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The Effect of Student Metacognitive Awareness on Academic Performance in Mathematics of Grade Ten Learners

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Abstract: This study aims to determine the student's a) level of academic performance in mathematics, b) the level of metacognitive awareness, and c) the relationship between academic performance and metacognitive awareness in mathematics. A quantitative correlational design was employed with 52 Grade 10 students of Valencia National High School officially enrolled in the school year 2024 – 2025. The results reveal that a) student's mean score for their academic performance is 84.62, classifying them as "Satisfactory level" This mean score is subdivided by these: there were (23.08%) had an outstanding level of academic performance, which means that 12 out of 52 students got the grade of 90 to 100. 25% or 13 students obtained the level of very satisfactory; 38.46% or 20 students obtained the level of satisfactory; and lastly, 13.46% or 7 students obtained the level of fairly satisfactory, and no participants obtained below 75. In b) level of metacognitive awareness with an overall mean of 3.56 interpreted as "High Metacognitive awareness". The sub variable Declarative knowledge obtained a high mean of 3.66, interpreted as "High Metacognitive awareness," followed by Conditional knowledge obtained a mean of 3.59, interpreted as "High Metacognitive awareness", and lastly the sub variable Procedural knowledge obtained the lowest mean of 3.45, interpreted as "Moderate Metacognitive awareness". Lastly, the findings c) reveal that the academic performance and metacognitive awareness of students have a moderate positive correlation, by having a Pearson r value of 0.397, implying that the students with a higher level of metacognitive awareness tend to achieve better academic performance.

Keywords: academic performance, metacognitive awareness, grade ten students.

INTRODUCTION

The use of mathematical principles worldwide has enabled critical thinking, which has generated vast knowledge and useful practices. The discipline of mathematics gives people the ability to solve problems and develops their ability to think both analytically and logically. People need these fundamental abilities for educational environments, together with everyday life, because sound decision-making is fundamental in both cases. Skilled mathematicians have access to many job opportunities since numerous industries depend on mathematical understanding and procedures.

However, the Philippines' performance in mathematics is regularly depicted worryingly by foreign assessments. For instance, the Philippines scored 355 points on the most recent PISA, placing it 77th out of 81 nations, much lower than the global average of 472 points. Furthermore, schools implementing an instruction of problem-based learning to develop students' mathematics proficiency and also to achieve a high quality and positive student performance. According to Descargar and Cardona, (2021) stated that students think that good study habits are key to doing well in school, but teachers have noticed that students' study habits have gotten worse. Teachers feel that parents often side with their children when they disagree with the teachers' assessments. How well students do in math can be explained by their study habits. The better the attitude towards Mathematics, the higher the performance in the subject. Attitude has a positive impact on performance in Mathematics. (Oredina, *et al*., 2024)

Mathematics educational achievement by students functions as an essential measurement to assess their educational development throughout their school experience. Apart from its numerical abilities, mathematics brings meaningful skills for logical thinking and problem-solving, which benefit personal life situations. Students who demonstrate excellence in mathematics gain better possibilities for academic and professional opportunities because numerous fields, including engineering, finance, and technology, base their operations on mathematical concepts. According to Kliziene, *et al*., (2022) stated that these skills, such as problem-solving and logical thinking, are essential for personal life situations and academic success.

Metacognitive awareness is an important part of student-centered education. The understanding students have about their learning processes when dealing with mathematics concepts forms the basis of metacognitive awareness. The understanding students possess about their learning processes directly influences their approach toward problem-solving and learning activities. Students who

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understand the nature of their cognition can check their comprehension while selecting strategic methods to solve mathematical problems. However, some students had experienced different metacognitive awareness failures in solving problems, as proved by Adinda, *et al*., (2021). The students failed to notice their mistakes when both finding problems and using algebraic procedures for solving them. Students frequently failed to sense the errors in how they tackled problems.

Filipino students, especially in math, have generally been struggling academically, as shown by various national and international test scores (Montero and Elipane, 2021). This suggests that the challenges Filipino students face in their academic performance are also related to their lack of metacognitive awareness. In this context, Grizzle-Maritin, as cited by Odani (2020), Students often find it hard to solve math problems because they are not fully aware of the different metacognitive strategies they could use. Overall, metacognition plays a crucial role in the learning process and significantly impacts students' academic success, particularly in math.

This study investigated the relationship between academic performance and metacognitive awareness in mathematics of regular Grade Ten learners at Valencia National High School. The study sought to provide ideas and insight from the educators and policymakers on potential practices to improve the academic performance of the learners.

1.2 Statement of the Problem

This study aimed to answer the following questions:

1. What is the level of students' academic performance in mathematics?
2. What is the level of students' metacognitive awareness in mathematics in terms of:

a) Declarative Knowledge;
b) Procedural Knowledge; and
c) Conditional Knowledge.

