International Journal of Multidisciplinary Research and Publications
ISSN (Online): 2581-6187

Optimizing Stem Students' Conceptual Knowledge and Problem-Solving Skills in Physics Through Insight Learning Theory-Based Strategy

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***Abstract*—This research entitled "Optimizing STEM Students' Conceptual Knowledge and Problem-Solving Skills in Physics through Insight Learning Theory-Based Strategy", determines the level of Insight Learning Theory-Based Strategy in terms of preparation, incubation, insight, and verification. It also examines the level of STEM students' conceptual knowledge and problem-solving skills in physics. Furthermore, it answers whether there is a significant relationship between the Insight Learning Theory-Based Strategy (ILTBS) and the STEM students' conceptual knowledge in physics, as well as the significant effect of Insight Learning Theory-Based Strategy (ILTBS) on the STEM students' problem-solving skills in physics. The researcher used a Descriptive-Correlational Method. Data were gathered through a validated self-made questionnaire to measure the STEM students' conceptual knowledge, while test scores were used to assess their problem-solving skills. The respondents of this study were composed of fifty-two (52) Grade 12 STEM students enrolled in General Physics 2 at Green Fields Integrated School of Laguna Inc. located at Santa Rosa, Laguna. In selecting the respondents, the researcher used the purposive sampling technique to identify participants who were most suitable for the objectives of the study. The findings reveal that the level of Insight Learning Theory-Based Strategy (ILTBS) is Very High across all measured dimensions. It is also revealed that the level of STEM students' conceptual knowledge while utilizing the Insight Learning Theory-Based Strategy was generally Very High across all dimensions. It is also found that the STEM students generally demonstrated a Very Satisfactory level of Problem-Solving Skills across all elements. A significant positive relationship between the implementation of Insight Learning Theory-Based Strategy and the STEM students' conceptual knowledge across all dimensions was demonstrated. On the contrary, no significant effect is found on STEM students' problem-solving skills in physics. The findings showed that the Insight Learning Theory-Based Strategy (ILTBS) significantly improved STEM students' conceptual understanding of physics but did not significantly enhance their problem-solving skills. This suggests that while ILTBS is effective for building conceptual knowledge, additional instructional strategies may be needed to develop problem-solving abilities. Therefore, teachers, students, institutions, and future researchers are encouraged to further apply, support, and explore the use of ILTBS in different educational contexts.*

***Keywords*— Insight Learning Theory-Based Strategy (ILTBS), Conceptual Knowledge, Problem-Solving Skills, Physics Education, STEM Students.*

I. Introduction

Physics is one of the fundamental subjects in the STEM program where the students are not only expected to understand the theories but can also solve different problems. However, traditional instruction in physics espouses rote learning and computational methods of problem solving, which foster shallow learning. This instructional approach may inhibit the learning of a strong knowledge base necessary to support students' problem solving through the grounded principles of physics concepts and confine the consequential training to apply this learning in more unique and different problem-solving scenarios.

In response to these challenges, this research has proposed insight learning theory as a viable different learning strategy. Insight learning is based on a concept of reorientation of the problem so as to reveal its solution and not on the regular logical-arithmetical approach familiar to students in the course of physics and mathematics learning. In insight learning there is deliberately guided problem-solving which can provide opportunities for students to make connections and, therefore, enhance pattern recognition hence promote deeper understanding.

Espinoza (2020) observed that students have been seen going through instances of being confused, engaging in trial and error experiments, and reflection, all of which are important for concepts development. Consequently, this thesis aimed at establishing how the implementation of Insight Learning Theory-Based Strategy influenced the enhancement of Conceptual Knowledge and Problem-Solving Skills among STEM Students in Physics.

1.1 Statement of the Problem

Problem/s which were addressed by the research

This study aimed to determine the significance of Insight Learning Theory-Based Strategy on STEM Students' Conceptual Knowledge and Problem-Solving Skills in Physics.

Specifically, it sought to answer the following questions.

1. What is the level of Insight Learning Theory-Based Strategy in terms of:
   1.1 Preparation;
   1.2 Incubation;
   1.3 Insight; and
   1.4 Verification?
2. What is the level of STEM students' conceptual knowledge in Physics in terms of:
   2.1 Interpretation;

2.2 Making connections;
2.3 Reasoning; and
2.4 Accuracy of Responses?
3. What is the level of STEM students' Problem-solving Skills in Physics in terms of:
 3.1 Analytical Thinking;
 3.2 Critical Thinking;
 3.3 Logical Thinking; and
 3.4 Procedural Fluency?
4. Do the Insight Learning Theory-Based Strategy significantly correlate to STEM students' Conceptual Understanding in Physics?
5. Do the Insight Learning Theory-Based Strategy significantly affect STEM students' Problem-Solving Skills in Physics?

II. Methodology

The researcher used a Descriptive-Correlational Method. Data were gathered through a validated self-made questionnaire to measure the STEM students' conceptual knowledge, while test scores were used to assess their problem-solving skills. The respondents of this study were composed of fifty-two (52) Grade 12 STEM students enrolled in General Physics 2 at Green Fields Integrated School of Laguna Inc. located at Santa Rosa, Laguna. In selecting the respondents, the researcher used the purposive sampling technique to identify participants who were most suitable for the objectives of the study.

