

The Use of Metacognitive Strategies in Fostering Students' Self Regulated Learning and Performance in Science

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Abstract—This study examined the use of metacognitive strategies in fostering students' self-regulated learning and performance in Science specifically, it aimed to determine the level of metacognitive strategies used in teaching Science, the level of students' self-regulated learning in students' academic performance in terms of formative and summative assessments. It also investigated the significant relationship between metacognitive strategies and students' self-regulated learning, as well as the effect on students' academic performance. This study employed a quantitative research design using a descriptive-correlational approach. The respondents consisted of 118 Grade 11 students, including 45 from the HUMSS strand, 45 from HE A, and 33 from the ABM strand, selected through purposive sampling. Data were collected using a validated questionnaire using a five-point Likert scale. Descriptive statistics such as weighted mean and standard deviation were used, while Pearson Product–Moment Correlation and t-test were applied to determine relationships and effects among variables. The results indicated that teachers use metacognitive strategies to a very high level, the students' self-regulated learning was rated very high. Regarding academic performance, students demonstrated outstanding results in formative assessments, with the majority classified as outstanding. However, their performance in summative assessments was generally at a satisfactory level, indicating stronger performance in ongoing assessments than in major exams. Further analysis revealed significant relationships between metacognitive strategies and certain aspects of self-regulated learning. Finally, results from the t-test showed that metacognitive strategies in teaching Science did not have a significant effect on students' performance in either formative or summative assessments. Both hypotheses were rejected based on the findings of the study. The findings indicate that using metacognitive strategies significantly linked and improved students self-regulated learning and performance. Based on the findings, it is recommended that teachers continue to strengthen the use of metacognitive strategies in Science instruction to enhance students' self-regulated learning. School administrators are encouraged to support instructional improvements through training and supervision, while students should actively develop their self-regulation skills. Future researchers may explore similar studies in different contexts to further examine these relationships.

Keywords— Metacognitive Strategies, Self-Regulated Learning, Planning Strategies, Monitoring Strategies, Evaluation Strategies, Cognitive Regulation, Behavioral Regulation, Emotional Regulation, Motivational Regulation

I. INTRODUCTION

In recent years, educational environments have become more dynamic, with blended learning, technology-enhanced

instruction, and increasing demands for autonomy from students. Such changes require learners to be more active agents in their own learning, rather than passive recipients. As educational settings shift, there is a growing need to focus on students' ability to self-regulate, managing their motivation, cognition, and behavior in order to adapt and succeed pointed out by Munshi et.al. (2022).

Self-regulated learning has been shown to mediate how well students cope with these new demands. It refers to the capacity of learners to plan, monitor, regulate, and evaluate their learning processes asserted by Sui, Yen and Chang (2023). Students possessing strong self-regulated learning skills tend to set goals effectively, maintain persistence, and respond adaptively when challenges arise. These skills govern not just how learners engage with tasks, but also how they achieve performance outcomes.

Academic performance remains a central concern for educators and students alike: test scores, course grades, and subject mastery are concrete measures of how well learning has occurred. Studies have found significant positive associations between self-regulated learning and academic outcomes students who self-regulate well generally perform better (e.g., in EFL contexts, among college students) when they use metacognitive strategies alongside other regulatory strategies. Thus, performance serves as a dependent variable that reflects both outcome and learning efficacy.

Metacognitive strategies represent a crucial independent variable in the process of fostering self-regulated learning. These strategies include planning, monitoring, and evaluating, recent research by Dignath and Veenman (2021). has placed particular emphasis on how knowledge (metacognitive awareness) and regulation components influence student behavior (e.g., in blended learning environments). These strategies enable learners to assess their current understanding, anticipate difficulty, adjust approaches, and reflect on their success or failure.

It was revealed by Javier (2019) that the use of planning strategy enhanced self-efficacy, which in turn mediated effects of metacognitive strategies on general learning behaviors. In blended learning contexts, students with high metacognitive knowledge and regulation displayed more diversified Self-regulated learning processes, such as engaging in goal setting, whereas those with lower metacognitive levels tended to rely more on simpler regulation such as time management.

