



# THE INFLUENCE OF METACOGNITIVE SKILLS ON PROBLEM SOLVING SKILLS IN MATHEMATICS AMONG SENIOR HIGH SCHOOL STUDENTS: BASIS FOR AN INTERVENTION PLAN

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Article DOI: <https://doi.org/10.36713/epra28404>

DOI No: 10.36713/epra28404

## ABSTRACT

This study employed a quantitative research design using descriptive and correlational approaches to determine the influence of metacognitive skills on problem-solving skills in Mathematics. Two hundred fifty-six respondents were gathered from five large public schools of Cluster 6, Division of Davao City. The study used an adopted metacognitive skills questionnaire and a researcher-made problem-solving test. Mean, spearman rho, and regression analysis were used to analyze the data. A significant positive relationship was found between metacognitive skills and problem-solving skills, indicating that students with higher metacognitive skills tend to demonstrate better performance in solving mathematical problems. Furthermore, inferential analysis revealed that metacognitive skills significantly influence students' problem-solving performance in Mathematics. Based on the findings of the study, an intervention plan was proposed to enhance students' metacognitive skills through targeted learning strategies and problem-solving activities aimed at improving mathematical performance.

**KEYWORDS:** mathematics education, metacognitive skills, problem-solving skills, quantitative design, senior high school students, regression analysis, Philippines

## INTRODUCTION

Mathematics problem-solving remains a challenge among Senior High School students, particularly in problem analysis, strategy selection, and logical reasoning (Nugroho et al., 2022). In Davao City, Grade 11 learners were rated within the "Nearly Proficient to Low Proficient" range in mathematical problem-solving, highlighting the need to examine factors such as metacognitive skills that may affect performance (Department of Education Region XI, 2023).

In the Philippines, Senior High School students continue to face challenges in mathematical problem-solving, particularly in problem analysis, strategy selection, and concept application (Almadin et al., 2021). Likewise, Grade 11 learners in Davao City were rated within the "Nearly Proficient to Low Proficient" range, indicating a need for interventions to improve performance (Department of Education Region XI, 2023).

These findings highlight the need to examine metacognitive skills, which involve planning, monitoring, and evaluating one's thinking during learning (Veenman, 2017). Since effective metacognitive regulation is linked to improved problem-solving performance (Fitriani et al., 2020), the study may help teachers develop interventions to enhance students' learning outcomes in Mathematics.

## OBJECTIVES

1. To determine the level of metacognitive skills among Senior High School students in terms of:
  - 1.1 metacognitive knowledge and learning strategies;
  - 1.2 knowledge about learning and learning unit; and
  - 1.3 ability in planning and monitoring own learning.

2. To assess the level of problem-solving skills among Senior High School students based on their Mathematics test scores.
3. To examine the significant relationship between metacognitive skills and problem-solving skills among Senior High School students.
4. To investigate the influence of metacognitive skills on the problem-solving skills in Mathematics among Senior High School students.
5. To propose an intervention plan based on the findings of the study.

## METHODOLOGY

This study employed quantitative research design, specifically descriptive and correlational approaches. The descriptive approach was used to determine the levels of metacognitive skills and problem-solving skills in Mathematics among Senior High School students, while the correlational approach was utilized to examine the relationship and influence of metacognitive skills on students' problem-solving skills (Apuke, 2017).

The study utilized a descriptive-correlational approach. The descriptive approach was used to determine the levels of metacognitive skills and problem-solving skills in Mathematics, while the correlational approach examined the relationship and influence of metacognitive skills on students' problem-solving skills without manipulating the variables.

The study was conducted among Grade 11 Senior High School students from the five largest public secondary schools in Cluster 6, Schools Division of Davao City, during School Year 2025–2026. Using proportionate stratified and systematic random sampling, 256 students from the Academic and TVL tracks were selected from a population of 763 respondents.



## RESULTS

The study revealed that Senior High School students have low metacognitive skills, indicating weak manifestation. While they show moderate knowledge about learning and the ability to plan and monitor, they struggle with applying effective learning strategies and self-regulation consistently.

