Efficacy of Strategic Intervention Material (SIM) on the Learning Proficiency of Grade 10 Earth Science Students

Florannie L. Cenabre, Gina Fe G. Israel, EdD*

Email: cenabreflorannie28@gmail.com

Student, University of Mindanao, Tagum City, Davao del Norte, 8100, Philippines
Professor, University of Mindanao, Tagum City, Davao del Norte, 8100, Philippines

Abstract

Science education has typically been unenjoyable for numerous students, resulting in low proficiency in the subject's critical concepts that relate to societal situations. To address this issue, educators have incorporated Strategic Intervention Material (SIM) into their instructional methods to stimulate students' engagement and enhance their learning proficiency. The purpose of this study was to examine the efficacy of SIM in enhancing the learning proficiency of grade 10 earth science students with poor academic performance at La Filipina National High School (LFNHS), situated in Tagum City. The use of SIM was the independent variable, while the level of learning proficiency of the grade 10 low performing students in earth science was the dependent variable. A quasi-experimental research design was utilized in this study, involving the collection of pre-test and post-test scores from the participants. The respondents in the research were grade 10 students who were enrolled at La Filipina National High School (LFNHS) during the school year 2020-2021. The data was collected using a standardized questionnaire created by the division. Mean, standard deviation, and t-test were used as statistical tools to analyze the data. The findings indicate a notable correlation between the use of SIM and the learning proficiency of grade 10 students at La Filipina National High School. These results signify that there is enough evidence from the sample to support a significant relationship. Overall, the outcomes of the study suggest that the implementation of SIM in grade 10 earth science has proven effective in boosting students' learning proficiency.

Keywords: MAED – Teaching Science, Strategic Intervention Material, Learning Proficiency, Earth Science, Low Performing Students, Experimental, Traditional Approach, Philippines

1. INTRODUCTION

A significant number of students complete their schooling with false impressions and misinterpretations regarding the importance of Earth Science and its significance in education. Such attitudes perpetuate the narrow views of reductionist policymakers in the educational sector, comprising politicians,

scientists, and educators, leading to no discernible transformation in the status of Earth Science in schools or its instructional approach (Orion, 2019). For numerous students, the process of learning science, especially earth science, has never been an enjoyable experience, which has resulted in poor learning proficiency in this particular subject area (Dacumos, 2016 cited in Dandan 2022).

As per a leading source of data and analysis on scientific education, the Philippines has been ranked last among 58 countries in the global assessment of Math and Science. These conclusions are based on the 2019 Trends in International Mathematics and Science Study (TIMSS) results (Bernardo, 2020). The National Achievement Test (NAT) results for Grade 10 students, which are published annually, exhibited a comparable trend. The evaluation indicated that students from across the country demonstrated equally poor performance overall. In the 2005 National Achievement Test, the Grade 10 students' performance in science had the lowest mean percentage score (MPS) among the five subjects assessed, with a score of 39.49. The outcomes suggest that there are inadequacies in the teaching and management of science classes (Dacumos, 2016 cited in Dandan 2022).

Teachers must create and provide essential materials that are suitable for students' needs to establish a successful educational process in the 21st century. To achieve this, they can integrate teaching aids such as SIM into their instructional methods to stimulate students' engagement and enhance their learning proficiency. For science teachers to effectively enhance their students' comprehension of science, it is crucial that they possess a comprehensive understanding of their students. This enables them to provide personalized educational materials that cater to each student's specific needs, resulting in an improved and tailored learning experience (Dacumos, 2016 cited in Dandan 2022).

The researcher, who is also a science teacher, has not encountered any quantitative studies on the efficacy of SIM in enhancing the learning proficiency of grade 10 earth science students at her current workplace. Therefore, she intends to investigate whether SIM is indeed effective in improving students' science learning proficiency. The outcomes of this study may provide useful insights to science teachers at La Filipina National High School, including those who taught our students in elementary school, to develop SIM that addresses the least mastered competencies and skills to help students improve their learning performance. This underscores the significance of conducting this study.

