attributed to the low quality of teaching, lack of conceptual knowledge, and unsupportive environment (Peteros et al., 2020; Bernardo et al., 2022; Nicolas and Emata, 2018). Mathematics is often viewed by students as challenging and discouraging, a factor that adversely influences the level of involvement and academic performance. Such difficulties emphasize the need to

use strategies that would integrate effective pedagogy with motivational support and technology.

Surveys at the local level in Davao del Norte show that mathematics proficiency has only 71.21% of students in 2018-2019, which is lower than the target of 75% (Zamora et al., 2022). Even those students who have already mastered the basic material can find academic challenges in the more advanced concepts in the university, that is why specific interventions should be applied. The combination of AI tools and pedagogical approaches and promotion of positive study attitudes would help students achieve higher education mathematics.

In spite of the potential of AI, there is a lack of study exploring the relationship between the study attitudes and the use of AI by students on mathematics performance in tertiary education. This research was undertaken in Davao de Oro State College and the target was the students of Bachelor of Secondary Education major in Mathematics. In particular, the study examines the role of AI usage in mediating the association between the attitude of students in terms of studying mathematics and their academic achievements. The study will offer useful information to teachers, policy makers and learning institutions by exploring the relationship between mindset, AI tools, and pedagogy in this context to ensure that AI complements rather than replaces effective learning strategies. Overall, this study aimed to investigate the influence of artificial intelligence utilization on students' study attitudes and mathematics achievement across the different campuses of Davao de Oro State College (DDOSC). Specifically, it sought to determine the levels of study attitude and AI utilization of BSED-Mathematics students; second, it sought to determine the level of mathematics achievement of BSED–Mathematics students and examine its relationships with study attitude and AI utilization.

MATERIALS AND METHODS

Research locale

This study was conducted in the following locations: Davao de Oro State College (DDOSC) main campus, then at the DDOSC, Montevista campus, Maragusan campus and the Maragusan National High School and the New Bataan Branch (Figure 1). The province was previously known as Compostela Valley but its name was changed by plebiscite to Davao de Oro since 2019. It has a land area of 4,560.09 km^2 and with a population of 767,547 as determined by the 2020 census. This represented 14.64% of the total population of the Davao Region, 2.92% of the overall population of the Mindanao island group. The population density was computed at 168 inhabitants per km^2. The province is considered a first-class province in the Philippines with rich natural resource including rice, coconut, cacao, coffee, papaya, mango, pineapple, durian and banana, other vegetable crops. It is also popular with nature and coastal tourism but especially known for mining gold as most of its municipalities have gold mines and has consistently claimed the richest province moniker in the past years due to its gold deposits.