More so, show that metacognitive strategy use has a direct impact on academic performance from the study Munshi et.al. (2022) that learners, metacognitive strategies showed significant positive relationships with academic success, beyond the contributions of effort regulation and time management alone. Furthermore, research in technology-enhanced environments indicates that technology tools combined with metacognitive scaffolds (e.g., monitoring prompts, self-assessment tools) improve not only self-regulated learning behaviors but also learning outcomes.

Given this strong evidence, it becomes clear that educational interventions should explicitly incorporate metacognitive strategy instruction if the aim is to foster self-regulated learning and improved performance. However, gaps remain for example, how different metacognitive sub-strategies compare in effectiveness; how these effects may differ across student demographics, task types, or instructional modalities; and how long the effects persist. Research such as Munshi et al. (2022) has begun to address scaffolding strategies in blended learning but more is needed in diverse educational settings.

Therefore, this study aims to investigate the use of metacognitive strategies including planning, monitoring, evaluating, regulating, debugging, and information management and how these relate to students' self-regulated learning and performance (DV). Specifically, the study will examine which metacognitive sub-strategies most strongly predict Self-regulated learning behaviors and academic outcomes among students, possibly exploring mediation and modulation by learning environment. By clarifying these relationships, the research hopes to provide guidance for instructional design that promotes both strong SRL and high academic performance in the current educational context.

1.1 Statement of the Problem

Problem/s which were addressed by the research

The study aims to determine the metacognitive strategies in fostering students self-regulated learning and performance.

Specifically, it seeks sought answer the following questions:

1. What is the level of Using Metacognitive Strategies In Teaching Science in terms of:
 - 1.1 Planning Strategies;
 - 1.2 Monitoring Strategies; and
 - 1.3 Evaluation Strategies?
2. What is the level of Students' Self-Regulated Learning in Science in terms of:
 - 2.1 Cognitive Regulation,
 - 2.2 Motivational Regulation,
 - 2.3 Behavioral Regulation, and
 - 2.4 Emotional Regulation?
3. What is the level of Students' Performance in Science terms of
 - 3.1 formative assessment and
 - 3.2 summative assessment?
4. Is there a significant relationship between the Metacognitive strategies and students' self -regulated learning in Science?

5. Is there a significant effect on metacognitive strategies and student performance in Science?

II. METHODOLOGY

This study employed a quantitative research design using a descriptive-correlational approach. The respondents consisted of 118 Grade 11 students, including 45 from the HUMSS strand, 45 from HE A, and 33 from the ABM strand, selected through purposive sampling. Data were collected using a validated questionnaire using a five-point Likert scale. Descriptive statistics such as weighted mean and standard deviation were used, while Pearson Product–Moment Correlation and t-test were applied to determine relationships and effects among variables.

III. RESULTS AND DISCUSSION

This part deals with the presentation, analysis, and interpretation of data gathered to answer the sub-problem relative to the main problem of this study. This part discusses the findings of the study based on the questions.

Level of Using Metacognitive Strategies in Teaching Science

In this study, the level of Using Metacognitive Strategies in Teaching Science refers to Planning Strategies; Monitoring Strategies; and Evaluation Strategies.

The level of Using Metacognitive Strategies in Teaching Science is revealed in the following table, which shows the statement, Mean, Standard Deviation, remarks, and verbal interpretation.

Table 1 presents the level of using metacognitive strategies in teaching Science in terms of planning strategies. Respondents agree that teachers set clear goals before starting a learning task, outline time effectively to complete academic activities, prepare necessary materials and resources prior to the lesson, create study plans to guide task completion, and prioritize tasks based on importance and deadlines.

Table 1. Level of Using Metacognitive Strategies in Teaching Science in terms of Planning Strategies

Statements	Mean	SD	Remarks
My teacher models effective planning strategies by...			
...setting clear goals before starting a learning task.	4.71	0.47	Agree
...organizing time effectively to complete academic activities.	4.91	0.29	Agree
...preparing the necessary materials and resources before beginning the lesson.	4.85	0.36	Strongly Agree
...Making a study plan to guide how tasks will be accomplished.	4.81	0.40	Agree
...Prioritizing tasks based on importance and deadlines.	4.76	0.43	Agree
Weighted Mean	4.81		
SD	0.72		
Verbal Interpretation	Effective		

The level of using metacognitive strategies in terms of planning strategies attained a weighted mean of 4.81 with a standard deviation of 0.72, verbally interpreted as Effective.