III. Results and Discussion

This chapter deals with the presentation, analysis and interpretation of data gathered that determined the significant relationship between Insight Learning Theory-Based Strategy to the Students' Conceptual Knowledge and Problem-Solving Skills in Physics. 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 analyzed using tables and figures in order to shed some light on the study's findings. The data gathered were answered by the fifty-three (52) STEM students in Green Fields Integrated School of Laguna, Inc. Santa Rosa, Laguna.

Level of Insight Learning Theory-Based Strategy

In this study, the level of Insight Learning Theory-Based Strategy refers to Preparation; Incubation; Insight; and Verification.

The level of Insight Learning Theory-Based Strategy is revealed in the following table, which shows the statement, Weighted Mean, Standard Deviation, remarks, and verbal interpretation.

Table 1 shows the level of Insight Learning Theory-Based Strategy in terms of Preparation. Specifically, it shows how the preparation stage helps the students to activate their prior knowledge, understand the context of the problem, and identify given and unknown information before calculation. It also emphasizes careful reflection of what the problem requires. This stage helps learners build a clear foundation for more effective problem-solving in Physics.

Table 1. Level of Insight Learning Theory-Based Strategy in terms of Preparation

Statements When my teacher implemented Insight Learning Theory-Based Strategy, I can…	Mean	SD	Remarks
…recall relevant prior knowledge about the topic before solving problems.	4.58	0.61	Always
…grasp the situation described in the problem before applying formulas.	4.69	0.54	Always
…identify the given and unknown values before performing calculations.	4.77	0.51	Always
…reflect on the meaning of the problem before proceeding with any calculations.	4.63	0.63	Always
…choose the most appropriate formula based on my understanding of what the problem requires.	4.81	0.44	Always
Weighted Mean	4.70		
SD	0.55		
Verbal Interpretation	Very High		

Table 1 shows the level of Insight Learning Theory-Based Strategy in terms of Preparation attained a weighted mean of 4.70, and a standard deviation of 0.55 with verbal interpretation as Very High among the respondents.

Specifically, students recalling relevant prior knowledge before solving problems was an important aspect of preparation (M=4.58, SD=0.61) and emphasized grasping the situation described in a problem before applying formulas (M=4.69, SD=0.54). Identifying given and unknown values was rated highest (M=4.77, SD=0.51), showing consistent agreement among respondents. Likewise, reflecting on the meaning of the problem before calculations was valued (M=4.63, SD=0.63), while choosing the most appropriate formula based on problem requirements received the strongest consensus (M=4.81, SD=0.44).

The level of Insight Learning Theory-Based Strategy in terms of Preparation was rated Highly Implemented based on the overall ratings of the students (M=4.70). This implies that the use of Insight Learning Theory-Based Strategy in terms of Preparation is a stable pattern of preparedness and cognitive engagement, reinforcing its role in strengthening students' readiness and confidence in tackling Physics problems.

The level of Insight Learning Theory-Based Strategy in terms of Incubation was revealed in Table 2, which shows the average mean, standard deviation, and verbal interpretation.

Table 2 shows the level of Insight Learning Theory-Based Strategy in terms of Incubation attained (M=4.68, SD=0.58) and verbally interpreted as Very High among the respondents.

Students affirmed that pausing to think critically before rushing to solve problems was essential (M=4.69, SD=0.47). They also highly valued reflecting on the problem and considering different approaches before attempting a solution, which received the highest mean (M=4.83, SD=0.38), indicating very consistent responses. Taking mental breaks when feeling stuck was likewise strongly agreed upon (M=4.50, SD=0.70), suggesting slightly more varied perceptions but still a strong consensus. Finally, thinking about the problem at their own pace to allow deeper insight

Jhonelle Sandoval Cerbito, "Optimizing Stem Students' Conceptual Knowledge and Problem-Solving Skills in Physics Through Insight Learning Theory-Based Strategy," *International Journal of Multidisciplinary Research and Publications (IJMRAP)*, Volume 9, Issue 2, pp. 644-652, July 2026.

International Journal of Multidisciplinary Research and Publications
ISSN (Online): 2581-6187

was rated highly, (M=4.75, SD=0.48), showing strong agreement and consistency.

Table 2. Level of Insight Learning Theory-Based Strategy in terms of Incubation

Statements When my teacher implemented Insight Learning Theory-Based Strategy, I can…	Mean	SD	Remarks
…pause and think critically about the problem before rushing to solve it.	4.69	0.47	Always
…reflect on the problem and consider different approaches before attempting a solution.	4.83	0.38	Always
…work on other tasks or activities and return to the problem with a refreshed perspective.	4.62	0.75	Always
…take mental breaks when I feel stuck, allowing my mind to reset and enhance creativity.	4.50	0.70	Always
…think about the problem at my own pace, allowing time for deeper insight without feeling rushed.	4.75	0.48	Always
Weighted Mean	4.68		
SD	0.58		
Verbal Interpretation	Very High		

The Insight Learning Theory-Based Strategy in terms of Incubation was rated Highly Implemented based on the overall ratings of the students (M=4.68). This confirms that incubation strategies were perceived as highly effective, reinforcing the role of Insight Learning Theory-Based Strategy in promoting reflection, creativity, and deeper problem-solving engagement.

Table 3 shows the level of Insight Learning Theory-Based Strategy in terms of Insight. It involves learners experiencing sudden understanding of solutions while connecting and integrating ideas to make sense of problem structures. It also highlights their ability to relate concepts, links past and new problems, and understand relationships between variables.