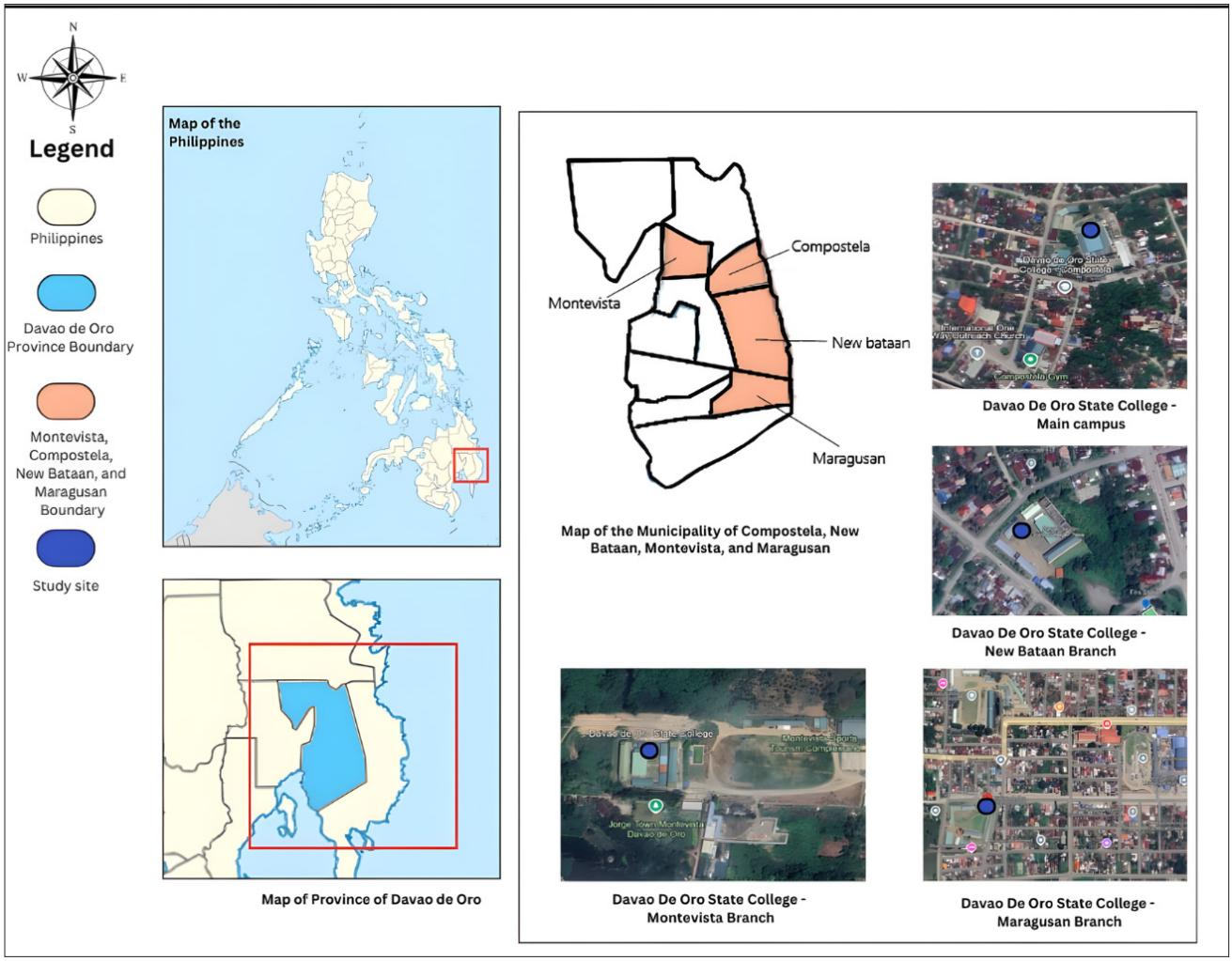

Figure 1. Map showing the various study sites.

Research design

The study employed a quantitative, descriptive-correlational research design to examine the relationships among AI utilization, students' study attitudes, and mathematics performance, with AI included as a mediating variable. A quantitative approach allows for structured analysis, accurate measurement of variables, and the application of appropriate statistical methods to identify patterns and interactions (Abulela and Harwell, 2020). A correlational design was used to determine the nature and strength of relationships among the variables, examining whether changes in one variable are associated with changes in another and the direction and magnitude of these relationships (Pratama et al., 2023). The study also aimed to inform educational practices and decision-making by identifying significant connections that could guide instructional improvements and provide evidence of how AI usage and study attitudes relate to mathematics performance.

Respondents

The respondents of this study were first-, second-, and third-year Bachelor of Secondary Education major in Mathematics (BSED-Math) students enrolled in the second semester of the 2024–2025 academic year at the Davao de Oro State College campuses. A total of 323 students were initially identified based on institutional data: Main Campus (107), Maragusan (102), New Bataan (57), and Montevista (57). From this initial pool, the final number of respondents was reduced to 195 due to student withdrawals and the application of inclusion criteria. In collecting the data, only students currently taking mathematics-related subjects at the same time utilizesAI tools at least weekly were included, ensuring relevance to the variables on AI utilization, mathematics study attitude, and achievement. Fourth-year students were excluded because they no longer had mathematics subjects.

Sampling technique

The researcher utilized a stratified random sampling strategy for the study to fully comprehend the underlying structure of the data. According to Alim and Shukla (2019), Stratified random sampling manages large datasets, facilitating predictive analytics by extracting representative samples from various strata. This sampling approach was ideal for this study, as it allows for selecting strata and individuals from each stratum. The stratified random sampling design is used in the study to randomly choose a more miniature representation of mathematics students from the first to the third year. Each stratum, classed as a data sample, reflects the total population of each year level of the BSED-Mathematics department. Furthermore, the researchers employed a frequency table attached to the research questionnaire in identifying AI users with occasional (1-2 times a week) use as threshold based on the study of Kelly (2024) where 54% of the students surveyed utilized AI at least on a weekly basis. With the use of this method, the researchers identified 195 random students as AI users from 323 total population.

