



SUPERSOLO STRATEGY IN SCIENCE: ENHANCING THE CRITICAL THINKING SKILLS AMONG THE SELECT GRADE 7 STUDENTS IN CALATAGAN NATIONAL HIGH SCHOOL

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ABSTRACT

The study aimed to determine the effectiveness of SuperSOLO strategy in enhancing the critical thinking skills among the select Grade 7 students in Calatagan National High School. The study employed quasi-experimental method of research. The respondents were 30 Grade 7 students in Calatagan National High School. The researcher-constructed test and the researcher-made survey questionnaire were the main data-gathering instruments. Different statistical tools were utilized which include frequency and percentage distribution, weighted mean, composite mean, standard deviation and Wilcoxon signed rank test. The results indicated that the SuperSOLO strategy significantly enhanced students' critical thinking skills in science. It was also revealed that there is a notable improvement in post-test results compared to pre-test scores. The p-value of 0.001, which is far below the chosen significance level of 0.05, indicating a significant difference between the two sets of assessment results. It was also revealed that among the three aspects, analysis obtained the highest mean score of 4.67 (SD = 0.60), which is verbally interpreted as excellent. This indicates that students demonstrated a very high ability to examine information, identify relationships, and draw logical conclusions. The findings also revealed that the respondents strongly agree that the SuperSOLO strategy enhanced their critical thinking skills.

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Keywords: *Critical Thinking Skills, SOLO Taxonomy, SuperSOLO strategy, uni structural, multi-structural, relational, extended abstract*

CONTEXT AND RATIONALE

In today's rapidly evolving world, critical thinking has become an essential skill for students to succeed. Science education plays a vital role in fostering critical thinking, problem-solving and analytical skills. Science education doesn't just fill students with fact; it teaches them how to think as well. It equips them with the tools to question, investigate, reason, and solve problems, which are all essential parts of critical thinking and lifelong learning.

As Department of Education aims to equip Filipino students with high-quality education and the skills, they need to meet the challenges of the 21st century. (DepEd Order No. 21 s, 2019). Critical thinking is the number two among the top ten 21st century skills that the students should have in 2020 according to the World Economic Forum survey in 2016 (World Economic Forum, 2016). According to Stauffer, (2021) critical thinking is one of the four "C's" needed by the student to succeed in school. However, many students struggle with these skills, hindering their ability to fully comprehend scientific concepts.

In 2018, the Philippines participated for the first time in the Program for International Student Assessment (PISA), a global benchmarking tool developed by the Organization for Economic Co-operation and Development (OECD). The results were concerning: Filipino 15-year-old students ranked among the lowest in all three core domains—reading, mathematics, and science. Specifically, in science, the Philippines had an average score of 357, significantly below the OECD average, and only about 23% of students reached the minimum proficiency level. This alarming outcome highlighted systemic issues in the Philippine education system, such as gaps in curriculum delivery, lack of critical thinking instruction, and overreliance on rote learning. It became clear that many students were struggling not because they lacked exposure to scientific content, but because they were unable to apply knowledge, reason logically, analyze data, and evaluate evidence—skills that are central to science literacy as

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defined by PISA.

In response, the Department of Education launched "Sulong Edukalidad," an initiative aimed at improving the quality of basic education in the country through reforms in teacher development, curriculum review, and learning environment enhancement. However, national-level reforms require support from grassroots initiatives in the classroom. One such response is the implementation of the SUPERSOLO strategy—a pedagogical approach grounded in the Structure of the Observed Learning Outcome (SOLO) taxonomy, which guides learners from surface-level understanding to deep and extended abstraction. The SUPERSOLO strategy enhances the traditional SOLO framework by integrating scaffolding techniques, metacognitive prompts, and inquiry-based learning tasks designed to progressively build students' critical thinking skills.

According to Brazel (2020), enhancing pupils' literacy and giving them the ability to evaluate and analyze information are vital. Despite the fact that 97.95 percent of Filipinos are literate, the nation has not changed in recent decades to match the demands of the modern world in terms of information processing. Educational institutions must change their teaching methods to enable students to evaluate, interpret, and find reliable sources for their own work in order to counteract this trend.