Table 3. Level of Insight Learning Theory-Based Strategy in terms of Insight

Statements When my teacher implemented Insight Learning Theory-Based Strategy, I can…	Mean	SD	Remarks
…recognize moments when I suddenly grasp the solution to a problem.	4.67	0.55	Always
…link ideas together, making it easier to understand why the problem is structured the way it is.	4.67	0.62	Always
…associate different concepts to deepen my understanding of the problem.	4.62	0.60	Always
…make connections between old and new problems, enhancing my problem-solving skills.	4.65	0.65	Always
…understand the relationship between variables after reflecting on the problem.	4.67	0.62	Always
Weighted Mean	4.66		
SD	0.60		
Verbal Interpretation	Very High		

Table 3 shows the level of Insight Learning Theory-Based Strategy in terms of Insight attained (M=4.66, SD=0.60) and verbally interpreted as Very High among the respondents.

The results indicate that learners consistently recognized the importance of insight strategies in enhancing their problem-solving process. Recognizing sudden moments of grasping a solution was rated highly (M = 4.67, SD = 0.55), showing strong consensus on the value of these “aha” experiences and linking ideas together to better understand problems (M=4.67, SD=0.62). Associating different concepts to deepen understanding was also strongly agreed upon (M = 4.62, SD = 0.60), while making connections between old and new problems to improve problem-solving skills (M=4.65, SD=0.65), indicating consistent but slightly more diverse responses. Finally, understanding the relationship between variables after reflection was highly valued (M=4.67, SD=0.62), reinforcing the role of reflection in comprehension.

Overall, the findings affirmed that insight strategies were perceived as Highly Implemented, underscoring the Insight Learning Theory-Based Strategy’s ability to foster sudden comprehension, meaningful connections, and deeper insights in problem-solving.

Table 4 shows the level of Insight Learning Theory-Based Strategy in terms of Verification. It indicates that verification is an essential part of learning where students review and evaluate their answers to ensure full understanding and alignment with the problem requirements. It also emphasizes the use of feedback, analysis of one’s solution process, and exploration of alternative methods to identify strengths and areas for improvement, ultimately deepening conceptual understanding and enhancing problem-solving skills.

Table 4. Insight Learning Theory-Based Strategy in terms of Verification

Statements When my teacher implemented Insight Learning Theory-Based Strategy, I can…	Mean	SD	Remarks
…review the problem after solving it to ensure I fully understand the solution.	4.67	0.51	Always
…reflect on whether my solution aligns with the conditions and requirements of the problem.	4.75	0.48	Always
…use feedback from the teacher to understand why my solution was correct or incorrect.	4.58	0.72	Always
…explore alternative methods for solving the problem to deepen my understanding.	4.73	0.63	Always
…analyze my approach, identifying what I did correctly and what I could improve after solving the problem.	4.75	0.56	Always
Weighted Mean	4.70		
SD	0.51		
Verbal Interpretation	Very High		

Table 4 shows the level of Insight Learning Theory-Based Strategy in terms of Verification attained (M=4.70, SD=0.51) and verbally interpreted as Very High among the respondents.

The results show that learners consistently valued verification strategies as part of the Insight Learning Theory-Based approach. Reviewing the problem after solving it to ensure full understanding was strongly agreed upon (M=4.67, SD=0.51), while reflecting on whether solutions aligned with the conditions and requirements of the problem received one of the highest ratings (M=4.75, SD=0.48), indicating very strong consensus. Using teacher feedback to understand correctness was also recognized (M=4.58, SD=0.72), though with slightly more varied responses compared to other items. Exploring alternative methods to deepen understanding was highly rated (M=4.73, SD=0.63), and analyzing one’s approach to identify strengths and areas for improvement was equally valued (M=4.75, SD=0.56).

In summary, the findings confirmed that the Insight Learning Theory-Based Strategy in terms of Verification were perceived as Highly Implemented, underscoring their role in fostering reflection, accuracy, and continuous improvement in problem-solving.

Level of STEM Students' Conceptual Knowledge

In this study, the level of STEM Students' Conceptual Knowledge refers to Interpretation, Making connections, Reasoning and Accuracy of Responses.

The level of STEM Students' Conceptual Knowledge is revealed in the following table, which shows the statement, Mean, Standard Deviation, remarks, and verbal interpretation.

Table 5 shows the level of STEM Students' Conceptual Knowledge in terms of Interpretation. This dimension focuses on students' ability to correctly identify the problem before applying any solution. Furthermore, it serves as an important indicator of how effectively learners can translate scientific information into meaningful understanding within various contexts.

Table 5. Level of STEM Students' Conceptual Knowledge in terms of Interpretation

Statements After my teacher implemented Insight Learning Theory-Based Strategy, I can…	Mean	SD	Remarks
…interpret what the problem is asking before attempting to solve it.	4.67	0.55	Always
…grasp the meaning of key terms and concepts discussed in class.	4.69	0.51	Always
…analyze and differentiate between relevant and irrelevant information in the problem.	4.65	0.65	Always
…clarify the conditions mentioned in the problem with clarity and detail.	4.73	0.60	Always
…comprehend how the verbal explanation and mathematical expression are connected.	4.69	0.64	Always
Weighted Mean	4.69		
SD	0.59		
Verbal Interpretation	Very High		

Table 5 shows the level of STEM Students' Conceptual Knowledge in terms of Interpretation attained (M=4.69, SD=0.59) and verbally interpreted as Very High among the respondents.