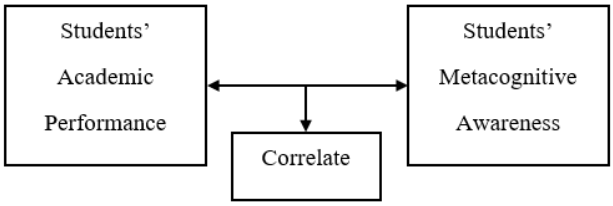
3. Is there a significant relationship between the level of students' academic performance and metacognitive awareness in mathematics?

1.3 Hypothesis of the Study

1. H_0: There is no significant relationship between the level of academic performance and metacognitive awareness in mathematics

1.4 Research Paradigm

The research paradigm illustrates the relationship between academic performance and metacognitive awareness of students.



LITERATURE REVIEW

The available literature and studies highlight the challenges faced by students in the Philippines and worldwide in terms of their metacognitive awareness and academic performance in mathematics.

Philippine students show perpetual weakness in mathematics according to their results from the 2018 Programme for International Student Assessment (PISA). As stated by Callaman and Itaas (2020), several factors have been found that lead to low proficiency in mathematics achievement. However, mathematical skills, attitude, and self-efficacy can be predictors of students' mathematics achievement. Additionally, the teacher's teaching strategies lead to the development of interest and positive learning towards mathematics. Eventually, the type of school where the student studies may cause significant variation.

The factors faced in education can provide a coping mechanism to address the learning problem of the students, such as study habits, which can improve students' academic performance as well as the attitudes towards mathematics (Cabuquin and Abocejo, 2023). Students' performances go hand in hand, while gender does not affect the ability of students to excel in mathematics. Although there is an improvement in students' academic performance through study habits, parents and teachers will also provide support to the learners to avoid misconceptions of terms in mathematics.

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Metacognitive awareness, defined as the knowledge and regulation of one's cognitive processes, has been increasingly recognized as a critical factor influencing academic achievement across various educational contexts. His awareness is crucial for students as it enables them to monitor their comprehension and adjust their strategies accordingly. Numerous studies show that metacognitive skills promote effective problem-solving strategies and foster deeper understanding (Güner and Erbay, 2021).

Metacognitive awareness is significantly important for developing students' learning process and outcomes in mathematics. On the other hand, it is awareness of how we learn, including how we take a step, monitoring our progress, and evaluating our performance. Students with high metacognitive awareness excel in problem-solving because they can reflect and adjust their learning strategies as needed. Metacognitive strategies help students identify their weaknesses and develop targeted approaches to learning, ultimately leading to improved mathematical proficiency (Thi-Nga, *et al*, 2024).

As a result, this research demonstrates the importance of metacognitive awareness and its close relationship to learners' academic achievement. This endeavor will benefit greatly from the study's attempt to increase metacognitive awareness. Bruning, Schraw, and Norby, as cited by Alecida (2023) in their cognitive psychology book, classified Knowledge into three categories: Conditional, Procedural, and Declarative Knowledge.

The reviewed studies provide consist of evidence that there is a positive relationship between academic performance and metacognitive awareness in mathematics. Additionally, there is an effect of students' academic performance in mathematics if there is an enhancement of students' metacognitive awareness.

METHODOLOGY

Research Design

This study employed a descriptive correlation research design to assess the impact on students' academic performance and metacognitive awareness in mathematics. This research design aimed to provide insights into the impact of students' metacognitive awareness and the correlation of students' academic performance in mathematics.

Research Locale and Participants

This study was conducted in Valencia National High School, Valencia City, Bukidnon, during the third grading period in the school year 2024-2025. The participants were Grade 10 students in the regular class. Names and other personal identifiers of the participants were not recorded. The sampling procedure used in the study is total enumeration, which includes all the grade 10 students.

Instrumentation

The primary data sources for assessing academic performance were the mathematics grades of grade ten students from the third grading period. This data was analyzed following the guidelines outlined in DepEd Order No. 8, series of 2015, as detailed below.

Table 1: Descriptors, Grading Scale, and Remarks (DepEd Order No. 8 s2015)

DESCRIPTOR	GRADING SCALE	REMARKS
Outstanding	90-100	Passed
Very Satisfactory	85-89	Passed
Satisfactory	80-84	Passed
Fairly Satisfactory	75-79	Passed
Did Not Meet Expectation	Below 75	Failed

To determine the students' metacognitive awareness, the researcher adopted the Metacognitive Awareness Assessment Tool, which was similarly modeled from the Metacognitive Awareness Inventory Tool of Schraw and Dennison (2004), used by Aliceda (2023). The scale is a 17-item using a 5-point Likert scale, from strongly agree to strongly disagree. Cronbach's alpha coefficient obtained in the present study was 0.804. It followed the scoring procedure below.