This finding is consistent with the studies of Magno (2010), which emphasized that many students experience difficulty in applying metacognitive processes such as planning, monitoring, and evaluating their learning, resulting in weaker self-regulation and learning outcomes.

Moreover, the study revealed that Senior High School students have below-average problem-solving skills in Mathematics. Consistent ratings from the researcher and expert raters indicate that students experience difficulties in understanding problems, selecting appropriate strategies, and applying mathematical concepts effectively.

This finding is consistent with Tambychik and Meerah (2023), reported that students experience difficulties in mathematical problem-solving due to weak analytical skills, limited strategy use, and insufficient conceptual understanding. The study also found a significant but weak negative relationship between metacognitive skills and problem-solving skills, indicating that higher metacognitive skills do not necessarily lead to better problem-solving performance.

Additionally, the findings are consistent with the study of Utami et al. (2022), who reported weak and inconsistent relationships between metacognitive skills and academic performance. Moreover, metacognitive skills significantly influenced problem-solving skills; however, the effect was weak, suggesting that metacognitive skills are not the primary factor affecting students' mathematical problem-solving performance.

## TABLES AND REFERENCES

**Table 1. Level of Metacognitive Skills Among Senior High School Students in Terms of Metacognitive Knowledge and Learning Strategies**

	Items	SD	Mean	Descriptive Equivalent
1.	I use my previous experiences while organizing my new learnings.	0.90	2.39	Low
2.	If the learning couldn't be accomplished, I search for other strategies that could be effective.	0.88	2.09	Low
3.	I revise my study plan that I used in learning and make necessary corrections.	0.95	2.59	Low
4.	When the learning strategy I use does not work, I try a new one.	1.14	2.70	Moderate
5.	I search for the reasons of the failure while learning a subject.	1.04	2.51	Low
6.	I search for how I learned a subject most effectively while learning.	0.99	2.39	Low
7.	I revise and correct the learning strategies while studying a subject.	0.92	2.48	Low
8.	I asses if the cognitive strategy that I employ has been successful or not	0.90	2.41	Low
<b>Category Mean</b>		<b>0.98</b>	<b>2.45</b>	<b>Low</b>

This finding is consistent with Varveris et al. (2023), who found that metacognitive skills significantly predict problem-solving performance but contribute only minimally to students' achievement. Based on the findings, an intervention plan is proposed to strengthen students' metacognitive and mathematical problem-solving skills through activities that promote planning, monitoring, evaluation, and effective problem-solving strategies.

## SUGGESTIONS

Based on the findings, students are encouraged to strengthen their metacognitive skills by practicing planning, monitoring, and evaluating their learning and by using varied problem-solving strategies in Mathematics to improve their understanding and performance.

Furthermore, Mathematics teachers are encouraged to integrate metacognitive strategies and structure problem-solving activities into their instruction, while school administrators should support professional development programs to enhance teaching practices and improve students' mathematics performance.

## CONCLUSION

Based on the findings, the study concludes that Grade 11 Senior High School students exhibit low metacognitive skills and below-average problem-solving skills in Mathematics. The results further revealed a significant but weak negative relationship between metacognitive skills and problem-solving skills, with metacognitive skills having a weak negative influence on problem-solving performance. This suggests that metacognitive skills alone do not sufficiently explain students' mathematical problem-solving abilities and that other factors may also contribute to their performance.



**Table 2. Level of Metacognitive Skills Among Senior High School Students in Terms of Knowledge About Learning and Learning Unit**

	Items	SD	Mean	Descriptive Equivalent
1.	I plan how and when to use the resources that will help me learn a subject well.	1.00	2.41	Low
2.	I don't have an exact idea of how to organize my learning.	1.55	3.01	Moderate
3.	While learning a subject, I am not aware of employing which strategy and how to use it.	1.03	3.20	Moderate
4.	I know how much time I need to learn a subject.	1.22	2.64	Moderate
5.	I have difficulty in planning my learning a subject in accordance with my own learning qualities.	1.08	2.69	Moderate
6.	I have difficulty in distinguishing important parts about a text or a learning unit.	0.99	2.79	Moderate
7.	I prepare the learning environment that is necessary for learning process.	0.99	2.66	Moderate
8.	I critically make plan before beginning to study a text.	1.11	2.88	Moderate
9.	I know which subjects I can learn easily and which I will have difficulty in learning.	1.25	2.26	Low
10.	I know the other subject matters that I can use an effective learning strategy in a subject.	1.20	2.55	Low
11.	I determine which learning strategy I should employ before I start studying.	1.08	2.68	Moderate
12.	I know when I need to ask for help.	1.22	2.31	Low
13.	I determine what I will learn about a subject before I start studying it.	1.10	2.59	Low
	<b>Category Mean</b>	<b>1.17</b>	<b>2.66</b>	<b>Moderate</b>