1. 1 Research Objectives

The goal of this research is to evaluate the Efficacy of the SIM to the Learning Proficiency of Grade 10 Earth Science students. Specifically, it seeks:

1. To assess the level of Learning Proficiency by analyzing the scores from both the pretest and posttest of the following:
   a. Control Group
   b. Experimental Group
2. To determine whether there exists a statistically significant difference between the scores obtained from the pretest and posttest of the following:
   a. Control Group
   b. Experimental Group

3. To determine if a significant difference exists between the following:
   a. Pretest Scores of both the Control Group and the Experimental Group
   b. Posttest Scores of both the Control Group and the Experimental Group

2. METHODOLOGY

2.1 Research Design

A quasi-experimental design with a pretest and posttest and a control group was utilized in this study as a quantitative research method. According to Alboruto (2017), quasi-experimental design is the most appropriate method for this study because it aims to measure the extent of the impact of the dependent variable after the treatment period. The distinction between the control group that uses the conventional approach and the experimental group that uses the SIM are quantified by measuring their pretest and posttest scores.

The study also employed a purposeful sampling approach since the teacher-researcher only had four sections for remediation, and a specific criterion was identified for the respondents. As Ayres (2019) suggests, a purposive sampling approach is used to intentionally select subjects to gather information from the target population.

2.2 Respondents of the Study

The respondents who participated in this study were the grade 10 learners enrolled in a public secondary school in Tagum City for the school year 2020 – 2021.

Fifty (50) students from the researcher's classes in a public secondary school in Tagum City received low grades, scoring 75 and below in the first quarter, particularly in the area of earth science. These students formed the initial group for the intervention program, which lasted for two weeks during the same quarter. Participants were given the option to withdraw from the study if they felt uncomfortable or threatened at any point.

To evaluate the efficacy of SIM in enhancing the academic achievement of grade 10 earth science students, this study deliberately selected students with low academic performance.

The researcher selected grade 10 students for this study as they were assumed to possess the essential academic skills required to excel in higher grades and academic and scientific activities. Compared to lower grade levels, grade 10 students were deemed more suitable participants due to their maturity and experience. Additionally, they were more likely to take their participation seriously. If participants experienced any discomfort during the assessments or found some items difficult to comprehend, they were given the opportunity to withdraw from the study due to physical inadequacy.

2.3 Research Instrument

To remediate the least mastered concepts in science 10, the study employed teacher-created SIM. The SIM was validated by experts in the field of science education, including a science instructor, a science coordinator, and a science master teacher. To test the acceptability of the SIM developed by the researcher, a

standardized division-made questionnaire was utilized. After the validation process, the SIM underwent revisions to ensure its effectiveness. Following the modifications, the researcher administered a standardized division-made pre-test consisting of 30 items to the respondents. The SIM was then utilized for remediation, and the participants completed a posttest using the same questionnaire as the pre-test. For data analysis, the scores of each respondent were utilized, and a comprehensive statistical analysis was conducted.

2.4 Statistical Treatment

The researcher employed the following statistical tools to interpret the data collected in this study.

Mean. This method was employed to compare the improvement in performance of both groups from pretest to posttest. It facilitated a straightforward comparison of the overall performance increase or decrease of one group relative to the other.

Standard Deviation. Hargrave (2019) defined the standard deviation (SD) as a statistical measure that calculates the square root of the variance and assesses the dispersion of a dataset in relation to its mean. Similarly, Rumsey (2018) suggested the use of SD in determining dispersion to enable a more effective comparison between two sets of data.

Paired Sample t-Test. The comparative score of both the control group and the experimental group was demonstrated using this method. By utilizing the mean scores in the pretest and posttest of the two groups, it identifies the level of significance between the two scores.

Level of Significance. In order to interpret the significant difference in achievement between students who used the SIM and those who did not, the computed p-value was compared with the tabular p-value at a .05 level of significance with 48 degrees of freedom. This comparison served as the basis for determining whether the null hypothesis should be rejected or accepted (Dy, 2007 cited in Dandan, 2022).

3. RESULTS AND DISCUSSION

This section contains the presentation of the study's results, including the analysis and interpretations. The data is presented in both tabular and textual formats, and all inferential findings were evaluated using a significance level of 0.05. The tables and their corresponding explanations are organized chronologically and categorized under subheadings that specify the level of learning proficiency, the significance of the correlation between pretest and posttest scores, and the significance of the contrast between the control and experimental groups.