As a means of guiding beliefs and actions, critical thinking is the intellectually rigorous process of actively and skillfully conceiving, applying, analyzing, synthesizing, and/or evaluating knowledge generated by or obtained from observation, experience, reflection, reasoning, or communication (University of Louisville, 2012).

In the Department of Education, most of the educators used Revised Bloom's by Anderson and Krathwohl (2001) as their guide in the formulation of the assessment task and lesson development (DepEd Order No. 8 s, 2015). However, Drew C. (2022), said that the SOLO taxonomy is a more practical framework than Bloom's taxonomy due to its focus on observable outcomes rather than internal cognitive processes. He also said that the verbs in SOLO taxonomy are all observable, making them ideal for assessments. SOLO is a framework craft by John Biggs and Kevin Collis that classifies levels of understanding as pre-structural,

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uni-structural, multi-structural, relational, and extended abstract. According to Damopolii, (2020) cited by Dumaraos, (2022), Biggs and Collis (1982) created the Solo Taxonomy (Structure of Observed Learning Outcomes), a methodical approach to how students' comprehension progresses from simple to complex as they study various tasks or subjects. The SOLO Taxonomy offers a methodical approach to gaining profound understanding and can be utilized to improve the caliber of instruction in the classroom.

According to Mukuka, A. et. al., (2020), one essential assessment tool for teaching and understanding mathematics is solo taxonomy. It reveals the area of the subject that the student has difficulties with and gives a hint of the area that needs remediation. SOLO taxonomy is one of the models that can be considered in developing assessments to analyze students' responses in what level of SOLO taxonomy the learning outcome falls. SOLO taxonomy combined with authentic assessment can be a powerful tool for evaluating students learning competency. (Mindayani et al., 2020).

This research focused on the application of the SUPERSOLO strategy in science education among selected Grade 7 students of Calatagan National High School. The need for this intervention is evident in the consistently low Mean Percentage Scores (MPS) obtained in quarterly assessments, which fall below the national standard. These results indicate limited mastery of learning competencies and underdeveloped critical-thinking skills among learners. The Grade 7 level is particularly significant, as it marks the transition into junior high school and serves as a foundational stage for cultivating scientific habits of mind. At this stage, students are expected not only to understand scientific concepts but also to engage with them critically and analytically. However, traditional instructional approaches often prioritize memorization over higher-order thinking skills such as reasoning and problem-solving. As a result, students may be able to recall information but struggle to apply their knowledge in unfamiliar contexts—an issue reflected in the country's performance in international assessments such as PISA.

The use of the SUPERSOLO strategy offers a potential solution to this challenge. By providing structured progression from simple to complex thinking tasks, the strategy

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encourages students to move beyond recall and comprehension toward relational and extended abstract levels of understanding. In doing so, it aligns well with PISA's framework, which measures students' ability to apply knowledge in real-world contexts. Furthermore, the research aims to address a critical gap in empirical evidence regarding the effectiveness of structured thinking strategies in the local classroom setting. Most studies on SOLO-based instruction are international; thus, this research contributes valuable insights specific to the Philippine context.

Ultimately, this study sought to determine whether the SUPERSOLO strategy can effectively enhance the critical thinking skills of junior high school students in science. If proven successful, the approach could be scaled for broader application and serve as a model for other schools aiming to uplift science education outcomes. More importantly, it directly supports the national education reform agenda by providing teachers with a practical, research-based framework to foster deeper thinking and improved scientific literacy among learners.

Innovation, Intervention, and Strategy

The Philippines' Department of Education emphasizes the development of critical thinking skills among students. However, many Grade 7 students in Calatagan National High School struggle with applying critical thinking skills in science education. Traditional teaching methods often focus on rote memorization, hindering students' ability to analyze and evaluate scientific information.