Data gathering procedure

During the data collection phase, the researchers followed systematic steps to ensure accuracy and reliability. The study began with formal approval from the Davao de Oro State College Research Ethics Committee (DDOSC-REC) and the College President of the selected campus. Informed consent was obtained from all participants, who were fully briefed on the study's purpose and procedures. A pilot test of the survey questionnaires was conducted with first-, second-, and third-year BSED–Mathematics students in a supervised classroom setting to refine the instrument. Researchers established rapport with participants to ensure their comfort and willingness to engage in the research. Data collection schedules were arranged according to participants' convenience to facilitate participation. All procedures were conducted ethically and carefully to maintain the validity and reliability of the study findings (Figure 2).

Figure 2. Students filling out the questionnaire form during the data collection period.

Instrument reliability and validity

The study utilized adapted instruments to measure students' study attitude and AI utilization. The study attitude scale was adapted from Yáñez-Marquina and Villardón-Gallego (2016) to assess three dimensions: interest in mathematics, perceived utility, and math self-concept. The 17-item instrument was content-validated by three educators from the Department of Secondary Mathematics Education and demonstrated high reliability (Cronbach's α = 0.88). For AI utilization, the instrument was adapted from Grájeda et al. (2024), measuring the effectiveness of AI tools, student proficiency, and advanced AI skills. The 30-item questionnaire was validated by three educators and showed good internal consistency (Cronbach's α = 0.86). A frequency scale was also employed to ensure respondents were active AI users, defined as using AI tools at least weekly, including ChatGPT and other generative AI platforms. Students who used AI less frequently, fourth-year students, Non-BSED Mathematics students, or those who did not provide consent were excluded. These measures ensured that the instruments were both valid and reliable for collecting accurate data on study attitude, AI utilization, and mathematics achievement among first- to third-year BSED Mathematics students.

Data analysis

In this study, both primary and secondary sources of data collection were employed in an elaborate data analysis exercise to establish the impact of AI use, study attitude, and student mathematics achievement. The mean, standard deviation, Pearson correlation coefficient, and simple linear regression analysis were important statistical methods for this investigation. The mean was obtained when the sum of deviations from the mean was equal to zero. This means that certain numbers amount to zero while others were way below the mean (Amiruzzaman, 2020). Thus, in an attempt to give a summary of each data set acquired, the study estimated the mean of mathematics student achievement, study attitude toward mathematics, and AI Utilization. Meanwhile the standard deviation (SD) was used as a measure of variability of the data. By comparing these measurements across the use of AI, the researchers were able to grasp the central tendencies and changes in these variables, shedding light on the impact of students' AI usage on their mathematics ability. Pearson correlation coefficients (Pearson-r) assumes that both variables are bivariate, normally distributed, meaning their joint distribution should exhibit a regular pattern. The correlation between the factor of AI utilization and study attitude, as well as between mathematical study attitude and mathematics achievement, was measured with the aid of Pearson's r. Whereas negative correlations implied the contrary, positive correlations indicated that an increase in one measure is linked to an increase in the other. These correlations revealed important information about the direct links between these variables. In addition, the use of linear regression analysis was to analyze study attitude and the interaction of the two on mathematical achievement.

The assumptions of linear regression were examined to validate the mediation analysis for the study AI Utilization as a Mediator between Students' Study Attitude and Mathematics Achievement. Linearity was met, confirming that the variables exhibit a linear relationship. The residuals showed acceptable normality: although the Shapiro–Wilk test was significant (p = .004), the Kolmogorov–Smirnov (p = .56) and Anderson–Darling (p = .68) tests indicated no meaningful deviation from normality, and the distribution remained suitable for regression. The Durbin–Watson statistic (1.85, p = .29) suggested no auto correlation, supporting the independence of errors. Homoscedasticity was also observed through the residual patterns. No significant utliers were detected, indicating stable and reliable estimates. Collectively, the assumption checks confirm that the data satisfy the key requirements for linear regression. Moreover, Sobel's test was employed to examine whether the indirect effect of an independent variable (IV) on a dependent variable (DV) operated through a mediating variable (MV). This indirect effect was obtained by multiplying the coefficient of the path from the IV to the MV with the coefficient of the path from the MV to the DV. When the MV was incorporated into the model, the resulting indirect effect reflected the reduction in the IV's total influence on the DV once the mediator was taken into account. A significant Sobel test result indicated that the MV substantially reduced the IV's impact on the DV, thereby confirming mediation (Preacher and Hayes, 2004). In this study, Sobel's test offered deeper insight into how AI use mediated the relationship between students' study attitude and their mathematics performance.

