# Peer Pressure and Perceived Student Self-efficacy in Mathematics: The Mediating Role of Artificial Intelligence-Supported Self-Regulation Learning

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## Abstract

Low student self-efficacy is concerning. The mediating role of AI- supported self-regulation learning on the relationship between peer pressure and perceived student self-efficacy in mathematics was verified. Predictive research design was used. The data were from 268 selected Grade 11 senior high school students, selected via stratified random sampling. They were analyzed using mediation analysis. Findings showed that the determinant-criterion correlation was partially but significantly mediated, partly supporting Social Cognitive Theory. Future research may explore other mediating variables to explain the remaining 29% variance, while school leaders may enhance student perceived self-efficacy through AI-supported self-regulation tools, teacher training, and positive peer learning environments.

Keywords: Peer pressure, perceived student self-efficacy in mathematics, mediating role of artificial intelligence-supported self-regulation learning

## 1. Introduction

Globally, low self-efficacy remains a significant problem among students, as weak beliefs in their abilities hinder academic success (Zhao et al., 2024). Additionally, low mathematics self-efficacy remains a significant problem among students worldwide (Yang et al., 2024). A cross-national study in the United States, China, and Finland found that disparities in mathematics self-efficacy remain a significant problem, influencing students' academic outcomes (Ma et al., 2021). Similarly, in several countries in Asia, students were found to have lower self-efficacy and higher mathematics anxiety compared to students in Europe (Hendral & Hidayati, 2023).In addition, in Saudi Arabia, mathematics self-efficacy has become a significant issue among middle school students, particularly in developing confidence in mathematics learning (Al-Makhalid & Ben-Motreb, 2025).

In the Philippines, low mathematics self-efficacy remains a significant concern among students, as it negatively affects their confidence in mathematics (Cuevas & Berou, 2016). Similarly, local studies in the Davao region showed that mathematics self-efficacy remains a significant concern among students, as low confidence in mathematics continues to affect their academic performance (Labong et al., 2025). Furthermore, the study identified low self-efficacy as a continuing problem among Filipino Science, Technology, Engineering, and Mathematics (STEM) students (Panergayo, 2023).

If self-efficacy is not addressed, students may experience low academic performance, weak motivation, poor engagement, anxiety, and a lack of persistence in accomplishing difficult tasks. Learners with low self-efficacy are more likely to avoid challenges and eventually develop poor educational outcomes (Supervía et al., 2022). Moreover, the study of Schunk and DiBenedetto (2020) on the mediating role of AI-supported self-regulated learning emphasized urgency due to the increasing influence of peer pressure on students' mathematics self-efficacy, motivation, and performance. There is also a significant research gap

in published studies, particularly in the Philippine educational context. Thus, this research was conducted.

This study was significant as it contributed to the advancement of quality education by examining the mediating role of AI-supported self-regulated learning in the relationship between peer pressure and perceived students' self-efficacy in mathematics. Anchored in the goals of the United Nations Sustainable Development Goal 4 (Quality Education), the study supported the promotion of inclusive, equitable, and technology-enhanced learning opportunities that improved student outcomes. The findings may provide valuable insights for the Department of Education in strengthening curriculum development, digital integration, and instructional strategies that foster self-regulated learning and resilience among students. Moreover, the study aligned with the mission of Holy Cross of Davao College to deliver innovative, student-centered education by highlighting the importance of integrating artificial intelligence tools to enhance learning processes and self-efficacy. Ultimately, this research may benefit educators, administrators, and policymakers by offering evidence-based approaches to improve mathematics achievement while equipping students with the skills necessary for independent learning and academic success in a technology-driven educational environment.

This study determined the mediating role of AI – supported self-regulation learning on the relationship between peer pressure and perceived students' self-efficacy in mathematics. Specifically, this study determined the following: 1.) To determine the levels of students' peer pressure in learning mathematics in terms of yielding to peer pressure, resistance to peer pressure, and peer encouragement; the level of AI-supported self-regulation learning on mathematics in terms of mental cognitive planning, growth mindset endorsement, strategic AI-utilization, self-monitoring and reflections, motivational resilience, and adaptive help seeking; and the level of perceived self-efficacy in mathematics in terms of mastery experience, vicarious experiences, physiological feedback, and verbal persuasion. 2.) To determine the significance of the correlation between peer pressures of mathematics, AI – supported self-regulation in mathematics, and perceived students' self-efficacy in mathematics. 3.) To determine the significance of the direct effect of peer pressure on perceived students' self-efficacy in mathematics, controlling for AI-supported self- regulated learning. 4.) To determine the significance of the indirect effect of peer pressure on perceived students' self- efficacy in mathematics, through AI-supported self- regulated learning. 5.) To determine the significance of the total effect of peer pressure on perceived self-efficacy in mathematics.