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Table 2: Metacognitive Awareness Assessment Tool

SCORE	RANGE	DESCRIPTIVE RATING	QUALITATIVE DESCRIPTION
5	4.51-5.00	Strong Agree	Very High
4	3.51-4.50	Agree	High
3	2.51-3.50	Undecided	Moderate
2	1.51.2.50	Disagree	Low
1	1.00-1.50	Strongly Disagree	Very Low

3.4 Data Gathering Procedure

This study involves two (2) Phases. In the First phase, Phase 1, all the necessary documents are acquired, which consist of approval letters, consent from the parents of the participants, as well as participants' consent (Grade 10 students), printing and preparation of the instrument used to ensure the readability and comprehensibility of the material. In the next phase, Phase 2 materials are administered the survey questionnaire that the students had answered. In the same phase, the grades of the students in the third grading are being correlated to examine if their metacognitive awareness in mathematics affects their math academic performance.

RESULTS AND DISCUSSIONS

Descriptive statistics were calculated for all 52 participating students' mathematics grades in the third grading period. Table 1 shows the descriptors, grading scale, and remarks used in analyzing the student's mathematics grades.

Table 3: Level of academic performance of grade 10 students in mathematics

RANGE	F	%	QUALITATIVE INTERPRETATION
90-100	12	23.08	Outstanding
85-89	13	25	Very Satisfactory
80-84	20	38.46	Satisfactory
75-79	7	13.46	Fairly Satisfactory
Below 75	0	0	Did Not Meet Expectation
MPS	84.62		Satisfactory

As illustrated in the table 3, the grade 10 students at Valencia National High School attained the mean score of 84.62%, categorized them as "Satisfactory" there were students (23.08%) had an outstanding level of academic performance, which means that 12 out of 52 students got the grade of 90 to 100. 25% or 13 students obtained the level of very satisfactory; 38.46% or 20 students obtained the level of satisfactory; and lastly, 13.46% or 7 students obtained the level of fairly satisfactory, and no participants obtained below 75.

Table 4: Level of Metacognitive Awareness in terms of Declarative Knowledge

Declarative Knowledge	Mean	QI
I have control over how well I learn.	4.35	HMA
I learn more when I am interested in the topic.	3.9	HMA
I understand my intellectual strengths and weaknesses.	3.88	HMA
I know what kind of information is most important to learn.	3.63	HMA
I know what the teacher expects me to learn.	3.62	HMA
I am a good judge of how well I understand something.	3.4	MMA
I am good at remembering information.	3.33	MMA
I'm good at organizing information.	3.17	MMA
Overall Mean	3.66	HMA

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Legend

Range	Descriptive Rating (DR)	Qualitative Interpretation (QI)
4.51-5.00	Strong Agree	Very High Metacognitive Awareness (VHMA)
3.51-4.50	Agree	High Metacognitive Awareness (HMA)
2.51-3.50	Undecided	Moderate Metacognitive Awareness (MMA)
1.51-2.50	Disagree	Low Metacognitive Awareness (LMA)
1.00-1.50	Strongly Disagree	Very Low Metacognitive Awareness (VLMA)

Table 4 shows the level of metacognitive awareness in terms of declarative knowledge, which obtained the overall mean of 3.66, categorized as "High Metacognitive awareness". The indicator "I have control over how well I learn." attained the highest mean of 4.35, followed by the indicator "I learn more when I am interested in the topic." Attained the mean of 3.9 interpreted as high metacognitive awareness, and the indicator "I'm good at organizing information." got the lowest mean of 3.17 interpreted as moderate metacognitive awareness.

Table 5: Level of Metacognitive Awareness in terms of Procedural Knowledge

Procedural Knowledge	Mean	QI
I try to use strategies that have worked in the past.	3.54	HMA
I am aware of what strategies I use when I study.	3.46	MMA
I find myself using helpful learning strategies automatically.	3.42	MMA
I have a specific purpose for each strategy I use.	3.38	MMA
Overall Mean	3.45	MMA

Legend

Range	Descriptive Rating (DR)	Qualitative Interpretation (QI)
4.51-5.00	Strong Agree	Very High Metacognitive Awareness (VHMA)
3.51-4.50	Agree	High Metacognitive Awareness (HMA)
2.51-3.50	Undecided	Moderate Metacognitive Awareness (MMA)
1.51-2.50	Disagree	Low Metacognitive Awareness (LMA)
1.00-1.50	Strongly Disagree	Very Low Metacognitive Awareness (VLMA)

As illustrated in Table 5 shows the level of metacognitive awareness in terms of procedural knowledge attained an overall mean of 3.45, categorized them as "Moderate Metacognitive Awareness". The indicator "I try to use strategies that have worked in the past" Obtained the highest mean of 3.54, interpreted as high metacognitive awareness, and the indicator "I have a specific purpose for each strategy I use" obtained the lowest mean of 3.38, interpreted as "Moderate Metacognitive awareness".