RESULTS

Summary of students' level of study attitude in mathematics

The results of the study attitude of students in mathematics demonstrated that the overall attitude was high, with a mean of 4.02, which showed that students had overall positive perceptions of learning mathematics and engagement. In particular, mathematics self-concept was high as students had a high level of confidence in their ability to understand and solve mathematical problems (M = 3.82). Perceived utility of mathematics was extremely high (M = 4.28), indicating that students were aware of the relevance and usefulness of mathematics in both school and real-life settings, and that may be a motivating factor to continue working. Students were also interested in mathematics (M = 3.97), which indicates that students tend to be curious and have a desire to work with this subject in general. Overall, these results suggest that the good attitudes of students, such as confidence, the ability to realize the usefulness, and the desire to learn, provide a good ground for the study and can positively affect academic performance.

Table 1. Summary table of students' level of study attitude in mathematics.

Indicator	Mean	Standard deviation	Descriptive level
Mathematics self-concept	3.82	0.74	High
Perceived utility of mathematics	4.28	0.76	Very high
Interest in mathematics	3.97	0.73	High
Overall mean	4.02	0.50	High

Summary of the level of AI utilization

The AI utilization among BSED Mathematics students (N = 195) was also analyzed and showed that AI usage was on a high level, with an average result of 3.52, which means that the students most of the time use AI tools during their learning activities. In particular, AI tools were rated as high (mean = 3.86) to indicate that students view these tools as effective in aiding their learning and solving problems in mathematics. The advanced skills of students in the field of AI were also rated high (mean = 3.52), indicating that students can use AI tools effectively to perform learning tasks. Nevertheless, the level of proficiency of students in using AI tools was moderate (M = 3.35), which means that students had just begun to use AI but are not quite proficient in realizing its potential. These data cause one to believe that even though students use AI as a source of learning, there is still more to be desired in terms of proficiency, and the teacher might have to offer guidance so that the use of AI could enrich their learning experiences.

Table 3. Summary table of mathematics achievement.

Number of students	Descriptive rating	Mean grade	SD
195	Very Satisfactory	88.4	2.6

Relationship between variables

In determining whether there is a significant relationship between the variables, the Pearson correlation coefficient was employed to determine the degree of connection between the two variables, in addition to being displayed in the analysis. The results of the relationship between the variables are presented in Table 4.

Table 4. Relationship between variables.

Variables correlated	r	*p*
Study attitude and mathematics achievement	0.16	0.03
AI utilization and mathematics achievement	-0.07	0.35
Students' study attitude and AI utilization	0.40	<0.001

The Pearson correlation analysis revealed a significant but weak positive relationship between students' study attitude and mathematics achievement (r = 0.16, p = 0.03), indicating that students with more positive attitudes toward learning tended to perform slightly better in mathematics. The students' study attitude to AI utilization was also found to be significant, and moderately positively correlated (r= 0.40, p < 0.001) suggesting that students who value and engage in their learning are more likely to use AI tools as part of their study practices. The relationship between the use of AI and mathematics performance was, however, negative with a weak correlation (r = -0.07, p = 0.35), and the relationship did not show a significant association, implying that the extent of AI use alone did not enhance students' mathematics performance in this sample.

It also considered the question of whether the use of AI mediates between the attitude to study and math achievement. Table 5 indicates that the study attitude was a significant predictor of AI utilization (p < .001), as well as AI utilization was a significant predictor of math achievement (p = .03). The attitude towards studying had a considerable direct impact on achieving grades in math (β = 0.35, p = 0.02). Nonetheless, the interaction of study attitude and AI use on math achievement was not significant (no impact on achievement score, 82 percent, 23.7%). There was no suppression effect. This means that a positive position towards studying helps to achieve better results in mathematics, but extensive use of an AI tool can affect the achievement of success in a negative way.

Table 5. Mediation analysis.