The SuperSOLO strategy, built on the Structure of Observed Learning Outcomes (SOLO) framework, offered a promising approach to enhance critical thinking skills. During the conduct of the science classes, the students were exposed to SuperSOLO type of assessment. Both formative and summative assessment were constructed using the SuperSOLO strategy and were administered to the respondents. At the early phase of utilizing the SuperSOLO strategy, 5 SuperSOLO items were given to the respondents, as their daily assessment. The stem was carefully constructed and the questions were built based on the

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SOLO Levels such as unistructural, multi-structural, relational and extended abstract. In this manner, the level of critical thinking skills of the respondents was being measured.

Action Research Questions:

This study is conducted to assess the effectiveness of SuperSOLO strategy in enhancing the critical thinking skills of the respondents in science.

Specifically, it sought answers to the following questions:

1. What is the level of critical thinking skills of the G7 students before and after employing SuperSOLO strategy?
2. Is there significant difference between the pre-test results and post-test results of the respondents?
3. What specific aspects of critical thinking skills (analysis, synthesis, evaluate) are most enhanced through the implementation of the SuperSOLO strategy in science education?
4. What are students' perceptions of the SuperSOLO strategy in enhancing their critical thinking skills in science?

significant difference between the pre-test results and post-test results of the respondents.

Action Research Methods

The study employed the quasi-experimental method of research to evaluate the effectiveness of SuperSOLO strategy in enhancing the critical thinking skills of the respondents. A quasi-experimental research method is a study design that seeks to establish a cause-and-effect relationship between variables by manipulating an independent variable, but unlike a true experiment, it does not use random assignment to create groups. Instead, participants are often assigned to groups based on non-random criteria, making it a practical or ethical alternative to true experiments in fields like education and medicine. Specifically, the study utilized the one group pretest and posttest design. The participants are selected

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based on convenience and suitability to the study (Gray, 2023). In this design, participants are measured before (pretest) and after (posttest) the intervention. The effect of the intervention is inferred from the difference in pretest and posttest results.

Participants and/or Other Sources of Data and Information

The study was conducted to 30 Grade 7 students who are being characterized as homogeneous group. The researchers employed purposive sampling, a sampling technique commonly utilized in research. Purposive sampling entailed the deliberate selection of particular individuals or elements from a population based on predetermined criteria and the researcher's judgment, rather than relying on random chance (Smith, 2013). This method proved particularly valuable when researchers aimed to investigate a subgroup of the population with unique characteristics, knowledge, or experiences relevant to the research objectives.

Data Gathering Methods

The research utilized a researcher-constructed test and questionnaire as the main instruments to gather the relevant data.

Researcher-constructed test. The study employed a researcher-constructed test. The test underwent the process of construction, validation, administration, and scoring. The test items focused on cell cycle, specifically, on recognizing that cells reproduce through two types of cell division, mitosis and meiosis. This specific competency was identified as the least mastered competency based on the conducted item analysis last SY 2024-2025.

Researcher-made questionnaire. The researchers also made use of a survey questionnaire as one of the tools in gathering the data. This also underwent the process of construction, validation, administration, and scoring. The said survey questionnaire was used to determine the respondents' perception on SuperSOLO strategy in enhancing their critical thinking skills in science.

Data Collection

The pre-test was administered to the students, ensuring that the instructions

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were clearly understood. The test materials were collected on the same day as the administration. After conducting the pre-test, the researchers implemented the SuperSOLO strategy assessment to the respondents.

Afterwards, the post-test was administered to the students with clear and precise instructions.

The survey questionnaire was also administered to determine the respondents' perception on SuperSOLO strategy.

Ethical Issues

Prior to the actual conduct of the research, the researchers requested permission through written communication to the Public District Schools Supervisor and to the school Principal. The researchers extended the process by formally requesting permission from the head teacher and class adviser of the respondents. The collected data was kept confidentially and intended for research purpose only.

a. Data Analysis Plan

The gathered data from the respondents were tallied, tabulated, and interpreted using the following statistical analysis.

Frequency and Percentage. This analysis was utilized to describe level of critical thinking skills of the G7 students before and after employing SuperSOLO strategy. It provides a clear understanding of the distribution of scores, helping to identify the frequency of specific performance levels in terms of percentages.