This indicates that teachers consistently apply planning strategies as part of their metacognitive practices in teaching

Science. This further implies that teachers are well-organized and intentional in structuring their lessons, which supports efficient classroom management and enhances the delivery of instruction.

In summary, the findings suggest that planning strategies as a component of metacognitive practices are evidently manifested among teachers. Through clear goal setting, effective time management, systematic preparation, and task prioritization, teachers are able to facilitate a more organized, purposeful, and effective teaching and learning process in Science.

Table 2 shows the level of Using Metacognitive Strategies in Teaching Science in terms of Monitoring Strategies.

Table 2. Level of Using Metacognitive Strategies in Teaching Science in terms of Monitoring Strategies

statements	Mean	SD	Remarks
My teacher facilitate regular monitoring by...			
...checks students' understanding as they study or read.	4.73	0.47	Strongly Agree
...asks questions to ensure I understand the lesson.	4.91	0.29	Strongly Agree
...my teacher track my progress while completing assignments.	4.82	0.45	Strongly Agree
...recognize when I am confused and need clarification	4.79	0.41	Strongly Agree
...review what I have learned during study sessions.	4.76	0.43	Agree
Weighted Mean	4.80		
SD	0.42		
Verbal Interpretation			Highly Effective

Table 2 presents the level of using metacognitive strategies in teaching Science in terms of monitoring strategies. Respondents strongly agree that teachers assess students' understanding during reading or study, ask questions to ensure comprehension of the lesson, track students' progress while completing tasks, recognize confusion and the need for clarification, and pause to review learned concepts during study sessions.

The level of using metacognitive strategies in terms of monitoring strategies attained a weighted mean of 4.80 with a standard deviation of 0.42, verbally interpreted as Highly Effective. This indicates that teachers consistently and actively implement monitoring strategies in their teaching practices. This further implies that teachers are attentive to students' learning processes, allowing them to provide timely feedback and support to improve understanding.

In summary, the findings suggest that monitoring strategies as a component of metacognitive practices are highly evident in Science teaching. Through continuous assessment, questioning, progress tracking, and responsive intervention.

Table 3 shows the level of Using Metacognitive Strategies in Teaching Science in terms of Evaluation Strategies.

Table 3 presents the level of using metacognitive strategies in teaching Science in terms of evaluation strategies. Respondents strongly agree that teachers reflect on students' performance after completing tasks, while they also agree that teachers justify the effectiveness of strategies used, assess whether learning goals are achieved, compare actual and

expected performance, and identify areas for improvement in future tasks.

Table 3. Level of Using Metacognitive Strategies in Teaching Science in terms of Evaluation Strategies

Statements	Mean	SD	Remarks
My teacher provides varied assessments by...			
...reflecting my performance after I finish a task.	4.76	0.45	Strongly Agree
...evaluating whether the strategies I used were effective.	4.92	0.27	Agree
...assessing whether my goals were achieved after studying.	4.83	0.46	Agree
...comparing my actual performance with my expected performance.	4.84	0.37	Agree
...identifying what I need to improve for future tasks.	4.81	0.39	Agree
Weighted Mean	4.83		
SD	0.39		
Verbal Interpretation			Highly Effective

The level of using metacognitive strategies in terms of evaluation strategies attained a weighted mean of 4.83 with a standard deviation of 0.39, verbally interpreted as Highly Effective. This indicates that teachers consistently implement evaluation strategies as part of their metacognitive practices in teaching Science. This further implies that teachers promote reflective thinking and self-assessment among students, which are essential in improving learning outcomes.

In summary, the findings suggest that evaluation strategies are highly evident in Science instruction. Through reflection, assessment of strategies, performance comparison, and identification of areas for improvement, teachers are able to guide students toward deeper understanding, continuous improvement, and more effective learning experiences.