The results highlight that students consistently demonstrated Very High levels of Conceptual Knowledge in terms of Interpretation. Interpreting what the problem is asking before attempting to solve it was rated highly (M=4.67, SD=0.55), while grasping the meaning of key terms and concepts discussed in class received an even stronger rating (M=4.69, SD=0.51), showing uniform agreement. Analyzing and differentiating between relevant and irrelevant information was also valued (M=4.65, SD=0.65), though with slightly more varied responses. Clarifying the conditions mentioned in the problem was rated highest (M=4.73, SD=0.60), indicating strong recognition of its importance, and comprehending the connection between verbal explanations and mathematical expressions was equally emphasized (M=4.69, SD=0.64).

Overall, the results demonstrate that Interpretation was perceived at a Very High level, underscoring the effectiveness of the Insight Learning Theory-Based Strategy in strengthening students' ability to understand, analyze, and connect concepts in problem-solving.

This resonates with the study of Fitriani, et al. (2025), emphasizing that interpretation is one of the most important indicators used in assessing learner's understanding of physics concepts. Students who can properly interpret scientific ideas are more capable of analyzing situations and applying concepts accurately in problem-solving.

Table 6 shows the level of STEM Students' Conceptual Knowledge in terms of Making connections.

Table 6. Level of STEM Students' Conceptual Knowledge in terms of Making Connections

Statements After my teacher implemented Insight Learning Theory-Based Strategy, I can…	Mean	SD	Remarks
…connect the current lesson to concepts covered in previous classes.	4.60	0.66	Always
…apply my existing knowledge when learning and understanding new concepts.	4.79	0.54	Always
…understand new ideas in the context of what I have already learned.	4.81	0.49	Always
…see how different concepts in the lesson are related to one another.	4.73	0.49	Always
…understand how the lesson applies to real-life or practical situations.	4.79	0.54	Always
Weighted Mean	4.74		
SD	0.55		
Verbal Interpretation	Very High		

Table 6 shows the level of STEM Students' Conceptual Knowledge in terms of Making Connections attained (M=4.74, SD=0.55) and verbally interpreted as Very High among the respondents.

Students demonstrated Very High Levels of Conceptual Knowledge in terms of Making Connections after the implementation of the Insight Learning Theory-Based Strategy. Connecting the current lesson to concepts covered in previous classes was highly rated (M=4.60, SD=0.66), showing strong agreement though with slightly more varied responses. Applying existing knowledge when learning new concepts received one of the highest ratings (M=4.79, SD=0.54), while understanding new ideas in the context of prior learning was rated even higher (M=4.81, SD=0.49), reflecting very consistent agreement. Seeing how different concepts in the lesson are related was also highly valued (M=4.73, SD=0.49), and understanding how lessons apply to real-life situations was equally emphasized (M=4.79, SD=0.54).

Overall, the weighted mean of 4.74 (SD=0.55) confirms that connection strategies were perceived at a very high level, underscoring the effectiveness of the Insight Learning Theory-Based Strategy in terms of Making Connections in enabling students to integrate prior knowledge, relate concepts, and apply learning to practical contexts.

Table 7 shows the level of STEM Students' Conceptual Knowledge in terms of Reasoning. It measures the importance of reasoning in problem-solving, where learners are expected to clearly explain and justify their answers using concepts learned in the lesson.

Table 7. Level of STEM Students' Conceptual Knowledge in terms of Reasoning

Statements After my teacher implemented Insight Learning Theory-Based Strategy, I can…	Mean	SD	Remarks
…clearly explain why a certain solution or answer is correct.	4.58	0.61	Always
…support my responses with ideas and concepts explored during the lesson	4.65	0.59	Always
…understand the reasoning behind each step of the solution.	4.75	0.56	Always
…explain my thought process during problem-solving.	4.71	0.57	Always
…justify my response when asked to explain why I chose it.	4.73	0.60	Always
Weighted Mean	4.68		
SD	0.58		
Verbal Interpretation	Very High		

Table 7 shows the level of STEM Students' Conceptual Knowledge in terms of Reasoning attained (M=4.68, SD=0.58) and verbally interpreted as Very High among the respondents.

Students demonstrated Very High levels of ability to explain and justify their reasoning after the implementation of the Insight Learning Theory-Based Strategy. Clearly explaining why a certain solution or answer is correct was rated (M=4.58, SD=0.61), showing strong agreement though with slightly more varied responses. Supporting responses with ideas and concepts explored during the lesson was valued at (M=4.65, SD=0.59), while understanding the reasoning behind each step of the solution received one of the highest ratings (M=4.75, SD=0.56), reflecting consistent recognition of its importance. Explaining one's thought process during problem-solving was also highly rated (M=4.71, SD=0.57), and justifying responses when asked why a choice was made was equally emphasized (M=4.73, SD=0.60).

Overall, the weighted mean of 4.68 (SD=0.58) confirms that explanation and justification strategies were perceived at a very high level, underscoring the effectiveness of the Insight Learning Theory-Based Strategy in fostering clarity, reasoning, and reflective communication in problem-solving. Table 8 shows the level of STEM Students' Conceptual Knowledge in terms of Accuracy of Responses. It describes students' accuracy in problem-solving, where learners are able to consistently produce correct answers by properly applying learned concepts and formulas. It also highlights their ability to integrate classroom ideas into solutions, follow instructions carefully, and solve problems effectively with minimal errors after fully understanding the task.