Mean and Standard Deviation. Mean and standard deviation were used to determine the specific aspect of critical thinking skills (analysis, evaluation, inference) that is most enhanced through the implementation of the SuperSOLO strategy in science education. The mean offers insight into the average performance, while the standard deviation indicates the degree of variation from this average. A higher standard deviation suggests greater variability in the scores.

W. The Wilcoxon signed rank test was employed to

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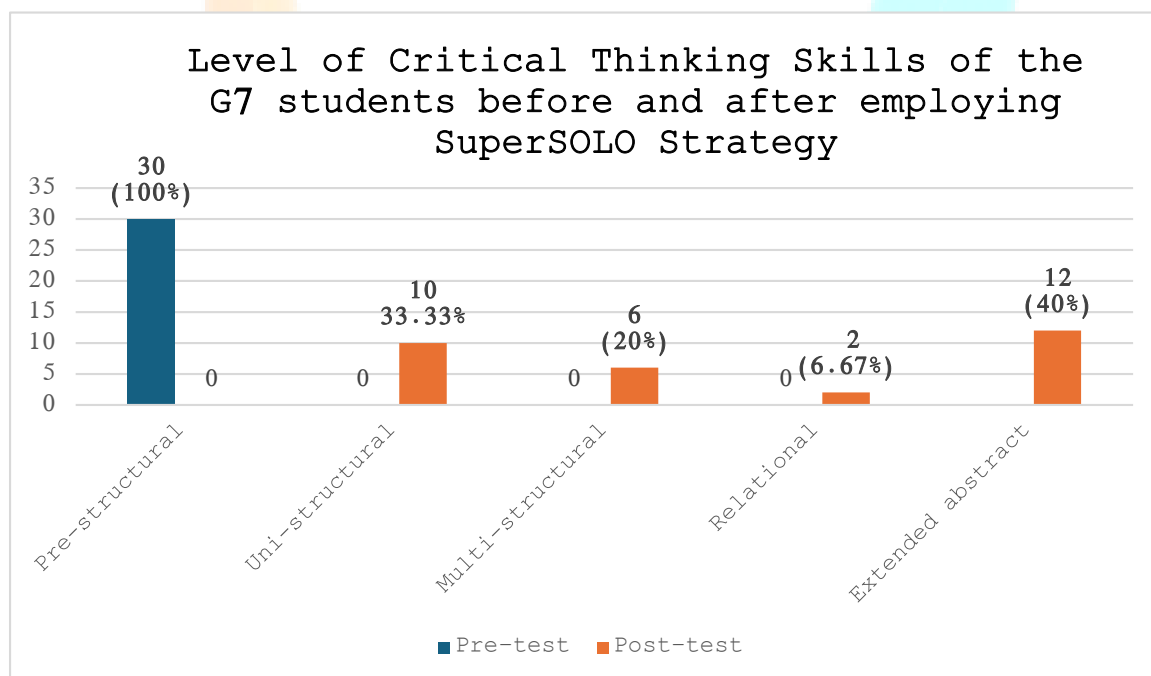
determine whether there is a significant difference in the results between the pre- and post-assessments. It was utilized in this study because the data obtained were non-normal. This statistical test is particularly useful for assessing whether an intervention or treatment has had a measurable impact on the participants' performance. It helps to identify if any observed changes are statistically significant or merely due to chance.

Weighted Mean and Composite Mean. These were used to assess the perceptions of the respondents on the SuperSOLO strategy in enhancing their critical thinking skills in science.

Discussion of Results and Reflection

1. Level of Critical Thinking Skills of the G7 Students before and after employing SuperSOLO Strategy

Table 1



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Table 1 presents the level of critical thinking skills of the G7 students before and after employing SuperSOLO Strategy. It also presents that before employing SuperSOLO strategy, 30 respondents or 100% of the respondents are in pre-structural level, which means that the respondents do not have prior knowledge.