## 2. Methodology

### *2.1 Research Design*

This study employed predictive research design that uses statistical or machine learning models to forecast future outcomes by analyzing patterns and relationships among variables (Gonzalez et al., 2023). In this approach, predictor variables are used to estimate or classify a dependent variable based on existing data. It is applied when the goal of a study is to anticipate future behaviors or conditions, such as predicting academic performance or identifying at-risk individuals using historical data to guide planning and intervention, making it especially useful in fields like education and social sciences (Umer et al., 2023). One key advantage of predictive research design is its ability to generate forward-looking, data-driven insights that support informed decision-making, while also handling complex relationships among multiple variables without requiring experimental manipulation, thereby making it practical and efficient in real-world settings (Gonzalez et al., 2023).

### *2.1 Locale of the Study*

The study was conducted in three public senior high schools under Cluster 5 in Davao City. These schools are located within Toril, Davao City, which is part of the third District of Davao

City. Toril is a highly urbanized district that serves as a key educational and commercial hub in the southern part of the city. It is home to several public and private secondary schools, as well as colleges that cater to diverse groups of students. This location was chosen because it provides a population of learners enrolled in mathematics-related subjects, making it suitable for examining the mediating role of AI-supported self-regulated learning on the relationship between peer pressure and perceived students' self-efficacy in mathematics.

*2.3 Sample and Sampling Technique*

The study involved Grade 11 students enrolled in Mathematics as the target population, with a total of 268 senior high school students from Cluster 5. The sample size was determined using Raosoft software with a 95% confidence level, 5% margin of error, and 50% response distribution from a population of 810 students across three schools: School A (540), School B (125), and School C (145). This study employed stratified sampling, a probability sampling technique in which a population is divided into homogeneous subgroups or strata, and random samples are drawn from each group to ensure proper representation. This method is applied when populations are heterogeneous, and researchers aim to improve the accuracy and precision of their findings by capturing variability across subgroups. It is particularly advantageous because it enhances representativeness, reduces sampling error, and increases the reliability of statistical estimates compared to simple random sampling (Ahmed, 2024).

*2.4 Data Gathering Technique*

The survey technique was used in this study. Survey technique enables efficient and standardized data collection, improves the reliability of responses, and facilitates statistical analysis of research variables (Kuphanga, 2024). The advantage of using survey questionnaires is that they allow researchers to collect large amounts of data quickly and in a standardized format, making responses easy to compare and analyze statistically. They are also cost-effective and suitable for measuring attitudes, perceptions, and behaviors from many respondents at the same time (Taherdoost, 2016).

Three adapted survey questionnaires were utilized in the study. The first research instrument measured the peer pressure of students toward learning Mathematics. The Peer pressure of Students in Mathematics Scale was adapted from Palani (2016). It consists of 30 items designed to assess the level of peer pressure experienced by students in learning Mathematics. The questionnaire utilized a four-point Likert scale. Pilot testing revealed a Cronbach's alpha coefficient of 0.668. The second research instrument measured the self-regulated learning of the students towards learning mathematics. It was adapted from Alatoai (2025). It consists of 48 items intended to measure the AI–supported self–regulated learning of students towards learning mathematics. The questionnaire also utilizes a four-point Likert scale. Pilot testing revealed a Cronbach's alpha of 0.815. The third research instrument measured the perceived self-efficacy of students towards learning mathematics. It was adapted from Tiangco (2024). It consists of 16 items intended to assess the perceived student self-efficacy towards learning mathematics. Similar to the previous tools, this instrument employed a four-point Likert scale. Pilot testing revealed a Cronbach's alpha of 0.783.