Independent variable	: Students' study attitude
Dependent variable	: Mathematics achievement
Mediating variable	: AI utilization

Paths	Unstandardized Beta (β)	Standard error (e)	*p*-value	Standardized Beta (β)
Path C (IV and DV)	0.93	0.15	0.02	0.35
Path B (MV and DV)	-0.78	0.08	0.03	-0.17
Path A (IV and MV)	0.39	0.13	< .001	0.69
Combined influence of IV, MV on DV	-0.30	0.14	0.09	-0.12

Overall, the results signified that the statistical outcomes failed to meet the conditions and criteria for mediation of AI utilization between the relationship of students' study attitude and mathematics achievement due to the identified suppressing effect of AI utilization. This finally concludes that AI utilization does not mediate the relationship between students' study attitude and mathematics achievement. To clarify the statistical discrepancy, Table 4 showed a non-significant bivariate correlation between AI utilization and mathematics achievement, whereas Table 5 revealed a significant negative path when

AI utilization was included in the mediation model. This pattern reflects a suppression effect, wherein the relationship between AI utilization and achievement becomes more pronounced only after statistically controlling for students' study attitude. In other words, the mediation model isolates the unique contribution of AI use, revealing variance that was not detectable in the simple correlation. This explains why the path coefficient appears significant even though the zero-order correlation was not.

DISCUSSIONS

This study focuses on the investigation of AI utilization and its relationship with study attitude and mathematics achievement among BSED–Mathematics students of Davao de Oro State College. Only first-, second-, and third-year students enrolled in significant mathematics subjects were included, while fourth-year students were excluded. The study defines an "AI user" as a student using AI-driven generative tools for studying purposes. The findings, conclusions, and recommendations are limited to the participants and context described.

Level of students' attitude

A general high attitude of the students towards mathematics in studying (M = 4.02, SD = 0.50) was expressed in high levels of self-concept, high levels of perceived utility, as well as continued interest in the topic. The perceived utility has a very high rating (M = 4.28), which means that students are well aware of the relevance and usefulness of mathematics, which is one of the motivational and persistence factors. Their high self-concept (M = 3.82) suggests confidence in their mathematical abilities, while their high interest (M = 3.97) demonstrates a prolonged readiness to work with mathematical activities. These results are in line with the literature that highlights the significance of psychological and instructional factors. There are previous studies (Shi et al., 2024; Mutiawati et al., 2023) indicating that teacher support and proper pedagogical plans reinforce student participation, which is probably a factor in the high level of attitude. Similarly, Murniati and Erika (2023) highlight that learning environments promoting a growth mindset can enhance interest and confidence—patterns reflected n the results. Fitriya et al. (2024) also note that motivation and self-belief are central to building positive mathematics attitudes, consistent with the students' high ratings across all indicators. Generally, the study attitude is high, therefore indicating that the students have motivational and affective resources necessary in learning mathematics, which support the importance of supportive training and optimism in the development of their activity.

Level of students' AI utilization

The measured use of AI showed a high overall (M = 3.52, SD = 0.57) level of AI tool utilization, which is indicative of the significance of the AI tools in the learning process of students. The high effectiveness of AI tools (M = 3.86) suggests that students perceive AI as helpful in supporting tasks, clarifying concepts, and improving academic performance, particularly in mathematics. Although proficiency in using AI tools was only moderate (M = 3.35), their advanced AI skills were rated high (M = 3.52), showing that while not all students are fully adept with AI operations, many can already apply AI for more complex academic needs. These results are consistent with existing research. Zhai et al. (2021) emphasize that individualized learning can be supported with the help of AI, which contributes to more interest and academic performance; as t estified by the positive attitudes of the students towards AI performance. Similar results were reported by Omarov et al. (2024), who discovered that AI-enhanced learning increased motivation and cognitive involvement levels, which is consistent with the high-level use of AI that the students have in the context of academic enhancement. Yuan and Hu (2024) also note that the generative AI promotes reflexive learning since it provides personalized feedback. At the same time, Wu (2024) also notes that AI-enhanced writing tools increase the quality of outputs and confidence of learners. These findings mirror the students' reported ability to use AI not just for task completion but for refining, evaluating, and extending their work, indicating a shift toward more autonomous and self-regulated learning.