The utilization of the standard deviation was crucial in gauging how much individual responses deviated from the mean. It's worth mentioning that the standard deviation for a 5-point Likert scale falls within the range of 2.69 to 3.54, suggesting that the study's ratings exceed 1. This implies that the data deviate considerably from the mean and are moderately dispersed from it (Wittink and Bayer, 1994, as cited in Baria and Gomez, 2022).

Level of Learning Proficiency in Terms of Pretest Scores

Table 1 displays the average score outcome of the pretest taken by the students in the control group and experimental group, aiming to assess their level of learning proficiency in plate tectonics.

Table 1. Level of Learning Proficiency in Terms of Pretest Scores

Group	Pretest Scores		Descriptive
	Mean	SD	Equivalent
Control	13.64	2.80	Moderate
Experimental	13.60	2.69	Moderate

Table 1 depicts the level of learning proficiency concerning pretest scores for both the control group and the experimental group. It presents the interpretation of the mean score and standard deviation, accompanied by their respective descriptions.

The control group's mean score of 13.64, accompanied by a standard deviation of 2.80, is labeled as "moderate." This suggests that the level of learning proficiency among grade 10 science students on plate tectonics concerning the pretest in the control group is developing.

The experimental group's mean score of 13.60, accompanied by a standard deviation of 2.69, is likewise labeled as "moderate." This implies that the level of learning proficiency among grade 10 science students on plate tectonics concerning the pretest in the experimental group is also developing.

Level of Learning Proficiency in Terms of Posttest Scores

Presented in Table 2 is the mean score result of posttest of students in the control group and the experimental group to determine the level of their learning proficiency in plate tectonics.

Table 2. Level of Learning Proficiency in Terms of Posttest Scores

Group	Posttest Scores		Descriptive
	Mean	SD	Equivalent
Control	21.60	3.54	High
Experimental	25.12	3.46	Very High

Table 2 demonstrates the level of learning proficiency regarding posttest scores for both the control and experimental groups. It presents the interpretation of the mean score and standard deviation, along with their respective descriptions.

A mean score of 21.60, accompanied by a standard deviation of 3.54 in the control group, is considered "high." This indicates that the level of learning proficiency among grade 10 science students on plate tectonics concerning the posttest in the control group is proficient.

The experimental group's mean score of 25.12 and a standard deviation of 3.46 indicate that they are “Very High”. This implies that the learning proficiency among the grade 10 science students on plate tectonics in term of posttest in the experimental group is exemplary.

Significant Difference between the Pretest Scores and Posttest Scores

Table 3 displays the average scores of the pretest and posttest administered to learners from both the control and experimental groups, with the objective of establishing the importance of the correlation between the pretest and posttest results.

Table 3. Significant Difference between the Pretest Scores and Posttest Scores

Group	Mean		t-value	p-value	Decision
	Pretest	Posttest			
Control	13.64	21.60	18.853	0.001	Reject H_o
Experimental	13.60	25.12	20.789	0.001	Reject H_o

The data suggests that both the control group and experimental group displayed better performance in the posttest than their respective pretest results, evident from the p-values of 0.001 for both groups. Notably, the mean scores of both groups have considerably increased, leading to the rejection of the null hypothesis. Additionally, the table illustrates that the experimental group showed significantly better performance in their scores than the control group during the posttest. Based on the outcomes, it can be concluded that the students' grasp of the concepts has improved after the study. Moreover, the findings confirmed that the students in the experimental group demonstrated superior performance compared to those in the control group after being introduced to the use of SIM. Consequently, the implementation of SIM exhibited an improvement in the students' performance, validated by a significantly higher average score in the posttest in comparison to the pretest. This, in turn, validates SIM's efficacy in improving the knowledge retention of plate tectonics among 10th-grade learners.

Significant Difference between Control Group and Experimental Group

Table 4 displays the mean scores of the pretest and posttest outcomes for both the control group and experimental group. The purpose was to evaluate the notable distinction between the pretest and posttest scores of the two groups at a significance level of 0.05 alpha.

