**ROLE OF METACOGNITIVE AWARENESS IN ENHANCING PERSISTENCE IN SOLVING MATHEMATICAL PROBLEMS AMONG MATH MAJORS**

**Abstract**

This study investigated how metacognitive awareness contributes to the persistence of BSEd Mathematics majors in solving mathematical problems. Using a descriptive-correlational design, data were gathered from 100 math majors at Davao Central College using two standardized tools: the Metacognitive Awareness Inventory (MAI) and the Persistence in Mathematical Problem-Solving Scale. Results revealed a very high level of metacognitive awareness and high persistence, especially during examinations. Pearson correlation showed significant relationships, and regression analysis indicated that metacognitive awareness explained 27.90% of the variance in persistence. The study concludes that students who plan, monitor, and regulate their thinking are more likely to persist through challenges. It recommends metacognitive training to strengthen effort and resilience in learning mathematics.

**Keywords:** *metacognitive awareness, persistence, mathematical problem-solving, knowledge about cognition, regulation of cognition*

**Introduction**

One critical issue in mathematics education is the lack of persistence among students when solving mathematical problems. Persistence, defined as the determination to stay focused on a task despite difficulty or prolonged effort (Shen et al., 2015), is crucial for achieving success in mathematics (Asoy, 2025). However, many students demonstrate insufficient persistence, which, combined with weak mathematical process skills, hinders their ability to grasp and apply mathematical concepts effectively (Kamid et al., 2024). This challenge undermines the learning process and limits the potential for meaningful knowledge transfer.

Rahmawati et al. (2024) found, in a study among vocational high school students in Jakarta, that persistence significantly improved students’ mathematical problem-solving abilities. A study conducted at the University of the East–Manila revealed that a Personal Instructing Agent (PIA) within a virtual learning tool significantly enhanced persistence in solving algebraic equations (Dela Cruz, 2024). Asoy and Picaza (2025) conducted a study involving first-year education students from three higher education institutions in Davao del Norte. Results showed a high level of persistence positively correlated with success in Mathematics in the Modern World. These findings underscore the importance of examining persistence in local educational contexts.

While numerous studies confirm the impact of metacognition on learning, limited research specifically explores how it supports persistence in solving complex mathematical problems, especially among math majors. Such gaps not only affect individual student outcomes but also compromise the quality of future educators, engineers, and researchers. Hence, it is urgent to investigate how metacognitive awareness can enhance persistence in mathematical problem-solving. The findings of this study will contribute valuable insights for educators and institutions seeking to strengthen learning strategies and improve mathematics achievement among math majors.

***Statement of the Problem***

The study aimed to investigate the role of metacognitive awareness in enhancing persistence in solving mathematical problems among math majors. Specifically, it seeks to answer the following questions:

1. What is the level of students' metacognitive awareness in terms of:

1.1. Knowledge about Cognition

1.2. Regulation of Cognition

1. What is the level of students’ persistence in solving mathematical problems in terms of:

2.1. Classroom exercises

2.2. Take-home assignments

2.3. Group tasks

2.4. Examinations

1. Is there a significant relationship between metacognitive awareness and persistence in solving mathematical problems?
2. Does metacognitive awareness significantly influence persistence in solving mathematical problems?

***Null Hypotheses***

Ho1: There is no significant relationship between metacognitive awareness and persistence in solving mathematical problems.  
Ho2: There is no significant influence of metacognitive awareness on persistence in solving mathematical problems.

***Theoretical/Conceptual Framework***

This study is anchored in John Flavell's (1979) theory of metacognition, which emphasizes the learner's ability to monitor and control their cognitive processes. Metacognitive awareness comprises two core components: knowledge about cognition and regulation of cognition. These skills enable students to manage their learning strategies effectively, contributing to enhanced persistence when faced with difficult mathematical tasks. When students are aware of their cognitive processes, they are more likely to persist, adapt strategies, and manage emotional responses to academic challenges.

|  |
| --- |
| **Metacognitive Awareness**   * Knowledge About Cognition * Regulation of Cognition |

|  |
| --- |
| **Persistence in Solving Mathematics Problem**   * Classroom exercises * Take home assignments * Group tasks * Examination |

***Figure 1. Conceptual Framework***

***Methodology***

This study utilized a descriptive-correlational research design to explore the relationship and influence of metacognitive awareness on students' persistence in solving mathematical problems. It was conducted at Davao Central College, located in Toril, Davao City, Philippines, during the academic year 2024–2025.

The participants consisted of 100 BSEd Mathematics majors, from first to fourth year, selected through purposive sampling. Only officially enrolled students were included in the study.

To gather the necessary data, two main instruments were used: the Metacognitive Awareness Inventory (MAI) developed by Schraw and Dennison (1994), which includes 52 items rated on a 5-point Likert scale, and the Persistence in Mathematical Problem-Solving Scale adopted from Ogbu and Ugwu (2023), composed of 28 items categorized into four academic contexts—classroom exercises, take-home assignments, group tasks, and examinations.

The data gathering procedure involved obtaining approval from the school administration and the program head. Informed consent was secured from the respondents prior to the distribution of the survey instruments. After collecting the responses, the data were encoded and analyzed.

Descriptive statistics, such as mean and standard deviation, were used to determine the levels of metacognitive awareness and persistence. Pearson’s correlation coefficient was employed to identify the relationships between the two variables, and multiple regression analysis was conducted to determine the extent to which metacognitive awareness influences persistence.

Ethical considerations were strictly observed throughout the research process. Confidentiality of responses was ensured, and participation was voluntary, with respondents free to withdraw at any point without penalty.