*2.5 Data Analysis Technique*

In this study, the data analysis techniques employed were descriptive, correlation, and mediation analyses. Descriptive analysis is used to organize and summarize the data to better understand patterns and distributions, utilizing the mean and standard deviation as statistical tools (Bhandari, 2023). Furthermore, correlation analysis is applied to determine the strength and direction of the relationship (Akoglu, 2018). Specifically for this study, it is between mathematics self-efficacy, technology utilization, and students' persistence in mathematics, with the use of the Pearson Product-Moment Correlation coefficient. Lastly, mediation analysis was

conducted to determine whether technology utilization mediates the relationship between mathematics self-efficacy and students' persistence in Mathematics. This analysis estimated the direct, indirect, and total effects using beta coefficients to provide a deeper understanding of the relationships among the variables (Hayes, 2022).

### *Ethical Considerations*

The study involved senior high school students from a public school in Davao City. To maintain the study's integrity, the researcher adhered to all ethical standards, including obtaining informed consent, ensuring confidentiality, and minimizing harm or discomfort. They voluntarily provided written consent and may withdraw from participation at any time without consequence. The survey included an informed consent form that promotes transparency, allowing participants to decline if they feel uncertain. Respondents were also assured of their right to skip sensitive questions, inquire about the study, and access its findings.

Anonymity and confidentiality were strictly upheld to protect participants' identities and safeguard them from potential harm. The researcher ensured that no identifying information or remarks were included in the data. The research was conducted with honesty, integrity, and respect, safeguarding participants' privacy and recognizing the value of their contributions. Ethical approval was secured from the Society for Moral Integrity Legal Ethics (SMILE) - Ethics Board, and permission to conduct the study was respectfully sought and obtained from the Department of Education (DepEd). Efforts have been made to maximize benefits, minimize potential risks, and ensure fairness throughout the research process, with findings reported transparently and any potential conflicts of interest properly disclosed to uphold the integrity of the research.

## 3. Results and Discussions

### *3.1 Descriptive Results*

Shown in Table 1 are the descriptive results of the study. Contained in the table are the variables involved, namely, AI-supported self-regulation learning, peer pressure, and perceived self-efficacy in Mathematics; and the number of samples, standard deviation, mean, and descriptive level specifically corresponding with each of the variables.

*Table 1: Descriptive Statistics (n = 268)*

| Variables | Number of Samples (N) | Standard Deviation | Mean | Descriptive Level |
|---|---|---|---|---|
| **AI-supported Self-regulation Learning** | **268** | **0.59** | **2.70** | **High** |
| *Mental cognitive planning* | | *0.56* | *2.68* | *High* |
| *Growth mindset endorsement* | | *0.60* | *2.72* | *High* |
| *Strategic utilization* | | *0.57* | *2.64* | *High* |
| *Self-monitoring and reflection* | | *0.57* | *2.70* | *High* |
| *Motivational resilience* | | *0.56* | *2.69* | *High* |
| *Adaptive help-seeking* | | *0.68* | *2.77* | *High* |
| **Peer Pressure** | **268** | **0.45** | **2.78** | **High** |
| *Yielding to peer pressure* | | *0.53* | *2.37* | *High* |
| *Resistance to peer pressure* | | *0.48* | *3.14* | *High* |
| *Perception about Mathematics* | | *0.73* | *2.83* | *High* |
| **Perceived self-efficacy In Mathematics** | **268** | **0.74** | **2.71** | **High** |

| | | | |
|---|---|---|---|
| *Mastery experience* | *0.81* | *2.80* | *High* |
| *Vicarious experience* | *0.72* | *2.75* | *High* |
| *Physiological feedback* | *0.68* | *2.51* | *High* |
| *Verbal persuasion* | *0.74* | *2.77* | *High* |

The table shows that the AI-supported self-regulation variable had a mean of 2.70, which is interpreted as a high level. This means that the students' AI-supported self-regulation learning is strong. Every indicator in this category scored high, so the results are consistent across the board. The standard deviation of 0.59, described as high consistent response, indicates a uniform perception of the responses. Similarly, the peer pressure variable came in with a mean of 2.78, described as a high level. So, peer pressure is clearly strong as well. Again, indicators scored high, indicating consistent responses across all aspects of peer pressure. The standard deviation was even lower, at 0.45. That means students largely agreed in their perceptions of peer pressure. Finally, perceived self-efficacy had a mean of 2.71, which is still high. Students seem confident in their math abilities. All measures here were consistently rated high, with a standard deviation of 0.74, another sign that showed little variation among respondents.