Table 4. Significant Difference between Control Group and Experimental Group

Scores	Mean		t-value	p-value	Decision
	Control	Experimental			
Pretest	13.64	13.60	0.052	0.959	Accept H_o
Posttest	21.60	25.12	3.560	0.001	Reject H_o

According to Table 4, the pretest mean scores for the control group (M=13.64) and experimental group (M=13.60) were almost the same. This indicates that there isn't a substantial distinction between the pretest scores of the two groups, and as a result, the null hypothesis is not rejected.

In addition, the table displays that the mean score in the posttest for the control group (M=21.60) and experimental group (M=25.12) have increased significantly, as suggested by the p-value of 0.001. This implies that there is a substantial difference between the posttest scores of the two groups, resulting in the null hypothesis being rejected.

4. CONCLUSION AND RECOMMENDATION

The researcher's analysis of the research objectives revealed that students who were exposed to the SIM exhibited a remarkable level of learning proficiency. The pretest scores of the control and experimental

groups did not display a significant difference in relation to the significant relationship between variables. This could be attributed to the absence of exposure to SIM by the respondents at that point. However, there was a considerable variation between the posttest scores of the control and experimental groups. This indicates a substantial enhancement in the posttest score relative to the pretest score, which substantiates the effectiveness of SIM in enhancing students' learning proficiency.

The utilization of SIM in the remediation of learners results in significantly better performance compared to those taught through traditional or conventional approaches. This confirms the efficacy of SIM in helping low-performing students to improve their grasp of the least-mastered competencies in earth science. Additionally, the study suggests that learning through SIM encourages a more profound comprehension of the lessons in comparison to the conventional method.

Upon careful examination of the study's findings and conclusions, the researcher recommends several ways to enhance students' science learning proficiency:

First, incorporate traditional or conventional approaches as they aid some students in developing foundational skills that contribute to a better understanding of the subject matter.

Second, regularly use SIM as a remediation tool to enhance students' learning proficiency in the least learned competencies.

Third, develop SIM for other least learned competencies in various scientific fields such as physics, biology, and chemistry to cater to students' needs throughout the science curriculum.

Fourth, further studies should be carried out to explore the use of SIM in improving the least mastered skills. These studies can help validate the results obtained and enhance the effectiveness of SIM, which can be integrated into the Learning Resources Management and Development System (LRMDS)."

Fifth, encourage Science Supervisors, Master Teachers, and teachers to create SIM resulting in a gallery of intervention materials tailored to their students.

Lastly, conduct seminars and workshops for teachers on developing and utilizing SIM to provide them with knowledge and keep them updated on the latest trends in creating and evaluating effective intervention materials.

5. ACKNOWLEDGMENT

The completion of this study is made possible by the assistance and efforts of numerous people who selflessly contributed their ideas and time to bring this research study to its birth and fruition. This would not have been possible without the efforts of these individuals.

First and foremost, the researcher wishes to thank God Almighty for the wisdom He has bestowed upon her, the financial provisions He has made, her strength, confidence, peace of mind, and good health that have enabled her to complete this research. Without Him, none of this would be possible. Everything comes from Him. The researcher expresses gratitude, adoration, and praise to God for everything He has done in order to finish this study.

The researcher would like to thank **Dr. Jeffrey C. Villarosa,** the former principal, and **Dr. Dionisio B. Siglos,** the current principal, of La Filipina National High School for extending their support and cooperation and for allowing the researcher to conduct her study.

Dr. Gina Fe G. Israel, her thesis adviser, for always checking on the progress of her study, for always being available and approachable when her expertise was needed, for the encouragement and motivation to continue and finish this study, and for all the words of encouragement and inspiration that gave the researcher courage despite all the difficulties she encountered and even for the outcome of her study.

Dr. Rey M. Regidor, Chairman of the Committee of Oral Examiners, and the panel members, **Dr. Noel T. Casocot, Dr. Ionne A. Avelino, and Prof. Ronel T. Revita,** who provided encouraging and constructive feedback, as well as valuable comments and suggestions in developing her research. To the pool of validators, **Ma'am Jean Maria G. Derrayal, Ma'am Gisselle G. Wong, Ma'am Karen Jane B. Sacatani, and Sir Jeryphier J. Cespon** are an integral part of her study. Their immense knowledge of research as well as their constructive criticism and heartening recommendations taught the researcher an incredible amount of knowledge.