Table 8 shows the level of STEM Students' Conceptual Knowledge in terms of Accuracy of Responses attained (M=4.63, SD=0.63) and verbally interpreted as Very High among the respondents.

Table 8. Level of STEM Students' Conceptual Knowledge in terms of Accuracy of Responses

Statements After my teacher implemented Insight Learning Theory-Based Strategy, I can…	Mean	SD	Remarks
…provide correct answers for most problems during the lesson.	4.54	0.67	Always
…correctly apply concepts and formulas when solving questions.	4.71	0.54	Always
…incorporate the ideas we studied in class into my solutions.	4.67	0.58	Always
…accomplish tasks correctly without making errors.	4.48	0.80	Always
…solve problems effectively after fully understanding the instructions.	4.73	0.49	Always
Weighted Mean	4.63		
SD	0.63		
Verbal Interpretation	Very High		

Learners demonstrated Very High levels of Accuracy in their Responses after the implementation of the Insight Learning Theory-Based Strategy. Providing correct answers for most problems during the lesson (M=4.54, SD=0.67), showing strong agreement though with slightly more varied responses. Correctly applying concepts and formulas when solving questions received one of the highest ratings (M=4.71, SD=0.54), while incorporating ideas studied in class into solutions was also highly valued (M=4.67, SD=0.58). Accomplishing tasks correctly without making errors was rated lower but still strong (M=4.48, SD=0.80), reflecting greater variability among learners. Solving problems effectively after fully understanding instructions was rated highest (M=4.73, SD=0.49), indicating consistent recognition of its importance.

Overall, the weighted mean of 4.63 (SD=0.63) confirms that Accuracy of Responses was perceived at a Very High level, underscoring the effectiveness of the Insight Learning Theory-Based Strategy in fostering precision, correct application of knowledge, and reliable problem-solving performance.

Level of STEM Students' Performance in Problem-solving Skills in Physics

In this study, the level of STEM Students' Performance in Problem-Solving Skills in Physics refers to Analytical Thinking; Critical Thinking; Logical Thinking; and Procedural Fluency.

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.

Table 9 shows the level of STEM Students' Performance in Problem-solving Skills in Physics in terms of Analytical Thinking.

Table 9 shows the level of STEM Students' Performance in Problem-Solving Skills in Physics in terms of Analytical Thinking attained (M=8.56, SD=1.84) and verbally interpreted as Very Satisfactory among the respondents.

The results showed that STEM students performed at a Very Satisfactory level in terms of Analytical Thinking

(M=8.56, SD=1.84). A majority of students (32 or 61.54%) achieved scores in the 9–10 range, which is interpreted as Outstanding, indicating that most learners demonstrated strong Analytical Skills in Physics. Meanwhile, 11 students (21.15%) scored in the 7–8 range, categorized as Very Satisfactory, suggesting consistent but slightly lower performance compared to the top group. Seven students (13.46%) fell within the 5–6 range (Satisfactory), showing moderate ability to analyze problems, while only two students (3.85%) scored in the 3–4 range (Fairly Satisfactory), reflecting limited Analytical Skills. Notably, no student scored in the 1–2 range (Needs Improvement), which highlights that all respondents demonstrated at least a satisfactory level of analytical thinking.

Table 9. Level of STEM Students' Performance in Problem-Solving Skills in Physics in terms of Analytical Thinking

Raw Score	f	%	Descriptive Equivalent
9-10	32	61.54	Outstanding
7-8	11	21.15	Very Satisfactory
5-6	7	13.46	Satisfactory
3-4	2	3.85	Fairly Satisfactory
1-2	0	0	Needs Improvement
Total	52	100.00	
Weighted Mean	8.56		
SD	1.84		
Verbal Interpretation	Very Satisfactory		

In summary, the distribution of scores reveals that while most students excelled in identifying relationships, breaking down problems, and applying logical reasoning in physics, a smaller portion still requires support to strengthen their analytical processes. The high weighted mean and absence of "Needs Improvement" scores affirm that the Insight Learning Theory-Based Strategy effectively enhanced students' analytical thinking, enabling them to approach physics problems with clarity, precision, and structured reasoning.

Table 10 shows the level of Level of STEM Students' Performance in Problem-Solving Skills in Physics in terms of Critical Thinking. It further highlights the extent to which critical thinking skills are demonstrated in analyzing and evaluating physics problems, particularly in how students apply logical reasoning to arrive at well-supported solutions in Physics contexts.

Table 10. Level of STEM Students' Performance in Problem-Solving Skills in Physics in terms of Critical Thinking

Raw Score	f	%	Descriptive Equivalent
9-10	21	40.38	Outstanding
7-8	12	23.08	Very Satisfactory
5-6	15	28.85	Satisfactory
3-4	4	7.69	Fairly Satisfactory
1-2	0	0	Needs Improvement
Total	52	100.00	
Weighted Mean	7.60		
SD	2.02		
Verbal Interpretation	Very Satisfactory		

Table 10 shows the level of STEM Students' Performance in Problem-Solving Skills in Physics in terms of Critical Thinking attained (M=7.60, SD=2.02) and verbally interpreted as Very Satisfactory among the respondents.