Looking at these results together, it's easy to see that AI-supported self-regulation, peer pressure, and self-efficacy are all strong influences for this group. Students are actively using AI tools to help themselves, and their friends play a big role in their academic world; overall, they feel good about learning mathematics. Peer pressure actually had the highest mean, hinting that students are most affected by what others around them think and do.

*3.2 Correlation Results*

Table 2 presents the correlational results between AI- supported self-regulation learning and peer pressure as predictive variables, and the perceived self-efficacy of students in Mathematics.

*Table 2: Correlational Table (n =268)*

| Variables | **Perceived Self-efficacy in Mathematics** | | | |
|---|---|---|---|---|
| | r-value | p-value | Decision on *Ho* | Interpretation |
| AI-supported self - Regulation learning | 0.763 | 0.000 | Reject Ho | Positive and significant high correlation |
| Peer pressure | 0.515 | 0.000 | Reject Ho | Positive, and significant moderately high correlation |

***Level of Significance: 0.05, Decision Rule: Reject $H_0$ if p < 0.05***

As for the relationships between these factors, the correlation between AI-supported self-regulated learning and perceived self-efficacy variables yielded a p-value of 0.000, which is below the 0.05 level of significance; thus, the null hypothesis was rejected, confirming a statistically significant relationship. The obtained r-value of 0.763 suggests a positive and significant high correlation between AI-supported self-regulation learning and students' perceived self-efficacy. In plain terms, the more students engage in self-regulated learning with AI, the more confident they feel in their math skills.

Peer pressure showed the same low p-value of 0.000, which is also less than the 0.05 threshold, leading to the rejection of the null hypothesis and confirming a statistically significant relationship. The r-value of 0.515 indicates a positive and moderately high correlation, implying that higher levels of peer influence are associated with increased student self-efficacy.

Both AI-supported self-regulated learning and peer pressure are strongly linked to students' confidence in math. But that stronger r-value for AI-supported self-regulation tells you that using AI tools to manage learning has a bigger impact on boosting students' confidence than peer pressure does.

*3.3 Mediation Results*

Table 3 presents the mediation analysis examining the role of AI-supported self-regulation in the relationship between peer pressure and perceived self-efficacy in Mathematics. The table shows the direct and indirect effects, including their corresponding estimates, standard errors, z-values, p-values, and decisions on the hypotheses.

Table 3. Mediation Table (n =268)

| Label | Path/Effect | Estimate | SE | Z-value | p-value | Decision | Interpretation |
|---|---|---|---|---|---|---|---|
| A | Peer Pressure →A-I supported self-regulation | 0.82 | 0.08 | 10.87 | 0.000 | Reject Ho | Significant |
| B | AI-supported self-regulation →Perceived self-efficacy | 0.73 | 0.05 | 13.92 | 0.000 | Reject Ho | Significant |
| C' | Peer Pressure → Perceived Self-efficacy (Direct effect) | 0.24 | 0.07 | 3.35 | 0.000 | Reject Ho | Significant |
| a x b | Indirect effect (Mediation) | 0.602 | 0.07 | 8.12 | 0.000 | Reject Ho | Significant |
| (a x b)+c | Peer Pressure → Perceived Self-efficacy (Total Effect) | 0.84 | 0.08 | 10.55 | 0.000 | Reject Ho | Significant |

*Level of Significance: 0.05*
*Decision Rule: Reject Ho if p < 0.05*
*Proportion Mediated: indirect effect/ total effect = 0.7166*

The table specifically shows that the direct effect of peer pressure on students' perceived self-efficacy in mathematics, controlling for AI-supported self-regulation learning, yields an estimated Beta 0.24, with a corresponding p-value of 0.000, which is less than the 0.05 level of significance. Hence, the null hypothesis was rejected. This indicates that the direct effect is significant. This implies that the direct effect of peer pressure on students' perceived self-efficacy in mathematics controlling AI-supported self-regulation. Moreover, the indirect effect of peer pressure on the criterion through the mediator was estimated at a Beta of 0.602 with a p-value of 0.000, which is less than the 0.05 level of significance. Thus, the null hypothesis was rejected. This indicates that peer pressure enhances students' perceived self-efficacy in learning mathematics, both directly and indirectly through AI-supported self-efficacy, supporting their mathematics performance. Lastly, the total effect of mathematics peer pressure on perceived self-efficacy in

learning mathematics obtained an estimated Beta of 0.84, with a p-value of 0.000, which is lower than the 0.05 level of significance. Thus, the null hypothesis was rejected. This indicates that the indirect effect is significant.