**Results and Discussion**

**Table 1. Descriptive Table**

|  |  |  |  |
| --- | --- | --- | --- |
| **Variables and Their Indicators** | **Standard Deviation** | **Mean** | **Verbal Description** |
| **Students Metacognitive Awareness** | **.372** | **4.31** | **Very High** |
| Knowledge Cognition | .415 | 4.30 | Very High |
| Regulation of Cognition | .377 | 4.32 | Very High |
| **Persistence in Solving Mathematics Problems** | **.467** | **4.06** | **High** |
| Classroom exercises | .547 | 4.02 | High |
| Take-home assignments | .676 | 3.88 | High |
| Group tasks | .621 | 4.06 | High |
| Examination | .482 | 4.29 | Very High |

Table 1 shows high mean scores for both metacognitive awareness and persistence in solving mathematical problems. The mean score for Knowledge of Cognition was 4.30, while Regulation of Cognition yielded a slightly higher average of 4.32. The relatively low standard deviations across these measures further suggest a strong consistency in students’ responses, reflecting a shared sense of self-efficacy in applying metacognitive approaches to learning. The overall mean of 4.31 indicates that students generally perceive themselves as highly aware of their learning processes and confident in their ability to manage and regulate their cognitive strategies.

On the other hand, students demonstrate a high degree of persistence in solving mathematics problems across different academic contexts. The highest mean score was garnered in mathematics examinations with a mean score of 4.29. The take-home assignments garnered the lowest mean score of 3.88. The standard deviations indicate moderate variability in students' responses. The overall mean of 4.06 suggests that students, on average, put a strong effort and remain resolute, specifically during exams, which shows the most persistence.

**Table 2. Test of Relationship**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Independent Variable** | **Persistence in Solving Mathematical Problems** | | | |
| **R-value** | **p-value** | **Decision on Ho** | **Remarks** |
| **Metacognitive Awareness** | .528 | .000 | Rejected | Significant |

Table 2 shows the statistical correlation between metacognitive awareness and students' persistence in solving mathematical problems. The results show a significant positive relationship, with a computed Pearson correlation coefficient (R-value) of .528 and a p-value of .000. Since the p-value is less than the standard significance level of 0.05, the null hypothesis is rejected, indicating that metacognitive awareness has a statistically significant relationship on students' persistence in mathematical tasks.

**Table 3. Regression Table**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Independent Variable** | **Persistence in Solving Mathematical Problems** | | | | |
| **R2-value** | **F-Value** | **p-value** | **Decision on Ho** | **Remarks** |
| **Metacognitive Awareness** | 27.90% | 37.9 | .000 | Rejected | Significant |

Table 3 presents the results of the regression, that metacognitive awareness is a significant predictor of students' persistence in solving mathematical problems. The R² value of 27.90%, nearly a third of the variation in persistence for students, can be attributed to their level of metacognitive awareness. With an F-value of 37.9 and a p-value of .000, the result is statistically significant, leading to rejection of the null hypothesis (Ho). This gives evidence that students with better metacognitive awareness concerning mathematics are more persistent in solving mathematical problems. However, the remaining 72.1% of the variance may be explained by other unexamined variables, underscoring the importance of exploring additional factors that influence mathematical performance.

**Discussion**

The study revealed that students showed very high metacognitive awareness in both knowledge about and regulation of cognition, indicating their ability to manage their thinking processes. This supports findings by Bakar and Ismail (2019) on the positive impact of metacognitive strategies and by Guner and Erbay (2021), who emphasized that these skills can be developed. Students also demonstrated high persistence in solving mathematical problems, especially during examinations, suggesting strong motivation. These results align with Sultanova et al. (2024), who highlighted persistence as key to resilience, and Mazana (2019), who noted its link to deeper task engagement.

Correlation analysis revealed a significant positive relationship between metacognitive awareness and persistence, suggesting that students with strong metacognitive skills sustain effort in solving problems (Attami et al., 2020; Kamid et al., 2023). Metacognitive training also boosts academic resilience, helping students face challenges with confidence (Rahmawati et al., 2024). Integrating these strategies in math instruction enhances both performance and persistence.

Regression analysis confirmed that metacognitive awareness significantly influences persistence, supporting previous research that links metacognition to mathematical resilience. Resilient students tend to understand their strengths and weaknesses, reflect on their learning, and plan effective strategies (Agustin et al., 2022). Metacognitive awareness fosters a positive mindset, motivation, and self-belief, enabling students to persist through challenges (Hutauruk et al., 2019; Sahin & Kendir, 2013).

**Conclusion**

Since metacognitive awareness significantly influences Persistence in Solving Mathematical Problems, the theory of metacognition, by John Flavell (1979), is affirmed, which emphasizes the learner's ability to monitor and control their cognitive processes. Metacognitive awareness comprises two core components: knowledge about cognition and regulation of cognition. These skills enable students to manage their learning strategies effectively, contributing to enhanced persistence when faced with difficult mathematical tasks. When students are aware of their cognitive processes, they are more likely to persist, adapt strategies, and manage emotional responses to academic challenges. Consequently, math majors with higher metacognitive awareness showed greater persistence, especially during examinations. Statistical results showed that metacognitive awareness explained 27.9% of the variance in persistence. This implies that other factors may influence persistence in solving mathematical problems not covered in the present study.

**Recommendation**

Given these findings, it is essential to apply them to educational practice. Students are encouraged to regularly engage in metacognitive practices such as self-monitoring, goal-setting, and evaluating their own problem-solving approaches to enhance both persistence and mathematical performance. Teachers may incorporate explicit instruction on metacognitive strategies within mathematics lessons to help students become more aware of their thinking processes and promote greater autonomy in learning. Future researchers may explore other influencing variables, such as motivation, academic self-efficacy, and emotional regulation, that may also affect students’ persistence in mathematics. Moreover, similar studies may be conducted across different academic levels, disciplines, or institutions to validate and enrich the findings of this research.

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