The results reveal that STEM students performed at a Very Satisfactory level in terms of Critical Thinking in Physics (M=7.60, SD=2.02). A significant portion of students (21 or 40.38%) scored in the 9–10 range, interpreted as Outstanding, showing strong ability to evaluate, reason, and make judgments in solving physics problems. Meanwhile, 12 students (23.08%) achieved scores in the 7–8 range (Very Satisfactory), and 15 students (28.85%) fell in the 5–6 range (Satisfactory), indicating that while many students demonstrated solid critical thinking, a notable group still showed moderate performance. Four students (7.69%) scored in the 3–4 range (Fairly Satisfactory), reflecting limited skills in evaluating solutions and reasoning through problems. Importantly, no student scored in the 1–2 range (Needs Improvement), which suggests that all respondents displayed at least a basic level of critical thinking ability.

Overall, the distribution highlights that while a large proportion of students excelled in analyzing and evaluating problem-solving approaches, variability in scores indicates that some learners need further support to strengthen their reasoning and evaluative skills. The high weighted mean and absence of "Needs Improvement" scores affirm that the Insight Learning Theory-Based Strategy effectively enhanced students' critical thinking, enabling them to approach physics problems with sound judgment, logical evaluation, and reflective reasoning.

Table 11 shows the level of STEM Students' Performance in Problem-Solving Skills in Physics in terms of Logical Thinking. It indicates that students are able to apply reasoning skills in organizing ideas, following systematic steps, and using appropriate concepts and formulas to solve physics problems.

Table 11. Level of STEM Students' Performance in Problem-Solving Skills in Physics in terms of Logical Thinking

Raw Score	f	%	Descriptive Equivalent
9-10	27	51.92	Outstanding
7-8	12	23.08	Very Satisfactory
5-6	10	19.23	Satisfactory
3-4	3	5.77	Fairly Satisfactory
1-2	0	0	Needs Improvement
Total	52	100.00	
Weighted Mean	8.06		
SD	2.00		
Verbal Interpretation	Very Satisfactory		

Table 11 shows the level of STEM Students' Performance in Problem-Solving Skills in Physics in terms of Logical Thinking attained (M=8.06, SD=2.00) and verbally interpreted as Very Satisfactory among the respondents.

The results show that STEM students performed at a Very Satisfactory level in terms of Logical Thinking (M=8.06, SD=2.00). More than half of the respondents (27 or 51.92%) scored in the 9–10 range, interpreted as Outstanding, indicating strong ability to reason systematically and apply logical steps in solving physics problems. Twelve students (23.08%) scored in the 7–8 range (Very Satisfactory), while ten students (19.23%) fell in the 5–6 range (Satisfactory), reflecting moderate but acceptable logical reasoning skills. A smaller group of three students (5.77%) scored in the 3–4 range (Fairly Satisfactory), showing limited ability to structure reasoning effectively. Importantly, no student scored in the 1–2 range (Needs Improvement), which demonstrates that all learners displayed at least a satisfactory level of logical thinking.

Overall, the distribution highlights that most students excelled in applying logical sequences and coherent reasoning in physics problem-solving, though some variability remains among learners. The high weighted mean and absence of low scores affirm that the Insight Learning Theory-Based Strategy effectively strengthened logical thinking, enabling students to approach problems with structured reasoning, consistency, and accuracy.

Table 12 shows the level of STEM Students' Performance in Problem-Solving Skills in Physics in terms of Procedural Fluency.

Table 12. Level of STEM Students' Performance in Problem-Solving Skills in Physics in terms Procedural Fluency

Raw Score	f	%	Descriptive Equivalent
9-10	23	44.23	Outstanding
7-8	7	13.46	Very Satisfactory
5-6	15	28.85	Satisfactory
3-4	6	11.54	Fairly Satisfactory
1-2	1	1.92	Needs Improvement
Total	52	100.00	
Weighted Mean	7.40		
SD	2.44		
Verbal Interpretation	Very Satisfactory		

Table 12 shows the level of STEM Students' Performance in Problem-Solving Skills in Physics in terms of Procedural Fluency attained (M=7.40, SD=2.44) and verbally interpreted as Very Satisfactory among the respondents.

The results indicate that STEM students performed at a Very Satisfactory level in terms of Procedural Fluency (M=7.40, SD=2.44). Nearly half of the respondents (23 or 44.23%) scored in the 9–10 range, interpreted as Outstanding, showing strong mastery of step-by-step procedures in solving physics problems. Seven students (13.46%) scored in the 7–8 range (Very Satisfactory), while 15 students (28.85%) fell in the 5–6 range (Satisfactory), reflecting moderate but acceptable procedural skills. Six students (11.54%) scored in the 3–4 range (Fairly Satisfactory), and only one student (1.92%) was in the 1–2 range (Needs Improvement), indicating minimal difficulty in applying systematic processes.

Overall, the distribution shows that most students excelled in following logical steps, applying formulas correctly, and completing tasks systematically, though a small group still struggles with consistency and accuracy. The high proportion of "Outstanding" scores and the overall very satisfactory interpretation affirm that the Insight Learning Theory-Based Strategy effectively strengthened procedural fluency, enabling learners to approach physics problems with structured, accurate, and repeatable methods.

Significant Relationship between the Insight Learning Theory-Based Strategy and the STEM Students' Conceptual Knowledge in Physics

In this study, the level of Insight Learning Theory-Based Strategy refers to Preparation; Incubation; Insight; and Verification while the STEM Students' Performance in Problem-Solving Skills in Physics refers to Interpretation, Making Connections; Reasoning; and Accuracy of Responses.