Level of Students' Self-Regulated Learning in Science

In this study, the level of Students' Self-Regulated Learning in Science refers to Cognitive Regulation, Motivational Regulation, Behavioral Regulation, and Emotional Regulation.

The level of Students' Self-Regulated Learning in Science is revealed in the following table, which shows the statement, Mean, Standard Deviation, remarks, and verbal interpretation.

The table 4 shows the level of Students' Self-Regulated Learning in Science in terms of Cognitive Regulation.

Table 4. Level of Students' Self-Regulated Learning in Science in terms of Cognitive Regulation

Statements	Mean	SD	Remarks
As a learner in Science, I...			
...use different strategies to improve my understanding of lessons.	4.73	0.47	Often
...connect new information to what I already know.	4.93	0.25	Often
...practice applying knowledge to solve problems.	4.83	0.38	Often
...review my notes to strengthen my memory.	4.81	0.42	Often
...check if I truly understand the topic before moving on.	4.78	0.42	Often
Weighted Mean	4.82		
SD	0.40		
Verbal Interpretation			High

Table 4 presents the level of students' self-regulated learning in Science in terms of cognitive regulation. Respondents often apply different strategies to improve their understanding of lessons, connect new information to prior knowledge, practice applying what they have learned to solve problems, review their notes to strengthen memory, and check their understanding before moving to the next topic.

The level of students' self-regulated learning in terms of cognitive regulation attained a weighted mean of 4.82 with a standard deviation of 0.40, verbally interpreted as High. This indicates that students frequently use cognitive strategies to support their learning in Science. This further implies that learners are actively engaging in thinking processes that enhance comprehension, retention, and application of knowledge.

In summary, the findings suggest that cognitive regulation is evident among students. Through consistent use of learning strategies, connection of ideas, and self-checking of understanding, students are able to improve their academic performance and deepen their understanding of scientific concepts.

Table 5 presents the level of students' self-regulated learning in Science in terms of motivational regulation. Respondents strongly agree that they motivate themselves to study even when lessons are difficult, and agree that they remind themselves of their goals, reward themselves after completing tasks, remain determined to finish challenging work, and maintain a positive attitude toward learning.

The level of students' self-regulated learning in terms of motivational regulation attained a weighted mean of 4.82 with a standard deviation of 0.39, verbally interpreted as High.

Table 5. Level of Students' Self-Regulated Learning in Science in terms of Motivational Regulation

Statements	Mean	SD	Remarks
As a learner in Science, I...			
...motivate myself to study even when the subject is difficult.	4.75	0.46	Strongly Agree
...remind myself of my goals when I feel tired or unmotivated.	4.93	0.25	Agree
...reward myself after completing important tasks.	4.81	0.42	Agree
...stay determined to finish my work even if it is challenging.	4.82	0.38	Agree
...keep a positive attitude toward learning despite difficulties.	4.79	0.41	Agree
Weighted Mean	4.82		
SD	0.39		
Verbal Interpretation	High		

This indicates that students are highly motivated and capable of sustaining their interest and effort in learning Science. This further implies that learners possess strong internal drive and perseverance, which help them overcome academic challenges.

In summary, the findings suggest that motivational regulation is strongly manifested among students. Through self-encouragement, goal-setting, and maintaining a positive mindset, students are able to stay focused and committed to their learning tasks.

The table 6 shows the level of Students' Self-Regulated Learning in Science in terms of Behavioral Regulation.

Table 6. Level of Students' Self-Regulated Learning in Science in terms of Behavioral Regulation

Statements	Mean	SD	Remarks
As a learner, I...			
...avoid distractions while studying.	4.76	0.43	Strongly Agree
...manage my time so I can focus on my schoolwork.	4.92	0.30	Agree
...complete tasks on time as part of my responsibility.	4.82	0.45	Strongly Agree
...maintain discipline in following my study schedule.	4.86	0.34	Strongly Agree
...control my actions to stay focused on my goals.	4.85	0.36	Strongly Agree
Weighted Mean	4.84		
SD	0.38		
Verbal Interpretation	High		

Table 6 presents the level of students' self-regulated learning in Science in terms of behavioral regulation. Respondents strongly agree that they avoid distractions, complete tasks on time, maintain discipline in following their study schedule, and control their actions to stay focused, while they also agree that they manage their time effectively.