Level of students' mathematics achievement

Most of the students recorded quite satisfactory mathematics achievements (M = 88.4, SD = 2.6), where 65.5% of the responses were in the range of Very Satisfactory, and the other 24.2% were rated Outstanding. This distribution suggests that higher education students tend to perform well in mathematics and have high foundation skills. These findings are also supported by Cabilan and Peteros (2024), who found that students from Davao de Oro tend to exhibit advanced independent learning skills, particularly cognitive and motivational strategies, which significantly contribute to stronger mathematics performance. On the same note, Oluwadayo (2024) affirms that the achievement of mathematics is highly influenced by effective teaching methods, which implies that positive performance attained by the students might be partially influenced by the instruction methods they go through. Also, Galangco (2023) focuses on the previous performance in mathematics, including the JHS mathematics GPA of students, which has a direct impact on future achievement. Younger students who come to higher education with a good math background stand a better chance of retaining the positive attitudes and beliefs in the topic, which leads to increased performance. Norouzi (2023) further explains that self-control and optimistic emotional involvement are key determinants of academic achievement, which means that high achievers who balance their learning and have many positive attitudes towards Mathematics are more likely to get higher scores, as in accordance with the current results.

Relationship between variables

The Pearson correlation analysis showed that there was weak but significant positive relationship between the study attitude of students and the achievement in mathematics (r = 0.157, p = 0.028). This means that students having more positive attitudes toward the learning of mathematics have a slight better performance in academics. This result is congruent with Mazana et al. (2018) and Gupta (2025), who have also indicated that positive study attitudes have positive mathematics performance. These findings indicate that helping students develop confidence, interest, and admiration of mathematics can improve the academic performance of students albeit in a slight manner. Moreover, the correlation between attitude towards the study and the use of AI was moderate and significant (r = 0.401, p < 0.001), which means that students with the more positive attitude towards the study tend to utilize AI tools in the context of studying. This aligns with Mallillin (2024) and Caratiquit and Caratiquit (2023) who concluded that students with a higher motivation level and favorable academic performance are more likely to implement technology-based learning techniques, such

as AI applications. The results of this study indicate that learners who attach importance to their education are more willing to use digital resources to facilitate their education. Conversely, the use of AI and mathematics achievement also had a weak, non-significant relationship (r =-0.067, p =0.354). It means that the use of AI does not always lead to better mathematics performance. This finding reflects what Sasikala and Ravichandran (2024) and An and Ma (2023) note as innovation users can become less engaged with learning content because of the excessive use of AI devices. These results indicate that although AI could be an educational asset, overuse or passive use could not lead to improved academic performance, and meaningful and directed use of AI in education was valuable.

Mediation analysis

The study found that AI utilization does not have a significant mediating effect on the relationship between students' study attitude and mathematics achievement. The total effect of study attitude on mathematics achievement was positive and significant (β = 0.354, p = 0.018), indicating that students with higher study attitudes tend to perform better in mathematics. However, when AI utilization was included in the model, the direct effect of study attitude on mathematics achievement became negative and non-significant (β = –0.115, p = 0.092), suggesting that AI use does not enhance the positive impact of study attitude and may even reduce it under certain conditions. The indirect effect of study attitude on mathematics achievement through AI utilization was negative (β = –0.115), reflecting a suppressing effect. Specifically, study attitude positively predicted AI utilization (β = 0.687, p < 0.001), yet AI utilization negatively predicted mathematics achievement (β = –0.168, p = 0.025). This indicates that while students with better study attitudes are more likely to use AI tools, increased reliance on AI may slightly hinder mathematics performance, possibly due to reduced opportunities for independent problem-solving and critical thinking. These findings are consistent with studies such as Emata (2023), Efendi et al. (2024), and Maulida et al. (2024), which observed that AI integration does not always lead to better academic outcomes and may interfere with learning if not implemented properly. Conversely, the results contrast with those of Körpeoğlu and Yıldız (2023) and Wang and Luo (2023), who reported that AI can improve engagement, self-efficacy, and academic performance. Mallillin (2024) also noted that AI has the potential to inspire adaptive learning, though its effectiveness depends on strategic and guided application. Overall, the results suggest that students have a high level of study attitude and AI use. Study attitude remains a positive predictor of mathematics achievement, but AI utilization does not mediate this relationship positively and may even partially suppress it. These findings highlight the importance of purposeful and guided use of AI to complement, rather than replace, independent learning and critical thinking.

CONCLUSION

The study successfully addressed its research objectives. First, it determined that BSED–Mathematics students exhibited high levels of study attitude and AI utilization. Second, it established that students' mathematics achievement was generally good and positively related to their study attitude. However, AI utilization did not significantly mediate the relationship between study attitude and mathematics achievement in this sample. These findings imply that educators should prioritize fostering students' study attitudes, such as confidence, interest, and perceived utility in mathematics, while promoting responsible and reflective use of AI as a supportive tool. Additionally, future instructional strategies should encourage independent problem-solving and thoughtful integration of AI, considering that AI alone may not directly enhance mathematics achievement. Further research is recommended to explore moderating factors, such as AI literacy and self-regulation, that could clarify under what conditions AI can most effectively support student learning.