The table further shows that following the implementation of the SuperSOLO strategy, student performance across the SOLO Taxonomy levels improved as follows: 10 respondents (33.33%) achieved the uni-structural level, 6 respondents (20%) reached the multi-structural level, 2 respondents (6.67%) attained the relational level, and 12 respondents (40%) achieved the extended abstract level. This indicates that the SuperSOLO strategy effectively facilitated student progression through the cognitive complexity levels, with a significant portion reaching the higher-order thinking levels of relational and extended abstract. This is supported by Silwana et al. (2021) who found that students with logical intelligence reached the extended abstract level while others reached lower levels, illustrating that reaching the highest level is possible though often achieved by fewer students.

2. Sthere significant **Difference between the Pre-test results and Post-test results**

Table 2

Variables	Mean	Wilcoxon Signed Ranked Test	p-value	Interpretation	Decision
Pre-test	6.97	30	0.001	Significant	Reject H ₀
Post-test	16.93				

Table 2 presents the Wilcoxon Signed Ranked Test between the pre-test results and post-test results of the respondents. The p-value of 0.001, which is far below the chosen significance level of 0.05, provides strong evidence against the null hypothesis, indicating a significant difference between the two sets of assessment results. This strongly suggests a

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substantial improvement from the pre-assessment to the post-assessment. In other words, the use of SuperSOLO strategy had a meaningful impact on the measured variable or skill, resulting in enhanced student performance. This finding highlights the effectiveness of the intervention in fostering positive developments in students' critical thinking skills.

This is supported by Arceo (2024), states that after the implementation of SOLO taxonomy, there is a substantial improvement in students' critical thinking. This implies that exposing the students to SOLO taxonomy assessment greatly improves the analyzation of the students.

3. Aspects of Critical Thinking Skills that are Most Enhanced through the Implementation of the SuperSOLO Strategy in Science Education

Table 3
Aspects of Critical Thinking Skills that are Most Enhanced through the Implementation of the SuperSOLO Strategy in Science Education

Aspect of Critical Thinking Skills	Mean	SD	Verbal Interpretation
Analysis	4.67	0.60	Excellent
Synthesis	3.86	0.99	Good
Evaluation	3.24	1.67	Fair

Table 3 presents the mean scores, standard deviations, and verbal interpretations of students' performance across three aspects of critical thinking skills: Analysis, Synthesis, and Evaluation.

Among the three aspects, analysis obtained the highest mean score of 4.67 (SD = 0.60), which is verbally interpreted as excellent. This indicates that students demonstrated a very high ability to examine information, identify relationships, and draw logical conclusions.

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The synthesis aspect recorded a mean score of 3.86 (SD = 0.99), interpreted as Good. This suggests that students are generally capable of combining ideas and forming new insights, though there is still room for improvement.

Finally, the evaluation aspect yielded the lowest mean score of 3.24 (SD = 1.67), corresponding to a fair interpretation. This implies that students showed moderate ability in making judgments, assessing arguments, and justifying decisions.

This is supported by Chubko, et al., (2019) who provided empirical support that students' thinking complexity can be tracked and improved, but often starts at lower levels and less often reaches the highest level (evaluation) which explained the pattern (highest in analysis, lowest in evaluation).

4. Students' Perceptions on SuperSOLO Strategy in Enhancing their Critical Thinking Skills in Science

Table 4
Students' Perceptions on SuperSOLO Strategy in Enhancing their Critical Thinking Skills in Science

Indicators <i>(The SuperSOLO Strategy...)</i>	Weighted Mean	Verbal Interpretation
1. helped me analyze and interpret scientific problems in greater depth.	4.00	Strongly Agree
2. improved my ability to evaluate and assess scientific evidence accurately.	3.60	Strongly Agree
3. enhanced my skill in constructing clear and logical scientific arguments.	3.63	Strongly Agree
4. increased my confidence in solving complex and high-order science problems.	3.70	Strongly Agree

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5. helped me integrate and relate different science concepts effectively.	3.60	Strongly Agree
6. encouraged me to reflect critically on my own thinking during science activities.	3.83	Strongly Agree
7. developed my ability to identify underlying assumptions and biases in scientific information.	3.63	Strongly Agree
8. aided me in organizing and structuring my scientific ideas systematically.	3.73	Strongly Agree
9. made my science learning experiences more engaging and intellectually stimulating.	3.80	Strongly Agree
10. enhanced my overall critical and analytical thinking skills in science.	4.00	Strongly Agree
Composite Mean	3.75	Strongly Agree

Table 4 presents the respondents' evaluation of the effectiveness of the SuperSOLO Strategy in enhancing their critical thinking and scientific skills. The weighted mean scores for all ten indicators ranged from 3.60 to 4.00, with all indicators receiving a verbal interpretation of "Strongly Agree." The composite mean of 3.75 further emphasizes the overall positive perception of the strategy among the respondents.