The level of students' self-regulated learning in terms of behavioral regulation attained a weighted mean of 4.84 with a standard deviation of 0.38, verbally interpreted as High. This indicates that students consistently demonstrate responsible and disciplined behaviors in managing their academic tasks. This further implies that learners are capable of organizing their actions and time to achieve their academic goals.

In summary, the findings suggest that behavioral regulation is highly evident among students. Through discipline, time management, and task completion, students are able to maintain focus and productivity in their learning process.

The table 7 shows the level of Students' Self-Regulated Learning in Science in terms of Emotional Regulation.

Table 7. Level of Students' Self-Regulated Learning in Science in terms of Emotional Regulation

Statements	Mean	SD	Remarks
As a learner, I...			
...Control my frustration when lessons are difficult.	4.71	0.45	Strongly Agree
...Stay calm during exams or challenging tasks.	4.81	0.41	Strongly Agree
...Manage my stress so it does not affect my performance.	4.77	0.44	Strongly Agree
...Maintain a positive mood while learning.	4.81	0.41	Agree
...Encourage myself to stay composed when I feel anxious.	4.75	0.43	Strongly Agree
Weighted Mean	4.77		
SD	0.43		
Verbal Interpretation	Very High		

Table 7 presents the level of students' self-regulated learning in Science in terms of emotional regulation. Respondents strongly agree that they control frustration, stay calm during exams, manage stress, and encourage themselves

when anxious, while they agree that they maintain a positive mood while learning.

The level of students' self-regulated learning in terms of emotional regulation attained a weighted mean of 4.77 with a standard deviation of 0.43, verbally interpreted as Very High. This indicates that students are highly capable of managing their emotions in learning situations. This further implies that learners can regulate their feelings to prevent negative emotions from affecting their academic performance.

In summary, the findings suggest that emotional regulation is strongly developed among students. Through maintaining composure, managing stress, and sustaining a positive outlook, students are able to enhance their learning experience and perform effectively in Science.

Level of Students' Performance in Science

In this study, the level of Students' Performance in Science refers to Summative Assessment and Formative Assessment.

The level of Students' Performance in Science is revealed in the following table, which shows the raw score, Frequency, Percentage, Mean, Standard Deviation, and verbal interpretation.

The table 8 shows the level of Students' Students' Performance in Science in terms of Formative Assessment.

Table 8. Level of Students' Performance in Science in terms of Formative Assessment

Raw Score	Students' Performance in Science in terms of Formative Assessment		Descriptive Equivalent
	F	%	
81-100	107	90.68	Outstanding
61-80	11	9.32	Very Satisfactory
41-60	0	0	Satisfactory
21-40	0	0	Fairly Satisfactory
1-20	0	0	Did Not Meet Expectation
Total	118	100	
Weighted Mean	90.04		
SD	6.47		
Verbal Interpretation	Outstanding		

Table 8 presents the level of students' performance in Science in terms of formative assessment. The data show that the majority of students fall under the Outstanding category with a frequency of 107 or 90.68%, while 11 students or 9.32% are classified as Very Satisfactory. No students fall under the lower performance categories such as Satisfactory, Fairly Satisfactory, or Did Not Meet Expectation.

The level of students' performance in terms of formative assessment attained a weighted mean of 90.04 with a standard deviation of 6.47, verbally interpreted as Fairly Satisfactory. This indicates that students generally perform well in formative assessments, demonstrating a high level of understanding of the lessons in Science. This further implies that most learners are able to meet and even exceed expected learning competencies during ongoing assessments.

In summary, the findings suggest that students' performance in formative assessment is generally high, with most achieving outstanding results. This reflects that students

are actively engaged in learning and are able to demonstrate their knowledge and skills effectively through continuous assessment practices.

The table 9 shows the level of Students' Students' Performance in Science in terms of Summative Assessment.