The Significant Relationship between the Insight Learning Theory-Based Strategy and the STEM Students' Conceptual Knowledge in Physics is revealed in the following table, which shows the Multiple Regression Analysis using Pearson Product Moment Correlation Coefficient or Pearson-r, p-value, and number of observation or respondents.

Table 13 shows the Significant Relationship between the Insight Learning Theory-Based Strategy and the STEM students' conceptual knowledge in physics. It suggests that the use of insight learning theory-based strategy is associated with improved understanding of physics concepts, indicating that students who experience deeper insight in learning tend to develop stronger conceptual knowledge.

Table 13. Significant Relationship between the Insight Learning Theory-Based Strategy and the STEM Students' Conceptual Knowledge in Physics

Insight Learning Theory-Based Strategy		STEM Students' Conceptual Knowledge in Physics			
		Int.	Making Connections	Reasoning	Accuracy of Responses
Preparation	Pearson Correlation	0.832*	0.848*	0.782*	0.764*
	Sig. (2-tailed)	0.000	0.000	0.000	0.000
	N	52	52	52	52
Incubation	Pearson Correlation	0.740*	0.619*	0.544*	0.643*
	Sig. (2-tailed)	0.000	0.000	0.000	0.000
	N	52	52	52	52
Insight	Pearson Correlation	0.732*	0.637*	0.739*	0.721*
	Sig. (2-tailed)	0.000	0.000	0.000	0.000
	N	52	52	52	52
Verification	Pearson Correlation	0.823*	0.771*	0.753*	0.777*
	Sig. (2-tailed)	0.000	0.000	0.000	0.000
	N	52	52	52	52

Furthermore, the results imply that structured learning experiences that promote insight can meaningfully enhance students' ability to interpret and connect scientific concepts. This implies that the instructional strategy not only supports immediate comprehension but also contributes to the longterm retention of knowledge. Hence, integrating insight-based approaches in physics instruction may lead to more effective and meaningful learning outcomes among STEM students.

The table presents the significant relationship between the Insight Learning Theory-Based Strategy and STEM Students' Conceptual Knowledge in Physics, particularly in terms of Interpretation, Making Connections, Reasoning, and Accuracy of Responses. It is reflected that the r-value ranges from 0.544 to 0.848, interpreted as "Moderately High Relationship", as attested further by the p-values of 0.000, which are lower than 0.05 and have verbal analysis of "Significant." The results indicate that the Insight Learning Theory-Based Strategy has a statistically significant relationship on STEM Students' Conceptual Knowledge in Physics across all measured domains.

The Preparation stage shows strong positive relationships across all domains, with correlation coefficients ranging from 0.764 to 0.848, all with p-values of 0.000 and verbally interpreted as "Significant." The highest relationship is observed in Making Connections (r=0.848), followed by Interpretation (r=0.832), Reasoning (r=0.782), and Accuracy of Responses (r=0.764). These results suggest that preparation plays a crucial role in enhancing students' ability to connect concepts, interpret information, and produce accurate answers.

The Incubation stage also demonstrates significant positive relationships, with r-values ranging from 0.544 to 0.740 and p-values of 0.000, all interpreted as "Significant." The strongest relationship is found in Interpretation (r=0.740), while the lowest is in Reasoning (r=0.544). This indicates that allowing time for reflection and subconscious processing contributes meaningfully to students' conceptual understanding, although its influence on reasoning is comparatively lower.

Similarly, the Insight stage exhibits significant relationships across all domains, with correlation coefficients ranging from 0.637 to 0.739 and p-values of 0.000, interpreted as "Significant." The highest correlation is observed in Reasoning (r=0.739), followed by Interpretation (r=0.732), Accuracy of Responses (r=0.721), and Making Connections (r=0.637). This suggests that moments of realization or deeper understanding significantly enhance students' reasoning ability and overall conceptual clarity.

The Verification stage also shows consistently strong and significant relationships, with r-values ranging from 0.753 to 0.823 and all p-values at 0.000, interpreted as "Significant." The strongest relationship is observed in Interpretation (r=0.823), followed by Accuracy of Responses (r=0.777), Making Connections (r=0.771), and Reasoning (r=0.753). These findings indicate that validating and checking answers reinforces students' understanding and improves the accuracy of their responses.

Overall, the results reveal that all stages of the Insight Learning Theory-Based Strategy have "Significant" positive relationships with all dimensions of Conceptual Knowledge in Physics. The consistently high correlation coefficients and uniform p-values of 0.000 indicate a strong association between the use of Insight Learning Theory-Based Strategy and improved the STEM Students' Conceptual Understanding in Physics. Among the stages, Preparation and Verification demonstrate particularly strong relationships, while Incubation and Insight also contribute meaningfully. This suggests that a comprehensive application of all stages of insight learning effectively enhances students' ability to interpret concepts, make connections, reason logically, and provide accurate responses.

Significant Effect between the Insight Learning Theory-Based Strategy on the STEM Students' Problem-Solving Skills in Physics

In this study, the level of Insight Learning Theory-Based Strategy refers to Preparation; Incubation; Insight; and Verification while the STEM Students' Performance in Problem-*Solving* Skills in Physics refers to Analytical Thinking; Critical Thinking; Logical Thinking; and Procedural Fluency.