RECOMMENDATIONS

The findings of this study emphasize that students' positive study attitudes remain the most reliable factor in improving mathematics achievement, while AI functions best as a supportive tool. To translate these results into practice, policy, and future research, the following recommendations are proposed:

- Strengthen students' attitudes by implementing strategies that build mathematics self-concept, perceived utility, and interest, since these were positively associated with achievement.
- Promote independent problem-solving before AI is used to preserve persistence and critical thinking, ensuring that AI serves as a supplement rather than a substitute for reasoning skills.
- Redesign assessments to reward reasoning and reflection by giving credit for problem-solving processes and thoughtful engagement with AI outputs, discouraging superficial use of technology.
- Provide teacher training on responsible AI integration so that educators can design lessons and assessments that balance traditional approaches with ethical and effective use of AI.
- Establish institutional guidelines for AI utilization to define appropriate practices, promote ethical standards, and ensure reflective and transparent use of AI in academic tasks.
- Teachers should prioritize cultivating positive study attitudes while embedding AI use in ways that extend, rather than replace, students' reasoning and persistence.
- Institutions should develop clear guidelines and capacity-building programs to ensure that AI integration supports ethical and reflective student learning.
- Future studies should investigate moderating factors such as AI literacy, self-regulation, and prior achievement to better understand when AI enhances or hinders mathematics achievement.

ACKNOWLEDGMENT

The researchers extend their sincere gratitude to all participants for their time and honest responses, and to the campuses of Davao de Oro State College for their support. They also thank their mentors for their guidance and feedback. Every contribution, big or small, is deeply appreciated.

AUTHOR CONTRIBUTIONS

L. E. R: Conceptualization, methodology, writing-orginal draft preparation, and project administration. G. B. M: Validation, data curation, formal analysis, supervision, and software. R. U. R: Writing-review and editing. All authors have read and approved the final version of the manuscript.

FUNDING SOURCE

This study was self-funded by the authors, and there were no external funds used to support this study.

DECLARATION

Informed consent statement

The researchers ensured that all participants were treated ethically, provided informed consent, and had the option to withdraw at any time without consequences. Data collected, including survey responses and academic records, were handled confidentially, anonymized, and stored securely to protect privacy. All procedures adhered to ethical guidelines set by the Davao de Oro State College Research Ethics Committee, ensuring participants' welfare, fairness, and integrity throughout the study.

Conflict of interest

The authors declare that there is no conflict of interest regarding the publication of this paper.

REFERENCES

Abulela, M. A. A., and Harwell, M. M. (2020). Data Analysis: Strengthening Inferences in Quantitative Education Studies Conducted by Novice Researchers. Kuram Ve Uygulamada Egitim Bilimleri, 20(1), 59–78. https://doi.org/10.12738/JESTP.2020.1.005

Afidchao, D. T., Bigayan, J. J. C. C., Galindez, M. S. S. M., Jimenez, E. J. B., Macam, F. K. C., Orias, C. E. L., Balonquita, M. C., and Bernardino, R. M. (2023). Perceived effectiveness of Artificial Intelligence-Powered Calculators on the academic performance of senior high school STEM students in mathematics. Zenodo (CERN European Organization for Nuclear Research). https://doi.org/10.5281/zenodo.8104870

Alim, A., and Shukla, D. (2019). An Application Approach of Stratified Sampling in Analytic-Predictive Environments of Big Data. Social Science Research Network. https://doi.org/10.2139/SSRN.3356445

Amiruzzaman, M. (2020). Exploring Students’ Understanding of Statistical Mean. Preprints. https://doi.org/10.20944/preprints202004.0455.v1

An, D., and Ma, C. (2023). A Model of Factors Influencing Learning Outcomes Based on Artificial Intelligence: Perspectives of Chinese University Students. *Journal of Logistics, Informatics and Service Science*, 11(1). https://doi.org/10.33168/jliss.2024.0126

Bacong, J. T., Encabo, C. M. T., Limana, J. M. B., and Cabello, C. A. (2023). The High School Students' Struggles and Challenges in Mathematics: A Qualitative Inquiry. Zenodo (CERN European Organization for Nuclear Research). https://doi.org/10.5281/zenodo.8251107