Table 9. Level of Students' Performance in Science in terms of Summative Assessment

Raw Score	Students' Performance in Science in terms of Summative Assessment		Descriptive Equivalent
	F	%	
49-60	0	0	Outstanding
37-48	23	19.49	Very Satisfactory
25-36	64	54.24	Satisfactory
13-24	31	26.27	Fairly Satisfactory
1-12	0	0	Did Not Meet Expectation
Total	118	100.00	
Weighted Mean	30.30		
SD	6.81		
Verbal Interpretation	Satisfactory		

Table 9 presents the level of students' performance in Science in terms of summative assessment. The data show that most students fall under the Satisfactory category with a frequency of 64 or 54.24%, followed by 31 students or 26.27% classified as Fairly Satisfactory, and 23 students or 19.49% under Very Satisfactory. No students are categorized as Outstanding or Did Not Meet Expectation.

The level of students' performance in terms of summative assessment attained a weighted mean of 30.30 with a standard deviation of 6.81, verbally interpreted as Outstanding. This indicates that students demonstrate a commendable level of achievement in formative assessments. This further implies that learners are able to show their understanding of the lesson through periodic evaluation and continuous monitoring.

In summary, the findings suggest that students' performance in summative assessment reflects a generally acceptable level of achievement. Although most students are within the satisfactory range, the results indicate that learners are able to meet the expected competencies and progressively improve their performance in Science through continuous assessment.

Significant Relationship between Using Metacognitive Strategies in Teaching Science and Students' Self-Regulated Learning in Science

In this study, the level of Using Metacognitive Strategies in Teaching Science refers to Planning Strategies; Monitoring Strategies; and Evaluation Strategies while the Students' Self-Regulated Learning in Science refers to Cognitive Regulation, Motivational Regulation, Behavioral Regulation, and Emotional Regulation.

The Significant Relationship between Using Metacognitive Strategies in Teaching Science and the Students' Self-Regulated Learning in Science is revealed in the following table, which shows the Multiple Regression Analysis using Pearson Product Moment Correlation Coefficient or Pearson-r to determine the strength and direction of relationships, along

with the p-value to test the significance of these relationships at a 0.05 level of significance, and number of observation or respondents (N) is 30.

Table 10 presents the test of the significant relationship between the use of metacognitive strategies in teaching Science and students' self-regulated learning in Science in terms of cognitive, motivational, behavioral, and emotional regulation. Using Pearson Product-Moment Correlation with 118 respondents, the analysis determined whether metacognitive strategies are significantly associated with students' self-regulated learning for better understanding.

The results reveal that Planning Strategies are significantly related to Cognitive Regulation and Emotional Regulation, while no significant relationship is found with Motivational and Behavioral Regulation. Monitoring Strategies show significant relationships with Cognitive and Motivational Regulation, while no significant relationships are observed with Behavioral and Emotional Regulation. Meanwhile,

Table 10. Significant Relationship between Using Metacognitive Strategies in Teaching Science and the Students' Self-Regulated Learning in Science

Using Metacognitive Strategies in Teaching Science	Students' Self-Regulated Learning in Science	Cognitive Regulation	Motivational Regulation	Behavioral Regulation	Emotional Regulation
Planning Strategies	Pearson Correlation	0.673*	0.164	0.040	0.309*
	Sig. (1-tailed)	0.000	0.076	0.670	0.001
	N	118	118	118	118
Monitoring Strategies	Pearson Correlation	0.198*	0.782*	0.015	0.039
	Sig. (2-tailed)	0.032	0.000	0.868	0.674
	N	118	118	118	118
Evaluation Strategies	Pearson Correlation	0.024	0.039	0.644*	0.011
	Sig. (2-tailed)	0.799	0.673	0.000	0.906
	N	118	118	118	118

Evaluation Strategies show a significant relationship only with Behavioral Regulation, while no significant relationships are found with Cognitive, Motivational, and Emotional Regulation. The correlations range from moderate to very strong, with $p < 0.001$ indicating consistent and substantial associations.

These findings imply that the use of metacognitive strategies in teaching Science is associated with selected domains of students' self-regulated learning. This suggests that when teachers apply appropriate planning, monitoring, and evaluation strategies, students are able to enhance their learning regulation in terms of understanding lessons, sustaining motivation, managing behavior, and controlling emotions depending on the strategy used.