**Table 3. Level of Metacognitive Skills Among Senior High School Students in Terms of Ability in Planning and Monitoring Own Learning**

	Items	SD	Mean	Descriptive Equivalent
1.	It is important for me to overview my learnings from time to time to determine how much and what I learned.	1.08	2.46	Low
2.	I recognize my errors during learning process.	1.18	2.46	Low
3.	I check if I understood a subject during learning.	1.13	2.55	Low
4.	I have difficulty in understanding the reason of the trouble I experienced during learning.	1.11	2.86	Moderate
5.	I check if I effectively use my time during learning.	1.06	2.57	Low
6.	It is important for me to build meaningful relations between learned subjects during learning.	1.07	2.59	Low
7.	Till I reach a result, I organize the conditions for keeping my attention.	1.05	2.73	Moderate
8.	I don't spare much time for monitoring how much I learned about the subject during learning process.	1.04	2.95	Moderate
9.	During learning process, I have difficulty to determine in which conditions I can learn and those I have failed to learn.	1.09	2.77	Moderate
	<b>Category Mean</b>	<b>1.10</b>	<b>2.66</b>	<b>Moderate</b>



**Table 4. Summary on the Level of Metacognitive Skills Among Senior High School Students**

Indicators	SD	Mean	Descriptive Equivalent
Metacognitive Knowledge and Learning Strategies	0.98	2.45	Low
Knowledge About Learning and Learning Unit	1.17	2.66	Moderate
Ability in Planning and Monitoring Own Learning	1.10	2.66	Moderate
<b>Overall Mean</b>	<b>1.19</b>	<b>2.52</b>	<b>Low</b>

**Table 5. Level of Problem- Solving Skills among Students in Mathematics**

Variable	Rater	SD	Mean Score Percentage	Descriptive Equivalent
	Researcher	29.53	33.21	Below Average
<b>Problem Solving Skills</b>	Expert 1	29.46	32.95	Below Average
	Expert 2	29.54	33.04	Below Average
	<b>Overall Mean</b>	<b>29.50</b>	<b>28.94</b>	<b>Below Average</b>

**Table 6. Significance of the Relationship Between the Level of Metacognitive Skills and Problem-Solving Skills among Senior High School Students**

Variables Correlated	<i>p</i>	<i>p</i> -value	Decision on $H_0$	Decision on Relationship
Metacognitive Knowledge and Learning Strategies and Problem-Solving Skills	-0.183	0.003	Reject	Significant
Knowledge About Learning and Learning Unit and Problem-Solving Skills	-0.106	0.091	Not Rejected	Not Significant
Ability in Planning and Monitoring Own Learning and Problem-Solving Skills	-0.103	0.101	Not Rejected	Not Significant
<b>Metacognitive Skills and Problem-Solving Skills</b>	<b>-0.168</b>	<b>0.007</b>	<b>Reject</b>	<b>Significant</b>

**Table 7. Regression Analysis on Metacognitive Skills and Problem-Solving Skills among Senior High School Students**

Independent Variables	Dependent Variable	Unstandardized Coefficients		Standardized Coefficients	<i>t</i>	<i>p</i> -value	Remarks
		<i>B</i>	Std. Error	Beta			
(Constant)		63.709	11.374		5.601	0.000	
Metacognitive Skills	Problem-Solving Skills	-11.748	4.332	-0.168	-2.712	0.007	Significant
<i>r</i> = -0.168;		<i>r</i> <sup>2</sup> = 0.028;		<i>F</i> = 7.354;		<i>p</i> = 0.007	

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