Specifically, the respondents strongly agreed that the SuperSOLO Strategy helped them analyze and interpret scientific problems with greater depth (weighted mean = 4.00), enhanced their ability to evaluate scientific evidence accurately (3.60), and improved their skills in constructing clear and logical scientific arguments (3.63). Moreover, it increased their confidence in solving complex and higher-order science problems (3.70) and facilitated the integration and effective relation of different science concepts (3.60).

The strategy also encouraged critical reflection on their own thinking during science activities (3.83), aided in identifying underlying assumptions and biases in scientific information (3.63), and helped organize and structure scientific ideas systematically (3.73).

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Additionally, it made their science learning experiences more engaging and intellectually stimulating (3.80), and overall enhanced their critical and analytical thinking skills in science (4.00).

These findings indicate that the SuperSOLO Strategy is highly effective in fostering various dimensions of critical thinking and analytical skills in science, which are essential for deepening understanding and promoting meaningful learning in the subject.

Conclusions

Based on the findings, the following conclusions were drawn:

1. SuperSOLO strategy effectively facilitated student progression through the cognitive complexity levels, with a significant portion reaching the higher-order thinking levels of relational and extended abstract.
2. There is significance difference between the pre-test results and post-test results of the respondents, thus, rejecting the null hypothesis.
3. Analysis, among the three aspects of critical thinking skills, obtained the highest mean score of 4.67 (SD = 0.60), which is verbally interpreted as excellent. This indicates that students demonstrated a very high ability to examine information, identify relationships, and draw logical conclusions.
4. The respondents strongly agree that SuperSOLO strategy enhanced their critical thinking skills in science.

Recommendations

The following recommendations are offered based on the findings and conclusions of the study:

1. Integrate the SuperSOLO strategy regularly in science instruction to enhance students' critical thinking skills through cognitive complexity levels.
2. Focus on developing students' analytical skills, as this aspect shows the highest potential for fostering critical thinking.

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3. Encourage teachers to adopt the SuperSOLO strategy to promote higher-order thinking, relational, and extended abstract understanding that enhance students' critical thinking skills.
 4. Provide training and workshops for educators on implementing the SuperSOLO strategy effectively in the classroom.



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Action Plan

OBJECTIVES	ACTIVITIES	STRATEGIES	PERSONS INVOLVED	TIME FRAME	EXPECTED OUTCOME
Deepen science teachers' understanding on SuperSOLO Strategy	Normalizing SuperSOLO strategy in science classes	Learning Action Cell	School Head Head Teacher Master Teacher Science Teachers	November 2025	Teachers demonstrate a better understanding on SuperSOLO Strategy
Construct SuperSOLO items for assessment	Capacitate science teachers in constructing SuperSOLO items	Learning Action cell	School Head Head Teacher Master Teacher Science Teachers	December 2025	Teachers construct SuperSOLO items for their students' assessment
Identify and utilize pedagogical approaches that will support SuperSOLO strategy	SuperSOLO Strategy as Instructional Approach	Learning Action cell	School Head Head Teacher Master Teacher Science Teachers	January 2026	Teachers utilize pedagogical approach that intensifies the use of SuperSOLO strategy in science classes

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Research Task	Activity	Materials	Cost
Gathering Materials	Administering Pre-test and Post- test Survey Questionnaires	Hard Copies of Test papers Survey Questionnaires	P100.00
Preparing the 3 copies of Full Research Paper	Printing and binding the 3 copies of Full Research Paper	Bond papers Ring binder Acetate	P 350.00
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