The table likewise specifies the mediated proportion of 0.7166, indicating that the mediating role of AI-Supported Self-regulation in mediating the correlation between peer pressure and perceived self-efficacy is strong. Since the direct effect of peer pressure on perceived self-efficacy in learning mathematics remains significant even when controlling for AI-Supported self-regulation, and the indirect effect is also significant, the result indicates partial mediation.

3.4 Peer Pressure and Perceived Student Self-efficacy in Mathematics Correlation

The finding that peer pressure has a positive and significant moderately high correlation with perceived student self-efficacy in mathematics affirms the study of Asare (2025), explaining that peer-related learning environments and interactions have a direct positive and statistically significant effect on mathematics-related outcomes, suggesting that engagement with peers can enhance learners' confidence and capability beliefs in mathematics. Similarly, the finding is consistent with Isnawati et al. (2025), who reported that peer influence and self-efficacy jointly contribute to students' learning motivation in mathematics, indicating that supportive peer contexts are positively associated with stronger self-beliefs and academic engagement. On the contrary, the current finding contradicts Shehadeh et al. (2020), who reported that higher academic stress negatively affects students' academic self-efficacy, suggesting that pressure may weaken learners' confidence in their academic abilities. This contrasts with the present finding that peer pressure has a positive and significant moderately high correlation with perceived student self-efficacy in mathematics. While Shehadeh et al. involved 117 respondents, the present study utilized 268 participants.

3.5 AI-supported Self-regulation Learning and Perceived Student Self-Efficacy In Mathematics Correlation

This finding that AI-supported self-regulation learning has a positive and significantly high correlation supports the study of Jiajia Shi (2025), demonstrating that self-regulated learning in AI-supported environments is significantly and positively associated with students' academic performance, indicating that learners who effectively regulate their learning with AI tools tend to achieve better outcomes. Similarly, the current finding affirms a meta-analysis by Ren et al. (2026), who found that AI-based learning environments positively influence students' self-efficacy and learning behaviors, including self-regulation, highlighting that AI integration strengthens both cognitive and motivational aspects of learning. However, the current finding contradicts Galindo-Domínguez and Delgado (2026), who reported that the relationship between self-regulated learning and AI use is not always positive, as some students exhibit overreliance on AI tools, which may weaken independent learning processes and core self-regulation skills.

3.5 Mediating effect of AI-supported Self-regulation

The finding of this study, asserting that AI-supported self-regulation partially mediates the correlation between peer pressure and perceived student self-efficacy, affirms the study of Liang et al. (2023), demonstrating that self-efficacy and cognitive engagement serially mediate the relationship between students' interaction with generative AI and learning achievement, suggesting that AI tools can enhance learner confidence indirectly through improved engagement and self-regulated learning behaviors. Similarly, the current finding affirms Ouyang (2025) who found that self-regulated learning significantly mediates the relationship between AI-driven learning environments and educational outcomes, indicating that external technological factors influence student outcomes indirectly through internal regulatory processes. However, the current finding contradicts the study of

Muh. Fiqri Nurrahmatullah(2024) suggests that self-efficacy does not significantly mediate the relationship between peer group factors and self-regulated learning, indicating that peer group influences may directly affect students' self-regulatory behaviors rather than indirectly through self-efficacy.

## 4. Conclusion

The findings confirm that AI-supported self-regulation partially mediates the relationship between peer pressure and perceived student self-efficacy. Hence, this conclusion partly affirms Social Cognitive Theory, which posits that the dynamic interaction between environmental, personal, and behavioral factors shapes human behavior.

## 5. Recommendations:

1. Future research may explore other potential mediating variables not covered in this study to account 29% of the unexplained strength of the mediation.
2. School leaders may strengthen students' perceived self-efficacy in mathematics by promoting AI-supported self-regulation tools, providing teacher professional development, and fostering positive peer learning environments through collaborative and peer-assisted activities.

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