In summary, the findings demonstrate that metacognitive strategies are significantly related to students' self-regulated learning in Science in specific domains. The results signify that these instructional strategies contribute to strengthening students' ability to regulate their own learning process and improve their overall learning experience in Science.

Significant Effect between Using Metacognitive Strategies in Teaching Science on the Students' Performance in Science

In this study, the level of Using Metacognitive Strategies in Teaching Science refers to Planning Strategies; Monitoring Strategies; and Evaluation Strategies while the Students' Performance in Science refers to Summative Assessment and Formative Assessment.

The Significant Effect between Using Metacognitive Strategies in Teaching Science on the Students' Performance in Science is revealed in the following table, which shows the Multiple Regression Analysis using t-Test, with the computed t-value (t-cal), p-value, number of observations or respondents, and critical t-value (t-crit) or constant.

Table 11 presents the test of significant effect between the use of metacognitive strategies in teaching Science and students' performance in Science in terms of summative and formative assessment. Using regression analysis with 118 respondents, the analysis determined whether planning, monitoring, and evaluation strategies significantly influence students' academic performance.

Table 11. Significant Effect between Using Metacognitive Strategies in Teaching Science on the Students' Performance in Science

Using Metacognitive Strategies in Teaching Science	Students' Performance in Science	Summative Assessment	Formative Assessment
Planning Strategies	t-value	1.45	0.46
	Sig. (2-tailed)	0.15	0.64
	N	118	118
Monitoring Strategies	t-value	-0.86	1.56
	Sig. (2-tailed)	0.39	0.12
	N	118	118
Evaluation Strategies	t-value	-0.38	-0.66
	Sig. (2-tailed)	0.71	0.51
	N	118	118

The results reveal that Planning Strategies have no significant effect on both summative and formative assessment. Similarly, Monitoring Strategies show no significant effect on students' performance in both assessment types. Evaluation Strategies also show no significant effect on summative and formative assessment.

Overall, the findings indicate that the use of metacognitive strategies in teaching Science does not significantly affect students' performance in terms of both summative and formative assessments. This implies that students' academic performance may be influenced by other factors beyond the metacognitive strategies applied by teachers.

In summary, the results demonstrate that metacognitive strategies, as applied in teaching Science, do not have a statistically significant effect on students' performance. This suggests that while these strategies may support the learning process, their direct influence on assessment outcomes is not evident in this study.

IV. CONCLUSION AND RECOMMENDATIONS

The results indicated a significant relationship between the use of metacognitive strategies in teaching Science and students' self-regulated learning, particularly in terms of

cognitive regulation, motivational regulation, behavioral regulation, and emotional regulation. Therefore, the hypothesis is rejected. This implies that the use of metacognitive strategies in teaching Science is associated with the development of students' self-regulated learning, allowing learners to improve their ability to plan, monitor, evaluate, manage behavior, and regulate emotions in the learning process.

The results further indicated that there is no significant effect between the use of metacognitive strategies in teaching Science and students' performance in both formative and summative assessments. Therefore, the hypothesis is accepted. This implies that metacognitive strategies, although beneficial in supporting learning processes, do not directly influence students' academic performance in Science.

Based on the drawn conclusions resulted to the following recommendations:

School Heads may support the integration of metacognitive strategies through the implementation of relevant programs, seminars, and classroom supervision. This will help ensure that teachers consistently apply effective instructional practices that promote students' self-regulated learning.

Teachers are encouraged to continue strengthening the use of metacognitive strategies in teaching Science, particularly in planning, monitoring, and evaluation strategies, since these are significantly associated with students' self-regulated learning. They may design more learning activities that promote reflection, self-monitoring, and evaluation of learning to

further enhance students' cognitive, motivational, behavioral, and emotional regulation.

Students are encouraged to actively develop their self-regulated learning skills by practicing goal-setting, monitoring their understanding, managing their behavior, and regulating their emotions during learning activities. This will help them become more independent and responsible learners in Science.

Future Researchers may conduct similar studies in other subject areas, grade levels, or educational settings to further explore the relationship between metacognitive strategies, self-regulated learning, and academic performance, especially since no significant effect was found on students' performance in this study.

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