Bernardo, A. B. I., Cordel, M. O., II, Lapinid, M. R. C., Teves, J. M. M., Yap, S. A., and Chua, U. C. (2022). Contrasting Profiles of Low-Performing Mathematics Students in Public and Private Schools in the Philippines: Insights from Machine Learning. *Journal of Intelligence*, 10(3), 61. https://doi.org/10.3390/jintelligence10030061

Cabilan, J. B., and Peteros, E. D. (2024). Predictive analysis of independent learning bearing on students' mathematics performance in Davao de Oro, Philippines. *Journal on Mathematics Education*, 15(4), 1409–1432. https://doi.org/10.22342/jme.v15i4.pp1409-1432

Calkins, D. S. (2017). Some effects of non-normal distribution shape on the magnitude of the Pearson Moment Correlation Coefficient. *Interamerican Journal of Psychology*, 8. https://psycnet.apa.org/record/1975-26610-001

Callaman, R. A., and Itaas, E. C. (2020). Students' mathematics achievement in the Mindanao context: A meta-analysis. *Journal of Research and Advances in Mathematics Education*, 5(2), 148–159. https://doi.org/10.23917/JRAMATHEDU.V5I2.10282

Caratiquit, K. D., and Caratiquit, L. J. (2023). ChatGPT as an academic support tool on the academic performance among students: The mediating role of learning motivation. *Journal of Social, Humanity, and Education*. https://doi.org/10.35912/jshe.v4i1.1558

Chand, S., Chaudhary, K., Prasad, A., and Chand, V. (2021). Perceived causes of students' poor performance in mathematics: a case study at BA and Tavua Secondary Schools. Frontiers in Applied Mathematics and Statistics, 7. https://doi.org/10.3389/fams.2021.614408

Eberly, L. E. (2007). Correlation and simple linear regression. Methods in Molecular Biology, 143–164. https://doi.org/10.1007/978-1-59745-530-5_8

EdTrust. (2024). Breaking down the nation's math scores - EdTrust. https://edtrust.org/blog/breaking-down-the-nations-math-scores/

Efendi, M., Panglipur, I. R., and Murtinasari, F. (2024). Identifying the use of artificial intelligence in math learning based on learning outcomes. *At-Ta`lim: Jurnal Pendidikan*, 10(2), 53–59. https://doi.org/10.55210/attalim.v10i2.1689

Emata, C. Y. (2023). The Moderating Effect of Technology Attitude on the Relationship between Math Self-Efficacy and Attitudes towards Mathematics. *Unnes Journal of Mathematics Education*, 12(1), 1–12. https://doi.org/10.15294/ujme.v12i1.62791

Fitriya, Y., Mustadi, A., Nugroho, I. A., and Anugrahana, A. (2024). Students' Mathematical Disposition and Resilience: An Analysis of Student Perceptions in Numbers and Algebra Courses. *Journal of Electrical Systems*. https://doi.org/10.52783/jes.2479

Galangco, J. (2023). Path model of mathematics achievement in Senior High school. *Journal of Research in Mathematics Education*, 12(3), 246–264. https://doi.org/10.17583/redimat.12759

Grájeda, A., Burgos, J., Córdova, P., and Sanjinés, A. (2023). Assessing student-perceived impact of using artificial intelligence tools: Construction of a synthetic application index in higher education. Cogent Education, 11(1). https://doi.org/10.1080/2331186x.2023.2287917

Gupta, N. N. K. S. (2025). Relationship between attitude towards mathematics and academic achievement of Eleventh-Class students. *Journal of Informatics Education and Research*, 5(1). https://doi.org/10.52783/jier.v5i1.2074

Hwang, S., and Son, T. (2021). Students' Attitude toward Mathematics and its Relationship with Mathematics Achievement. *Journal of Education and eLearning Research*, 8(3), 272–280. https://doi.org/10.20448/journal.509.2021.83.272.280

Kelly, R. (2024). Survey: 86% of students already use AI in their studies. Retrieved from https://campustechnology.com/Articles/2024/08/28/Survey-86-of-Students-Already-Use-AI-in-Their-Studies.aspx

Körpeoğlu, S., and Yıldız, S. (2023). Using artificial intelligence to predict students' STEM attitudes: an adaptive neural-network-based fuzzy logic model. *International Journal of Science Education*, 1–26. https://doi.org/10.1080/09500693.2023.2269291

Macaskill, P. (2018). Standard deviation and standard error: