

Model-Based Reasoning as Teaching Strategy in Fostering Learners' Logical and Practical Understanding in Science

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Abstract—The general objective of this study is to examine the effectiveness of Model-Based Reasoning as Teaching Strategy in Fostering Learners' Logical and Practical Understanding in Science within classroom and real-world settings. This study aimed to determine the level of Model-Based Reasoning Strategy in terms of symbolic, inquiry-based, simulation and collaboration. Furthermore, it intends to measure the level of learners' logical and practical understanding in science. In addition, the study sought to establish whether there is a significant relationship between the model-based reasoning strategies and students' logical as well as practical understanding in science. In this research, Descriptive-Correlational is applied as the design. It is used because it aims to determine the relationship between the use of Model-Based Reasoning (MBR) as teaching strategy and the development of learners' logical and practical understanding. This research was conducted at selected secondary public schools in Santa Cruz Sub-Office and Santa Maria Sub-Office. The total respondents are two hundred (200) STEM students from the sub-offices mentioned. The researcher employed the purposive sampling technique in selecting the participants. The study followed a systematic procedure to ensure the validity and reliability of the study. Starting from the preparation of the instrument to validation and then administration and distribution until it is ready for data collection and analysis. The statistical treatments used to determine the data are weighted mean, standard deviation and Pearson-r. Based on the findings of the study, it confirms that Model-Based Reasoning strategies significantly enhance both logical and practical understanding in science. The result of the level of model-based reasoning as teaching strategy revealed a corresponding verbal interpretation of "Very High" across all indicators. This result affirms that MBR strategies bridge the gap between abstract theory and real-world application. Therefore, it is concluded that the Model-Based Reasoning Strategy has a significant relationship with learners' logical understanding in science, leading to the rejection of the null hypotheses. This implies that when teachers use this pedagogical strategy inside the classroom, students are able to construct their very own model, create their own ideas and apply the concepts of science not only inside the classroom but also extending their knowledge to solve real-world problems. In relation with the findings from the study and the conclusions stated hereunto, the researcher come with the preposition that future researchers may conduct this study across different grade levels, learning areas, or school settings to determine the applicability and consistency of Model-Based Reasoning in various educational contexts and examine Model-Based Reasoning using experimental or quasi-experimental designs to establish stronger evidence of its effect on learners' logical and practical skills.

Keywords— Model-Based Reasoning Strategy, Logical Understanding, Practical Understanding, Symbolic, Inquiry-based, Simulation, Collaboration, Application, Creativity, Demonstration, Construction, Inference, Deductive Reasoning, Analytical Thinking, Decision-Making.

I. INTRODUCTION

Science education today is not just about memorizing facts; it's about teaching learners to think clearly and apply what they know in everyday life. Logical understanding means being able to explain ideas in an organized way, connect concepts and support conclusions with evidence. Practical understanding, on the other hand, is about using scientific knowledge to solve real world problems and make decisions. Both are essential if students are truly able to grasp science and use it meaningfully beyond the four walls of the classroom.

Yet, global assessments show that many students struggle to bridge the gap between theory and practice. They often know the concepts but fail to apply them to real-world issues. One promising approach to address this challenge is Model-Based Reasoning. By using symbolic representations, simulations and models, students can explain, predict and explore scientific phenomena while connecting them to real-life situations. (Organization for Economic Cooperation and Development, 2019).

Studies reveal that students engaged in modeling activities become better at explaining scientific problems, identifying relationships among variables, and applying their knowledge in new contexts (Louca and Zacharia, 2017). Other studies similarly highlight that model-based strategy promotes meaningful learning because it encourages students to actively build and revise their understanding rather than simply absorbing information (Gilbert and Justi, 2016). This aligns well with the goals of the K-12 curriculum, which emphasizes critical thinking, inquiry, and application.

By focusing on how students build and apply knowledge through models, the study aims to contribute to improved science teaching practices and support the development of learners who are not only knowledgeable but also capable of reasoning effectively and acting competently in real-world contexts.

1.1 Statement of the Problem

Problem/s which were addressed by the research

This study sought to determine the relationship between the Model-Based Reasoning Strategy and Learners' Logical and Practical Understanding in Science.

1. What is the level of Model-Based Reasoning Strategy in terms of:
 - 1.1 Symbolic;
 - 1.2 Inquiry-based;
 - 1.3 Simulation; and
 - 1.4 Collaboration;
2. What is the level of Learners' Logical Understanding in Science in terms of:
 - 2.1 Inference;
 - 2.2 Deductive Reasoning;
 - 2.3 Analytical Thinking; and
 - 2.4 Decision Making
3. What is the level of Learners' Practical Understanding in Science in terms of:
 - 3.1 Application;
 - 3.2 Construction;
 - 3.3 Creativity; and
 - 3.4 Demonstration
4. Is there a significant relationship between the Model-Based Reasoning Strategy and Learners' Logical Understanding in Science?
5. Is there a significant relationship between the Model-Based Reasoning Strategy and Learners' Practical Understanding in Science?

II. METHODOLOGY

In this research, Descriptive-Correlational is applied as the design. It is used because it aims to determine the relationship between the use of Model-Based Reasoning (MBR) as teaching strategy and the development of learners' logical and practical understanding. This research was conducted at selected secondary public schools in Santa Cruz Sub-Office and Santa Maria Sub-Office. The total respondents are two hundred (200) STEM students from the sub-offices mentioned. The researcher employed the purposive sampling technique in selecting the participants. The study followed a systematic procedure to ensure the validity and reliability of the study. Starting from the preparation of the instrument to validation and then administration and distribution until it is ready for data collection and analysis. The statistical treatments used to determine the data are weighted mean, standard deviation and Pearson-r.

III. RESULTS AND DISCUSSION

This part deals with the presentation, analysis, and interpretation of data gathered. It highlights how model-based reasoning as teaching strategy in fostering learners' logical and practical understanding were perceived by students in the classroom. The findings are organized into tables and narratives that explain the effectiveness of these strategies in addressing the research questions and sub-problems.

The following data were interpreted using tables and figures to give light and better understanding of the results of the study. The data gathered were answered by selected two

hundred (200) STEM students in Secondary Public Schools in Santa Cruz and Santa Maria Sub-office.

Level of Model-Based Reasoning as Teaching Strategy

In this study, the presentation of the major findings follows the order of the questions enumerated in the statement of the problem namely: the level of Model-Based Reasoning as Teaching Strategy in Fostering Learners' Logical Understanding in terms of Symbolic; Inquiry-based; Simulation; and Collaboration.

Table 1 shows the level of model-based reasoning as teaching strategy in fostering learners' logical understanding in terms of their ability to work with symbolic representation. This table reveals the responses gathered from the participants and organizes them in key components, which are the statements, mean, standard deviation, remarks, and verbal interpretation.

Table 1. Level of Model-Based Reasoning Strategy in terms of Symbolic

Statements	Mean	SD	Remarks
My teacher uses symbols, diagrams, and models for us to...			
...represent scientific concepts	4.49	0.66	Strongly Agree
...simplify abstract of complex ideas.	4.46	0.69	Strongly Agree
...show relationship among ideas or concepts.	4.59	0.63	Strongly Agree
...explain unseen or unobservable ideas.	4.49	0.72	Strongly Agree
...support explanations and conclusions	4.65	0.62	Strongly Agree
Weighted Mean	4.53		
SD	0.67		
Verbal Interpretation	Very High		

Table 1 shows that the use of symbolic reasoning strategies in teaching is perceived by students as "Strongly Agree". All items under this category received mean scores ranging from 4.46 to 4.65, with corresponding verbal interpretations of "Very High". This indicates that learners consistently recognize the value of symbols, diagrams, and models in enhancing their understanding of scientific concepts.

The highest-rated statement, "Support explanations and conclusions" (M = 4.65, SD = 0.62), suggests that symbolic tools are most impactful when used to justify and strengthen scientific reasoning. Similarly, the strong agreement on items such as "Show relationship among ideas or concepts" (M = 4.59) and "Explain unseen or unobservable ideas" (M = 4.49) highlights the role of symbolic representation in bridging abstract theories with concrete comprehension. The overall weighted mean of 4.53 with a verbal interpretation of "Very High" confirms that symbolic strategies are not only well-received but also essential in simplifying complex ideas and fostering deeper inquiry. In summary, these findings imply that teachers who integrate symbolic reasoning into their instruction significantly enhance students' ability to conceptualize, analyze, and apply scientific knowledge.

Table 2 shows the level of Model-Based Reasoning as Teaching Strategy in terms of Inquiry-Based.

Table 2 shows that inquiry-based strategies are perceived by students as "Very High", with a weighted mean of 4.52 and

consistent “Strongly Agree” ratings across all items. The highest-rated statement, “Use real-life situations to introduce inquiry questions” (M = 4.68, SD = 0.56), suggests that contextualizing lessons in everyday experiences strongly engages learners and stimulates curiosity. Similarly, high scores for “Ask questions about the lesson being studied” (M = 4.54) and “Think deeply and critically” (M = 4.53) highlight the role of inquiry in promoting active participation and critical thinking.

Table 2. Level of Model-Based Reasoning Strategy in terms of Inquiry-Based

Statements	Mean	SD	Remarks
My teacher utilizes inquiry-based for us to...			
...explore my own questions related to the topic.	4.39	0.66	Strongly Agree
...ask questions about the lesson being studied.	4.54	0.62	Strongly Agree
...think deeply and critically	4.53	0.66	Strongly Agree
...use real-life situations to introduce inquiry questions.	4.68	0.56	Strongly Agree
...make predictions of the outcome of an activity or experiment.	4.48	0.69	Strongly Agree
Weighted Mean	4.52		
SD	0.65		
Verbal Interpretation	Very High		

Overall, the findings affirm that teachers’ use of inquiry-based approaches effectively encourages students to explore their own questions, make predictions, and connect scientific concepts to real-world contexts. This supports the view that inquiry-based learning fosters deeper understanding and empowers learners to take ownership of their scientific reasoning process.

Table 3 shows that simulation-based strategies are regarded by students as “Very High”, with a weighted mean of 4.50 and consistent “Strongly Agree” ratings across all items. The highest-rated statements “Understand how scientific models represent real systems, including their strengths and limitations” (M = 4.56, SD = 0.66) and “Participate more actively because simulations feel interactive and immersive” (M = 4.56, SD = 0.74) indicate that simulations not only clarify abstract scientific concepts but also enhance student engagement through interactive learning.

Table 3. Level of Model-Based Reasoning Strategy in terms of Simulation

Statements	Mean	SD	Remarks
My teacher use simulation for us to...			
...explore “what if” scenarios to see how changes affect outcomes.	4.45	0.63	Strongly Agree
...understand how scientific models represent real systems, including their strengths and limitations.	4.56	0.66	Strongly Agree
...apply scientific principles to new or unfamiliar scenarios.	4.50	0.72	Strongly Agree
...grasp complex scientific concepts more clearly because we can visualize processes.	4.45	0.76	Strongly Agree
...participate more actively because simulations feel interactive and immersive.	4.56	0.74	Strongly Agree
Weighted Mean	4.50		
SD	0.70		
Verbal Interpretation	Very High		

In summary, the findings suggest that simulations provide learners with opportunities to explore “what if” scenarios, apply scientific principles to new contexts, and visualize complex processes. This reinforces the idea that simulation-based teaching strategies effectively bridge theory and practice, making science learning more meaningful, engaging, and accessible.

Table 4 shows the level of Model-Based Reasoning as Teaching Strategy in terms of Collaboration.

Table 4. Level of Model-Based Reasoning Strategy in terms of Collaboration

Statements	Mean	SD	Remarks
My teacher encourage collaboration among us to...			
...create shared representations such as diagrams, sketches, or models.	4.52	0.60	Strongly Agree
...refine ideas through peer discussion.	4.60	0.54	Strongly Agree
...present our group’s model to our classmates.	4.67	0.56	Strongly Agree
...express different versions of a model before choosing one.	4.64	0.59	Strongly Agree
...compare my group’s model with another group’s model.	4.50	0.76	Strongly Agree
Weighted Mean	4.50		
SD	0.62		
Verbal Interpretation	Very High		

Table 4 reveals that collaboration within model-based reasoning strategies is perceived as “Very High”, with a weighted mean of 4.50 and consistent “Strongly Agree” ratings across all items. The highest-rated statement, “Present our group’s model to our classmates” (M = 4.67, SD = 0.56) shows that sharing and communicating models in a group setting is particularly valued, as it enhances collective understanding and peer learning. Similarly, high scores for refining ideas through peer discussion (M = 4.60, SD = 0.54) and expressing different versions of a model before choosing one (M = 4.64, SD = 0.59) highlight the importance of dialogue and negotiation in strengthening reasoning skills.

In conclusion, these findings demonstrate that collaboration not only supports the creation of shared representations but also encourages comparison, refinement, and presentation of models. This suggests that collaborative practices are essential for developing scientific reasoning, as they foster active engagement, critical evaluation, and the joint development of knowledge among students.

Level of Learners’ Logical Understanding in Science

In this study, the level of Learners’ Logical Understanding in Science refers to the level of Learners’ Logical Understanding in Science is revealed in the following table, which shows the statement, Mean, Standard Deviation, remarks, and verbal interpretation.

Table 5 shows the level of Learners’ Logical Understanding in Science in terms of Inference.

Table 5 shows that the level of Model-Based Reasoning Strategy was very high in strengthening learners’ logical understanding, particularly in the domain of inference. Across all indicators, learners consistently rated their abilities at the “Always” level, with a weighted mean of 4.55. This suggests

that students not only developed the capacity to draw conclusions but also demonstrated confidence in supporting these conclusions with evidence.

Table 5. Level of Learners' Logical Understanding in Science in terms of Inference

Statements With my teacher's Model-Based Reasoning Strategy I can...	Mean	SD	Remarks
...draw conclusions based on evidence presented in class activities.	4.44	0.64	Always
...use data to support my conclusions.	4.52	0.63	Always
...explain how evidence leads to a particular conclusion.	4.59	0.64	Always
...avoid making conclusions without evidence.	4.54	0.67	Always
...explain why a result happened based on what was observed.	4.65	0.58	Always
Weighted Mean	4.55		
SD	0.63		
Verbal Interpretation	Very High		

The highest mean score ($M = 4.65$, $SD = 0.58$) was recorded for the statement "Explain why a result happened based on what was observed." This indicates that learners were most adept at articulating cause-and-effect reasoning, a critical aspect of scientific inquiry. Similarly, strong ratings were observed for "Explain how evidence leads to a particular conclusion" ($M = 4.59$, $SD = 0.64$) and "Avoid making conclusions without evidence" ($M = 4.54$, $SD = 0.67$), underscoring the strategy's success in cultivating evidence-based reasoning habits.

The overall weighted mean of 4.55 with a low standard deviation ($SD = 0.63$) further confirms the consistency of learners' responses, reflecting a shared perception of the strategy's effectiveness. The verbal interpretation of "Very High" validates that the Model-Based Reasoning Strategy significantly enhanced learners' ability to make logical inferences, a cornerstone of scientific thinking. Moreover, these findings highlight that when learners are guided to model, analyze, and interpret evidence systematically, they develop stronger logical understanding that can be applied across scientific contexts.

Table 6 shows the level of Learners' Logical Understanding in Science in terms of Deductive Reasoning.

The results in Table 6 show that the Model-Based Reasoning Strategy was very effective in strengthening learners' deductive reasoning skills.

With a weighted mean of 4.52 and consistently "Always" remarks, learners demonstrated strong ability to apply scientific laws, assess logical validity, and predict outcomes based on given conditions. The highest mean score ($M = 4.57$, $SD = 0.66$) was recorded for "Predict results in accordance with scientific laws/models," indicating that students were most confident in using established principles to anticipate outcomes.

Similarly, high ratings for "Assess whether a conclusion logically follows from given information" ($M = 4.56$, $SD = 0.60$) and "Use given conditions to logically determine an outcome" ($M = 4.54$, $SD = 0.66$) highlight learners' ability to reason systematically and avoid unsupported assumptions. The low standard deviation values across items suggest

consistency in learners' perceptions. In summary, the verbal interpretation of "Very High" confirms that the strategy successfully nurtured deductive reasoning, enabling learners to think like scientists by applying rules and principles to specific contexts and drawing valid conclusions.

Table 6. Level of Level of Learners' Logical Understanding in Science in terms of Deductive Reasoning

Statements With my teacher's Model-Based Reasoning Strategy I can...	Mean	SD	Remarks
...apply scientific laws or principles to explain particular situations.	4.39	0.67	Always
...assess whether a conclusion logically follows from given information.	4.56	0.60	Always
...determine whether or not a conclusion is valid on the basis of assumptions.	4.54	0.65	Always
...use given conditions to logically determine an outcome.	4.54	0.66	Always
...predict results in accordance with scientific laws/models.	4.57	0.66	Always
Weighted Mean	4.52		
SD	0.65		
Verbal Interpretation	Very High		

Table 7 shows the level of Learners' Logical Understanding in Science in terms of Analytical Thinking.

Table 7 reveals that the Model-Based Reasoning Strategy was very high in fostering learners' analytical thinking skills. With a weighted mean of 4.57 and consistently "Always" remarks, students demonstrated strong engagement in breaking down complex ideas and focusing on essential details when studying scientific phenomena.

The highest mean score ($M = 4.63$, $SD = 0.60$) was recorded for "Recognize the relations among the variables in scientific situations." Similarly, high ratings for "Analyze a problem by identifying its key components" ($M = 4.62$, $SD = 0.57$) and "Organize information in a way that allows me to understand it" ($M = 4.59$, $SD = 0.67$) highlight their ability to structure and interpret information systematically. Overall, the verbal interpretation of "Very High" confirms that the strategy successfully nurtured analytical thinking, enabling learners to recognize relationships, and organize information effectively.

Table 7. Level of Learners' Logical Understanding in Science in terms Analytical Thinking

Statements With my teacher's Model-Based Reasoning Strategy I can...	Mean	SD	Remarks
...break down complex scientific ideas to simpler components.	4.48	0.67	Always
...analyze a problem by identifying its key components.	4.62	0.57	Always
...focus on important details while studying scientific phenomena	4.56	0.66	Always
...organize information in a way that allows me to understand it.	4.59	0.67	Always
...recognize the relations among the variables in scientific situations.	4.63	0.60	Always
Weighted Mean	4.57		
SD	0.64		
Verbal Interpretation	Very High		

Table 8 shows the level of Learners' Logical Understanding in Science in terms of Decision Making.

Table 8. Level of Learners’ Logical Understanding in Science in terms of Decision Making

Statements	Mean	SD	Remarks
With my teacher’s Model-Based Reasoning Strategy I can...			
...arrive at a decision by comparing different possible explanations first.	4.51	0.62	Always
...look for more than one solution when solving scientific problems.	4.52	0.65	Always
...assess the strengths and weaknesses of alternatives.	4.56	0.63	Always
...avoid choosing an answer without thoroughly evaluating evidences.	4.52	0.64	Always
...arrive at a decision that is based on facts and observations, rather than assumptions.	4.63	0.61	Always
Weighted Mean	4.55		
SD	0.63		
Verbal Interpretation			Very High

Table 8 reveals that the Model-Based Reasoning Strategy was very high in enhancing learners’ decision-making skills. With a weighted mean of 4.55 and consistently “Always” remarks, students demonstrated strong engagement in evaluating evidence, comparing explanations, and considering multiple solutions before arriving at conclusions. The highest mean score (M = 4.63, SD = 0.61) was recorded for “Arrive at a decision that is based on facts and observations, rather than assumptions,” showing that learners were most confident in grounding their decisions in evidence.

Similarly, high ratings for “Assess the strengths and weaknesses of alternatives” (M = 4.56, SD = 0.63) and “Look for more than one solution when solving scientific problems” (M = 4.52, SD = 0.65) highlight their ability to weigh options critically and avoid premature judgments. Overall, the verbal interpretation of “Very High” confirms that the strategy successfully nurtured evidence-based decision-making, enabling learners to think critically, evaluate alternatives, and make logical choices in scientific contexts.

Level of Learners’ Practical Understanding

In this study, it presents the level of Learners’ Practical Understanding in terms Application; Construction; Creativity; and Demonstration.

The level of Learners’ Practical Understanding is revealed in the following table, which shows the statement, mean, standard deviation, remarks, and verbal interpretation.

Table 9 shows the level of Learners’ Practical Understanding in terms of Application.

Table 9 shows that the Model-Based Reasoning Strategy was very high in strengthening learners’ practical application skills. With a weighted mean of 4.51 and consistently “Always” remarks, students demonstrated confidence in applying models and replicating experiments. The highest mean score (M = 4.59, SD = 0.60) was recorded for “Transfer what I learned in the classroom to practical tasks.”

Similarly, high ratings for “Interpret experimental results” (M = 4.57, SD = 0.63) and “Apply models to solve problems” (M = 4.48, SD = 0.62) highlight their ability to use scientific reasoning in real-world contexts. The relatively low standard deviation values suggest consistency in learners’ perceptions. Overall, the verbal interpretation of “Very High” confirms that the strategy successfully nurtured practical understanding,

enabling learners to move beyond abstract concepts toward authentic application of knowledge in scientific tasks.

Table 9. Level of Learners’ Practical Understanding in terms of Application

Statements	Mean	SD	Remarks
With my teacher’s Model-Based Reasoning Strategy I can practically...			
...apply models to solve problems.	4.48	0.62	Always
...replicate or perform experiments after observing my teacher’s demonstration.	4.48	0.62	Always
...interpret experimental results.	4.57	0.63	Always
...refine models when necessary.	4.46	0.73	Always
...transfer what I learned in the classroom to practical tasks.	4.59	0.60	Always
Weighted Mean	4.51		
SD	0.64		
Verbal Interpretation			Very High

Table 10 shows the level of Level of Learners’ Practical Understanding in terms of Construction.

Table 10 shows that the Model-Based Reasoning Strategy effectively developed learners’ practical understanding in constructing.

Table 10. Level of Learners’ Practical Understanding in terms of Construction

Statements	Mean	SD	Remarks
With my teacher’s Model-Based Reasoning Strategy I can practically...			
...design and construct a model accurately.	4.50	0.67	Always
...incorporate learned concepts into a model.	4.51	0.68	Always
...check whether my constructed model function properly.	4.62	0.61	Always
...modify my models according to the results of experiments/simulations that are conducted.	4.60	0.61	Always
...confidently use models to explain how a concept works.	4.58	0.64	Always
Weighted Mean	4.56		
SD	0.65		
Verbal Interpretation			Very High

With a weighted mean of 4.56 and consistently “Always” remarks, students showed confidence in designing accurate models. The highest mean score (M = 4.62, SD = 0.61) was recorded for “Check whether my constructed model functions properly,” suggesting that learners were most engaged in validating the accuracy and reliability of their work.

Similarly, high ratings for the statement, “Modify my models according to the results of experiments/simulations” (M = 4.60, SD = 0.61) and “Confidently use models to explain how a concept works” (M = 4.58, SD = 0.64) highlight their ability to refine and communicate scientific ideas through model construction. As a result, the verbal interpretation of “Very High” confirms that the model-based reasoning strategy successfully nurtured the practical understanding of learners, enabling them to construct authentic tools for scientific reasoning and explanation.

Table 11 shows the level of learners’ practical understanding in terms of Creativity.

Table 11 shows that the Model-Based Reasoning Strategy effectively fostered learners’ creativity. With a weighted mean of 4.52 and consistently “Always” remarks, students demonstrated confidence in forming their own ideas,

exploring multiple solutions, and refining models creatively when outcomes did not meet expectations.

Table 11. Level of Learners' Practical Understanding in terms of Creativity

Statements	Mean	SD	Remarks
With my teacher's Model-Based Reasoning Strategy I can practically...			
...form my own ideas when working on activities or models.	4.48	0.67	Always
...think of multiple ways to solve a problem during hands-on tasks.	4.52	0.68	Always
...refine models creatively when the results don't match my expectations.	4.51	0.67	Always
...experiment with new approaches during activities and feel comfortable with it.	4.56	0.62	Always
...design my own procedures based on the concepts I learned.	4.56	0.66	Always
Weighted Mean	4.52		
SD	0.56		
Verbal Interpretation	Very High		

The highest mean scores ($M = 4.56$, $SD = 0.62$) for "Experiment with new approaches during activities" and ($M = 4.56$, $SD = 0.66$) for "Design my own procedures based on the concepts I learned" highlight learners' willingness to innovate and take ownership of their learning.

Overall, the verbal interpretation of "Very High" confirms that the strategy nurtured creative engagement, enabling learners to experiment, adapt, and design procedures independently.

Table 12 shows the level of Level of Learners' Practical Understanding in terms of Demonstration.

Table 12 reveals that teacher demonstrations within the Model-Based Reasoning Strategy were very high. With a weighted mean of 4.57 and consistently "Always" remarks from the respondents. The statement, "Clearly identify the important variables after watching a demonstration" got the highest mean score of ($M = 4.62$, $SD = 0.57$).

Table 12. Level of Learners' Practical Understanding in terms of Demonstration

Statements	Mean	SD	Remarks
With my teacher's Model-Based Reasoning Strategy I can practically...			
...assess how things work through the teacher's demonstrations.	4.55	0.58	Always
...determine the correct steps of a procedure through the teacher's demonstrations.	4.55	0.62	Always
...clearly identify the important variables after watching a demonstration.	4.62	0.57	Always
...perform tasks more accurately after watching the teacher's demonstration.	4.58	0.61	Always
...replicate the steps as modeled during the teacher's demonstration.	4.55	0.62	Always
Weighted Mean	4.57		
SD	0.60		
Verbal Interpretation	Very High		

Likewise, high ratings for "Perform tasks more accurately after watching the teacher's demonstration" ($M = 4.58$, $SD = 0.61$) and "Replicate the steps as modeled" ($M = 4.55$, $SD = 0.62$) highlight learners' ability to transfer observed procedures into accurate practice. Overall, the verbal interpretation is "Very High" confirming that demonstrations

played a crucial role in bridging observation with hands-on application.

Significant Relationship between the Model-Based Reasoning Strategy and the Learners' Logical Understanding in Science

In this study, the Model-Based Reasoning Strategy is measured in terms of Symbolic; Inquiry-based; Simulation; and Collaboration while the Learners' Logical Understanding in Science refers to Inference; Deductive Reasoning; Analytical Thinking; and Decision Making.

The significant relationship between the Model-Based Reasoning Strategy and the learners' logical understanding in science is demonstrated in the following table. This table presents the results of the Multiple Regression Analysis, utilizing the Pearson Product Moment Correlation Coefficient (Pearson-r) to determine both the strength and direction of the relationships between the variables. In addition, the analysis incorporates the p-value, which serves as the statistical test of significance at the 0.05 level of confidence, thereby establishing whether the observed correlations are meaningful and not due to chance. The table also specifies the number of observations or respondents, ensuring transparency in the scope of the data set and providing a clear basis for interpreting the findings.

Table 13 shows the Significant Relationship between the Model-Based Reasoning Strategy and the Learners' Logical Understanding in Science.

Table 13. Significant Relationship between the Model-Based Reasoning Strategy and the Learners' Logical Understanding in Science

Model-Based Reasoning Strategy	Pearson Correlation	Learners' Logical Understanding in Science			
		Inference	Deductive Reasoning	Analytical Thinking	Decision Making
Symbolic		0.615*	0.639*	0.643*	0.689*
	Sig. (2-tailed)	0.000	0.000	0.000	0.000
	N	200	200	200	200
Inquiry-based		0.616*	0.630*	0.645*	0.679*
	Sig. (2-tailed)	0.000	0.000	0.000	0.000
	N	200	200	200	200
Simulation		0.670*	0.648*	0.680*	0.701*
	Sig. (2-tailed)	0.000	0.000	0.000	0.000
	N	200	200	200	200
Collaboration		0.672*	0.610*	0.621*	0.628*
	Sig. (2-tailed)	0.000	0.000	0.000	0.000
	N	200	200	200	200

The table shows the relationship between the use of model-based reasoning strategy in science and the learners' logical understanding in terms of inference, deductive reasoning, analytical thinking, and decision making, which is statistically significant. It is reflected that the r-value range from 0.610 to

0.701, interpreted as “Moderately High” relationships, as attested further by the p-values of 0.000, which are lower than 0.05 and have verbal analysis of “Significant.” This indicates a moderately strong positive relationship, suggesting that the application of model-based reasoning strategies enhances learners’ ability to infer, reason deductively, think analytically, and make sound decisions in science.

Specifically, the simulation strategy yielded the highest correlations, with r-values of 0.670 in Inference, 0.648 in Deductive Reasoning, 0.680 in Analytical Thinking, and 0.701 in Decision Making, interpreted as “Moderately High Relationship”, “Moderately High Relationship”, “Moderately High Relationship”, and “High Relationship” and have verbal analysis of “Significant”. This implies that simulation-based activities provide learners with experiential contexts that strongly foster logical understanding.

The symbolic strategy also showed consistently strong correlations, particularly in decision making with r-value of 0.689, while the inquiry-based strategy demonstrated similar strength with r-value of 0.679 in decision making. Meanwhile, the collaboration strategy revealed its strongest relationship in inference with r-value of 0.672 and interpreted as “Moderately High Relationship” and have a verbal analysis of “Significant”, though comparatively lower in deductive reasoning as attested by the r-value of 0.610, indicating that collaborative approaches are effective in enhancing inferential skills but may require structured facilitation to fully support deductive and decision-making processes. In general, the results consistently show that all dimensions of logical understanding; inference, deductive reasoning, analytical thinking, and decision making, demonstrate significant relationships with multiple model-based reasoning strategies. This suggests that these strategies are particularly effective in strengthening learners’ logical reasoning understanding in science.

Among all predictors, simulation emerges as the strongest factor influencing logical understanding. Meanwhile, the consistently significant results across symbolic, inquiry-based, and collaborative strategies imply that a balanced integration of these approaches can holistically support the development of learners’ reasoning abilities.

Significant Relationship between the Model-Based Reasoning Strategy and the Learners’ Practical Understanding in Science

In this study, the Model-Based Reasoning Strategy refers to Symbolic; Inquiry-based; Simulation; and Collaboration while the Learners’ Practical Understanding in Science refers to Application; Construction; Creativity; and Demonstration.

The Significant Relationship between the Model-Based Reasoning Strategy and the Learners’ Practical Understanding in Science is revealed in the following table, which shows the Multiple Regression Analysis using Pearson Product Moment Coefficient or Pearson-r, p-value, and number of observations or respondents.

Table 14 shows the relationship between the use of model-based reasoning strategy in terms of symbolic and the learners’ practical understanding in science.

Table 14 reveals the relationship between the use of Symbolic Model-Based Reasoning Strategy and the learners’ practical understanding in Science.

Table 14. Significant Relationship between the Model-Based Reasoning Strategy and the Learners’ Practical Understanding in Science

Model-Based Reasoning Strategy		Learners’ Practical Understanding in Science			
		Application	Construction	Creativity	Demonstration
Symbolic	Pearson Correlation	0.611*	0.570*	0.609*	0.620*
	Sig. (2-tailed)	0.000	0.000	0.000	0.000
	N	200	200	200	200
Inquiry-based	Pearson Correlation	0.640*	0.550*	0.616*	0.638*
	Sig. (2-tailed)	0.000	0.000	0.000	0.000
	N	200	200	200	200
Simulation	Pearson Correlation	0.651*	0.570*	0.656*	0.655*
	Sig. (2-tailed)	0.000	0.000	0.000	0.000
	N	200	200	200	200
Collaboration	Pearson Correlation	0.644*	0.556*	0.596*	0.655*
	Sig. (2-tailed)	0.000	0.000	0.000	0.000
	N	200	200	200	200

It is reflected that the r-values of 0.611, 0.570, 0.609, and 0.620 are interpreted as “High Relationship,” “Moderately High Relationship,” “High Relationship,” and “High Relationship” relationships respectively, as attested further by the p-values of 0.000 which are lower than 0.05 and have verbal analysis of “Significant.” This indicates that symbolic reasoning consistently enhances learners’ ability to apply, construct, create, and demonstrate scientific knowledge in meaningful ways.

Moreover, the table shows the relationship between model-based reasoning strategy and the learners’ practical understanding in science. It is reflected that the r-values of 0.640, 0.550, 0.616, and 0.638 are interpreted as “High Relationship,” “Moderately High Relationship,” “High Relationship,” and “High Relationship” respectively, as attested further by the p-values of 0.000 which are lower than 0.05 and have verbal analysis of “Significant.” This suggests that inquiry-based reasoning strongly supports learners’ application, creativity, and demonstration of science concepts, while moderately strengthening their construction of ideas.

The table shows the relationship between using simulation strategy and the learners’ practical understanding in science. It is reflected that the r-values of 0.651, 0.570, 0.656, and 0.655 are interpreted as “High Relationship,” “Moderately High Relationship,” “High Relationship,” and “High Relationship” relationships respectively, as attested further by the p-values of 0.000 which are lower than 0.05 and have verbal analysis of “Significant.” This indicates that simulation is the strongest predictor overall, particularly in creativity and demonstration, showing that experiential and interactive approaches highly improve practical scientific understanding.

The table shows the relationship between using collaboration strategy and the learners' practical understanding in science. It is reflected that the r-values of 0.644, 0.556, 0.596, and 0.655 are interpreted as "High Relationship," "Moderately High Relationship," "Moderately High Relationship," and "High Relationship" relationships respectively, as attested further by the p-values of 0.000 which are lower than 0.05 and have verbal analysis of "Significant." This suggests that collaboration highly supports application and demonstration, while moderately enhancing construction and creativity. In general, the results consistently show that all four domains of learners' practical understanding demonstrate significant relationships with multiple model-based reasoning strategies.

This suggests that symbolic, inquiry-based, simulation, and collaboration strategies are particularly effective in strengthening students' practical grasp of science. Among all predictors, simulation emerges as the strongest factor, indicating the importance of interactive and experiential learning in fostering creativity and demonstration. Meanwhile, symbolic and inquiry-based strategies also show consistently high correlations, highlighting their role in applying and transferring scientific concepts. Collaboration, though slightly lower in creativity, still demonstrates strong significance across all domains, underscoring the value of peer learning and cooperative engagement.

IV. CONCLUSION AND RECOMMENDATIONS

There is a significant relationship between the Model-Based Reasoning Strategy and the Learners' Logical Understanding in Science. Therefore, the null hypothesis is rejected. This means that the implementation of Model-Based Reasoning Strategy in a classroom setting enhances the learners' ability to think deeply and make rational decision. Moreover, it helped students beyond memorization as it develops and enhance conceptual understanding in learning Science.

There is a significant relationship between the Model-Based Reasoning Strategy and the Learners' Practical Understanding in Science. Therefore, the null hypothesis is

rejected. This indicates that model-based reasoning consistently enhances learners' ability to apply, construct, create and demonstrate scientific knowledge in meaningful ways and link them in real-world problems.

This section presents recommendations drawn from the findings and conclusions of the study, which revealed significant relationships between the Model-Based Reasoning Strategy and Learners' Logical and Practical Understanding in Science.

Science teachers may design lesson plans that incorporate structured Model-Based Reasoning activities such as model construction, testing, and revision during science lessons to further strengthen learners' logical reasoning skills as demonstrated by the significant relationship found in the study.

Classroom instruction may include hands-on experiments and simulations aligned with Model-Based Reasoning, allowing learners to apply scientific models to real-world problems, which may enhance their practical skills in science.

Schools or training programs may use it for interdisciplinary projects such as environmental problems, engineering designs, or issues in social sciences where learners have to construct solutions and demonstrate knowledge in contextualized scenarios, thus developing transferable skills such as critical thinking, innovation and hands-on problem-solving.

Future researchers may conduct this study across different grade levels, learning areas and school settings to determine the applicability and consistency of Model-Based Reasoning using experimental or quasi-experimental designs to establish stronger evidence of its effect on learners' logical and practical skills.

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