Prof. Rex L. Sarvida, the researcher's statistician, who contributed his time and expertise to compute and tabulate the data required for the study.

Prof. Armela G. Taclibon, the researcher's grammarian who organized the ideas of the written output, for the comments and suggestions to improve the presentation of all ideas in the study and polish her work.

Sir Ken Clyde Longos and **Ma'am Jill Algones,** for the unwavering guidance and assistance throughout the entire research process.

Abante Dose Fam and **My Bff's, Ma'am Vivi, Ma'am Patine, Ma'am Bayen, Ma'am Karen, Ma'am Kakai, Ma'am Anching, Ma'am Pringles, Ma'am Janica, Sir Jerry, Sir Kurt, Sir PJ, Ma'am Mariane, Ma'am Lyra, Ma'am Sheng, Ma'am Elife, Ma'am Merlyn and Ma'am Lerma,** for the friendship they have shared, support, and excitement to continue her study.

LFNHS family especially the Grade 10 Department, **Ma'am Anching, Ma'am Pringles, Ma'am Mimi,** and **Sir Ramel** for taking the time to complete the questionnaire. Without their assistance, the researcher would not have been able to complete this work.

Finally, the researcher would like to express her gratitude towards her family for the encouragement that helped her in the completion of this paper. To her beloved and supportive husband, **Boboy,** who is always by her side when the researcher needed her most in making this study; to her lovable daughter, **Chekai,** who served as her inspiration to pursue this endeavor; to her devoted father, **Papang Nonie,** and grandmother, **Nanay Pening,** for their unwavering love and support; and to her **Tatay Paran,** who is now in heaven. To her loving siblings, **Bobet** and **Pepin,** her cousin **Joriez,** and working student **Donnabel,** thank you so much for being her support system.

6. REFERENCES

Alair, G. P. (2018). Strategic Intervention Material: Their Effects on the Academic Performance in Science of the Grade-8 Students of Bai Saripinang National High School.

Alboruto, V. M. (2017). Beating the Numbers Through Strategic Intervention Materials (SIMs). Innovative Science Teaching for Large Classes. Retrieved March 1, 2020, from https://aip.scitation.org/doi/10.1063/1.4983982

Aranda, Y., Diaz, R., Sombilon, M., & Gicana, C. F. (2019). Integrating strategic intervention materials (SIM)

in Science to low achieving learners. Journal of Science Teachers and Educators. 2 (1). Retrieved February 29, 2020, from https://nosteonline.org/wp-content/uploads/2019/06/Printing-Integrating-SIM.pdf

Arpilleda, A.J., (2021). Strategic intervention material: A tool in enhancing grade nine students' mathematical performance. Retrieved August 13, 2022, from https://www.researchgate.net/profile/Alcher-Arpilleda/publication/348815824_Strategic_intervention_material_A_tool_in_enhancing_grade_nine_students'_mathematical_performance/links/60134b6f45851517ef225b57/Strategic-intervention-material-A-tool-in-enhancing-grade-nine-students-mathematical-performance.pdf

Ayres, C. (2019). 18 Advantages and Disadvantages of Purposive Sampling. Retrieved May 18, 2019, from https://connectusfund.org/category/environment

Baria, K. & Gomez, D. (2002). Influence of social support to student learning and development. International Journal of Research Studies in Education, 11(2), 69-97. DOI:10.5861/ijrse.2022.112

Bernardo, A. B. I. (2020). Socioeconomic status moderates the relationship between growth mindset and learning in mathematics and science: Evidence from PISA 2018 Philippine data. International Journal of School & Educational Psychology, 9(2), 208-222. Retrieved July 20, 2022, from https://www.tandfonline.com/doi/full/10.1080/21683603.2020.1832635

Dacumos, L. P. N. (2016). The Perspective of Secondary Teachers in the Utilization of Science Strategic Intervention Material (SIM) in Increasing Learning Proficiency of Students in Science Education. Retrieved May 18, 2019, from http://po.pnuresearchportal.org/ejournal/index.php/asten/article/download/293/193

Dandan, K. B. V. (2022). ESIM (Electronic Strategic Intervention Material) in Science 9: An Aid to Improve the Online Learning Performance. Retrieved July 20, 2022, from https://ijrp.org/paper-detail/3369

Dapitan, D. G. & Caballes, D. (2019). Exploratory Effects of Strategic Intervention Materials in General Biology 2. Biometrics and Bioinformatics,11(3), 37-41.