The Significant Effect between the Insight Learning Theory-Based Strategy on the STEM Students' Problem-Solving Skills in Physics 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 14 shows the Significant Relationship between the Insight Learning Theory-Based Strategy on the STEM Students' Problem-Solving Skills in Physics

Table 14. Significant Effect between the Insight Learning Theory-Based Strategy on the STEM Students' Problem-Solving Skills in Physics

Insight Learning Theory-Based Strategy		STEM Students' Conceptual Knowledge in Physics			
		Analytical Thinking	Critical Thinking	Logical Thinking	Procedural Fluency
Preparation	t-value	2.609*	1.388	0.484	1.337
	Sig. (2-tailed)	0.012	0.171	0.631	0.187
	N	52	52	52	52
Incubation	t-value	3.734*	2.244*	1.827	2.201*
	Sig. (2-tailed)	0.000	0.029	0.074	0.032
	N	52	52	52	52
Insight	t-value	1.712	1.504	0.368	1.043
	Sig. (2-tailed)	0.093	0.139	0.714	0.302
	N	52	52	52	52
Verification	t-value	1.923	1.058	1.923	1.205
	Sig. (2-tailed)	0.060	0.295	0.060	0.234
	N	52	52	52	52

The table presents the significant effect of the Insight Learning Theory-Based Strategy on STEM Students' Problem-Solving Skills in Physics, specifically in Analytical Thinking, Critical Thinking, Logical Thinking, and Procedural Fluency. Statistical significance is determined at the 0.05 level, where p-values lower than 0.05 are interpreted as "Significant," while those higher than 0.05 are interpreted as "Not Significant."

The preparation stage shows a significant effect on Analytical Thinking, as indicated by its p-value (p=0.012), which is lower than 0.05 and verbally interpreted as "Significant." However, its effects on Critical Thinking (p=0.171), Logical Thinking (p=0.631), and Procedural Fluency (p=0.187) are all higher than 0.05 and are therefore "Not Significant." This implies that preparation helps improve students' ability to analyze problems but does not significantly influence deeper reasoning or procedural execution.

The Incubation stage demonstrates the most consistent significant effects across several domains. It significantly affects Analytical Thinking (p=0.000), Critical Thinking (p=0.029), and Procedural Fluency (p=0.032), all of which are below 0.05 and interpreted as "Significant." In contrast, its effect on Logical Thinking (p=0.074) is higher than 0.05 and therefore "Not Significant." These results suggest that the Incubation phase plays an important role in enhancing higher-order thinking and procedural skills, although it may not strongly influence logical structuring.

The Insight stage does not show any significant effects, with p-values of 0.093 for Analytical Thinking, 0.139 for Critical Thinking, 0.714 for Logical Thinking, and 0.302 for Procedural Fluency—all exceeding the 0.05 threshold and verbally interpreted as "Not Significant." This indicates that although insight is a key component of the learning process, it may not directly lead to measurable improvements in problem-solving performance without further reinforcement.

Similarly, the Verification stage yields no significant effects across all domains. Its p-values—0.060 for Analytical Thinking, 0.295 for Critical Thinking, 0.060 for Logical Thinking, and 0.234 for Procedural Fluency are all higher than 0.05 and interpreted as "Not Significant." This suggests that while verification is important for checking accuracy, it may not significantly enhance students' problem-solving skills unless combined with guided reflection or feedback.

Overall, the findings reveal that the Incubation stage emerges as the most influential phase, showing multiple "Significant" effects supported by p-values below 0.05. The Preparation stage contributes specifically to Analytical Thinking, while the Insight and Verification stages show "Not Significant" effects across all domains. This implies that reflective processing plays a more critical role in developing students' problem-solving skills than the other stages when considered independently.

IV. Conclusion and Recommendations

There is a significant relationship between the Insight Learning Theory-Based Strategy and the STEM Students' Conceptual Knowledge in Physics. The null hypothesis is rejected. This means that students who were exposed to the Insight Learning Theory-Based Strategy demonstrated improved understanding of physics concepts, indicating that the strategy effectively supports the development of conceptual learning.

There is no significant effect between the Insight Learning Theory-Based Strategy on the STEM Students' Problem-Solving Skills in Physics. The null hypothesis is accepted. This implies that the implementation of Insight Learning Theory-Based Strategy did not produce a measurable improvement in students' problem-solving skills in Physics. Although students may still have shown some level of performance, the results indicate that these changes were not strong enough to be considered statistically significant.

Based on the summary of findings and conclusions, the researcher, acquired the following suggestions and recommendations could be adopted to further improve the study.

Teachers may explore the application of Insight Learning Theory-Based Strategy across different grade levels, subject areas, or school settings to examine its consistency and adaptability in diverse educational contexts.

Students may deliberately follow the four stages of ILTBS when tackling physics problems, this structured approach ensures deeper conceptual understanding and prevents reliance on rote memorization.

Educational institutions are advised to support the implementation of the ILTBS and adopt instructional programs that combine conceptual learning with structured problem-solving approaches, along with providing teacher training and professional development.

Future researchers may examine other factors that contribute to students' academic performance beyond those covered in the study.

Reference

[1]. Espinoza, F. (2020). Impact of guided inquiry with simulations on knowledge of electricity and wave phenomena. European Scientific Journal, 16(33), 1–15. https://doi.org/10.19044/esj.2020.v16n33p1