Table 6: Level of Metacognitive Awareness in terms of Conditional Knowledge

Conditional Knowledge	Mean	QI
I learn best when I know something about the topic.	3.85	HMA
I can motivate myself to learn when I need to.	3.81	HMA
I use my intellectual strength to compensate for my weaknesses.	3.48	MMA
I know when each strategy I use will be the most effective.	3.46	MMA
I use different learning strategies depending on the situation.	3.35	MMA
Overall Mean	3.59	HMA

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Legend

Range	Descriptive Rating (DR)	Qualitative Interpretation (QI)
4.51-5.00	Strong Agree	Very High Metacognitive Awareness (VHMA)
3.51-4.50	Agree	High Metacognitive Awareness (HMA)
2.51-3.50	Undecided	Moderate Metacognitive Awareness (MMA)
1.51-2.50	Disagree	Low Metacognitive Awareness (LMA)
1.00-1.50	Strongly Disagree	Very Low Metacognitive Awareness (VLMA)

As illustrated in Table 6 shows the level of metacognitive awareness in terms of conditional knowledge attained an overall mean of 3.59, categorized them as "High Metacognitive awareness". The indicator "I learn best when I know something about the topic" obtained the highest mean of 3.85, interpreted as "High Metacognitive awareness", and the indicator "I use different learning strategies depending on the situation" obtained the lowest mean of 3.35, interpreted as "Moderate Metacognitive awareness".

Table 7: Summary on the level of Metacognitive Awareness

Metacognitive Awareness	Mean	QI
Declarative Knowledge	3.66	HMA
Conditional Knowledge	3.59	HMA
Procedural Knowledge	3.45	MMA
Overall Mean	3.56	HMA

Legend

Range	Descriptive Rating (DR)	Qualitative Interpretation (QI)
4.51-5.00	Strong Agree	Very High Metacognitive Awareness (VHMA)
3.51-4.50	Agree	High Metacognitive Awareness (HMA)
2.51-3.50	Undecided	Moderate Metacognitive Awareness (MMA)
1.51-2.50	Disagree	Low Metacognitive Awareness (LMA)
1.00-1.50	Strongly Disagree	Very Low Metacognitive Awareness (VLMA)

Table 7 illustrates the summary on the level of metacognitive awareness with an overall mean of 3.56, interpreted as "High Metacognitive awareness". The sub variable Declarative knowledge obtained the high mean of 3.66, interpreted as "High Metacognitive awareness", followed by Conditional knowledge obtained the mean of 3.59, interpreted as "High Metacognitive awareness", and lastly the sub variable Procedural knowledge obtained the lowest mean of 3.45, interpreted as "Moderate Metacognitive awareness".

Table 8: Correlation Analysis between Academic Performance and Metacognitive Awareness

		Academic Performance	Metacognitive awareness
Academic Performance	Pearson Correlation	1	.397**
	Sig. (2-tailed)		.004
	N	52	52
Metacognitive awareness	Pearson Correlation	.397**	1
	Sig. (2-tailed)	.004	
	N	52	52

**Correlation is significant at the 0.01 level (2-tailed)

Table 8 illustrates the correlation analysis between the academic performance and metacognitive awareness, indicating the Pearson correlation coefficient of r= 0.397** (p=0.004), which means

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that there is a moderate positive relationship where the students with a higher level of metacognitive awareness tend to achieve better academic performance. The result indicates that if the level of students' metacognitive awareness rises, the level of students' academic performance will also rise, and vice versa. The nonsignificant p-value of 0.004 at the 0.01 level means that we failed to reject the null hypothesis, furtherly emphasizing that there is a moderate positive correlation between academic performance and metacognitive awareness. This claim is also supported by Mwangi, *et al*. (2024).

CONCLUSION AND RECOMMENDATIONS

The following conclusions were reached in light of this study's findings:

The grade 10 students of Valencia National High School have a satisfactory Academic performance. When it comes to their level of metacognitive awareness, it has been found that they have high metacognitive awareness. When it comes to their relationship, it has been found that there is a moderate positive correlation, which implies that their metacognition will affect their academic performance I mathematics.

This study then leads to the following recommendation: this study may serve as a guide in preparing instructional materials to improve students' metacognitive awareness and help them design activities and another engaging model for the students to develop their regulation and mathematical skills. It would help provide knowledge and guidelines to policymakers who would help improve the country's education system. Lastly, further studies and the use of helpful strategies are encouraged to support students in their learning efforts.

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