De Jesus R. (2019). Improving the Least Mastered Competencies in Science 9 Using "Pump It Up!" Electronic Strategic Intervention Material Presented at the DLSU Research Congress 2019 De La Salle University, Manila, Philippines June 19 to 21, 2019. March 1, 2020, from https://www.dlsu.edu.ph/wp-content/uploads/pdf/conferences/research-congress-proceedings/2019/lli-II-011.pdf

Department of Education Memorandum No. 160, 2012. Maximizing the Utilization of the National Achievement Test (NAT) Results to Raise the Achievement Levels in Low Performing Schools. Retrieved July 20, 2022, from https://www.deped.gov.ph/wp-content/uploads/2012/09/DM_s2012_160.pdf

Dumigsi, M. P., & Cabrella, J. B., (2019). Effectiveness of Strategic Intervention Material in Mathematics as Remediation for Grade 9 Students in Solving Problems Involving Quadratic Functions. Asian Journal of Education and Social Sciences, 5(1). Retrieved July 11, 2020, from https://www.researchgate.net/profile/Jem-Boy-Cabrella/publication/335432286_Effectiveness_of_Strategic_Intervention_Material_in_Mathematics_as_Remediation_for_Grade_9_Students_in_Solving_Problems_Involving_Quadratic_Functions/links/5d9ab3eba6fdccfd0e7efa90/Effectiveness-of-Strategic-Intervention-Material-in-Mathematics-as-Remediation-for-Grade-9-Students-in-Solving-Problems-Involving-Quadratic-Functions.pdf

Gane, B., Zaidi, S. & Pellegrino, J. (2018). Measuring what matters: Using technology to assess multidimensional learning. Retrieved August 14, 2022, from https://onlinelibrary.wiley.com/doi/am-pdf/10.1111/ejed.12269

Hargrave, M. (2019). Standard Deviation Definition. Retrieved May 20, 2019, from Investopedia: https://www.investopedia.com/terms/s/standarddeviation.asp

Lazaro, J. P. (2018). Strategic Intervention Material (SIM) Effects on Students' Performance in Grade 10 Science Class. Dolores, Eastern Samar: Retrieved from Leyte Normal University.

Orion, N. (2019). The Future Challenge of Earth Science Education Research. Retrieved December 28, 2022, from https://link.springer.com/article/10.1186/s43031-019-0003-z

Pellegrino, J. (2013). Proficiency in Science: Assessment Challenges and Opportunities. Retrieved July 22, 2022, from https://www.science.org/doi/abs/10.1126/science.1232065

Rumsey, D. J. (2018). Why Standard Deviation is an Important Statistic. Retrieved April 28, 2020, from https://www.dummies.com/education/math/statistics/why-standard-deviation-is-an-important-statistic/

Salviejo, E. I., Aranes, F. Q., & Espinosa, A. A. (2014). Strategic Intervention Material-Based Instruction, Learning Approach and Students' Performance in Chemistry. International Journal of Learning, Teaching and Educational Research, 2(1), 91-123. Retrieved April 17, 2019, from https://www.ijlter.org/index.php/ijlter/article/download/10/17

Villonez, G. L. (2018). Use of SIM (Strategy Intervention Material) as Strategy and the Academic Achievement of Grade 7 Students on Selected Topic in Earth Science. Retrieved April 27, 2019, from https://www.researchgate.net/publication/329128554_USE_OF_SIM_STRATEGIC_INTERVENTION_MATERIAL_AS_STRATEGY_AND_THE_ACADEMIC_ACHIEVEMENT_OF_GRADE_7_STUDENTS_ON_SELECTED_TOPIC_IN_EARTH_SCIENCE