Integrating strategic intervention materials (SIM) in Science to low achieving learners

Yolly Ann Aranda[1], Renz Aena Diaz[1], Melbin Sombilon[1], Cheryl Ann F. Gicana[1,2]
[1]*Research Department - College of Education, Arts and Sciences,*
Capiz State University, Pontevedra, Capiz, Philippines
[2]*Teacher Education Department, Capiz State University, Pontevedra, Capiz, Philippines*

ABSTRACT

This quasi-experimental study employed pre-test-post-test research design to investigate the effect of the integration of strategic intervention material (SIM) in teaching grade seven Science to low achieving learners. This study was conducted to determine the pre-test and post-test performances of SIM and non-SIM group, and to find out the significant difference between the performance of the two groups. The researchers used purposive sampling to identify the respondents. After the pre-test, least learned topics were identified. These topics were Substance and Mixture, Metals and Non-metals and Solution. Descriptive and inferential statistics were employed to analyze and interpret the obtained data. Prior to the intervention of the study, the two groups were equivalent in terms of their academic performance in Science. The post-test result of the SIM group was higher compared to the post-test result of the non-SIM group. Also, a highly significant difference was found between the pre-test and post-test performance of SIM group after the conduct of the intervention. The investigation revealed that SIM as an instructional material was effective in teaching grade seven science to low achieving learners.

Keywords:
Science Education, Chemistry
Strategic Intervention Material (SIM)
Quasi-experimental research
Central Philippines

Introduction

As economic, social and cultural changes are taking place faster and faster, it seems clear that education should prepare people to face new situations and changing social conditions so as to satisfy both the individual needs of learners and the collective needs of society.

Science education is also revolutionizing in an answer to the needs of the learners. There is a gradual shift from a teacher-centered classroom to a more flexible learner-centered classroom. The primary goal of student-centered classrooms is to help students become independent. Through student-centered instruction, student can achieve independent minds and the capacity to make educational decisions and value judgments. Weimer (2012) enumerated the five characteristics of a learner-centered teaching. According to her **l**earner-centered teaching engages students in the hard, messy work of learning, includes explicit skill instruction, encourages students to reflect on what they are learning and how they are learning it, motivates students by giving them some control over learning processes, and encourages collaboration. This clearly requires that science teachers to maximize

their creativity to explore different strategies and approaches for better learning and understanding of students of the difficult concepts in science.

However, in the Philippines, DepEd data show that achievement rate of fourth DepEd data show that achievement rate of fourth year students in Science dropped from 39.49% to 37.98% in the same period (TIMSS). In the Trends in International Mathematics and Science Study in 2003, the last time the Philippines participated in this assessment, we scored 378 and ranked 34th of 38 countries (HS II math) and 43rd of 46 (HS II science).

Furthermore, the Philippines ranked 67th of 140 countries in quality of math and science education in the 2015-2016 Global Competitiveness Report of the World Economic Forum, 79th of 138 in the 2016-2017 data, and 56th of 137 in the 2017-2018 data (World Economic Forum, 2017). Guillermo M. Luz (in Kalino, 2017) at the forum on Innovation and Entrepreneurship for a Globally competitive Philippines, presented the disturbing results of the 2010 – 2011 Global Competitiveness Report which showed that Philippines only fared better than Cambodia in the fields of education, science and technology innovation.

These data simply show that Philippine education still have problems that waits to be resolved. Legaspi (2014) published that the unavailability of learning materials is just one of the problems still hounding the country's new basic education program, K to 12 implementations. Lack of classroom instructional materials have a big impact on the teaching and learning process inside the classroom. Dela Cruz (n.d.) stated that the status of instructional materials, equipment and facilities are inadequate, obsolete and dilapidated. Further, she recommended that science, vocational and technology teachers should be resourceful in the selection and utilization of instructional materials that are useful in the concepts that they teach in each lesson.

It is in this very reason, why this study was conducted – to determine the effect of integrating strategic intervention material (SIM) in teaching science to low achieving learners. This study wanted to develop science strategic intervention materials which are based on the students least mastered science topics anchored on the new K to 12 curriculum of the Department of Education.

Specifically, this study sought to answer the following: What is the pre-test and post-test performance of SIM group and non-SIM group? Is there a significant difference in the pre-test and post-test of SIM group? Is there a significant difference in the pre-test and post-test of the non-SIM group? Is there a significant difference in the pre-test and post-test performances of students under SIM group and of students under the non-SIM group? What plan of action can be developed from the result of the study?

This study was anchored on John Dewey and Lev Vygotsky's Constructivist Theory of Learning and Jerome Bruner and Edward Gagne's Cognitive Learning Theory.

Constructivism is a way of teaching and learning that intends to maximize student understanding. Woolfolk (2006) defines it as a teaching that emphasizes the active role of the learners in building understanding and making sense of information. Constructivism is a theory of how learning occurs (Henson, 1996 as cited by Parsons et al., 2000). It is a view that says how people construct their own understanding and knowledge of the world through experiencing things and reflecting on those experiences. When students encounter something new, they reconcile it with previous ideas and experiences. In the classroom, the constructivist view of learning can point towards a number of different teaching practices. The teacher makes sure she understands the student's preexisting conceptions, guides the activity to address them and then build on them. In this study, the researcher made use of students' prior knowledge about a certain science topic (what is known) and guide slow learning students to understand the topic through a developed strategic intervention material in

understanding science concepts which are too difficult for a student or learner to master on his own. Through this, therefore, student's previous knowledge about science concept is enhanced.

Since the Strategic Intervention Materials (SIM) used by the students involved several parts wherein the students worked on, it is in this context that learner-teacher dialogue was observed. It follows from this; constructivists maintain that learners need to be empowered and to have control over the learning process. So, the teacher relinquishes a great deal of authority and becomes a facilitator.

The conceptual model of this study shows the presence or the integration of strategic intervention material to the SIM group and the absence or without the integration of strategic intervention material to the non-SIM group. This was based on the belief that the performance of the participants in science may or may not be enhanced by the intervention. The performances of SIM and non-SIM group were assumed to be dependent on the intervention, or the use of strategic intervention material.

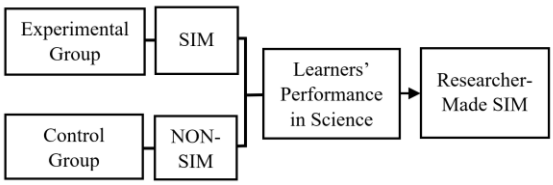

Figure 1. The conceptual framework of the study.

This study was conducted to determine the effect of integrating SIM in teaching grade 7 science to low achieving learners. In particular, the study is significant to the following: Through this study curriculum planners may be able to develop the curriculum in enriching the academic performance of the students to achieve quality education. The result of the study may also serve as a guide for science supervisors in improving and developing instructional methods and identify the factors that cause the weakness in achieving good scientific skills. The result of the study may help the school administration design and plan the appropriate interventions that will fit to the learners' need, specifically those with learning difficulties. This study may be helpful to science teachers in choosing appropriate intervention material in teaching science, and it may encourage other teacher to develop their strategies and methods in re-teaching what is not clear to the students. The result will be helpful in handling their students learning difficulties in science. It may also serve as a guide on how to become effective through the aid or instructional material.

The result of the study may enhance parents' active participation in supporting their children's need as well as in their participation in achieving high academic performance.

Through this study low achieving learners may be able to clarify and clear things. This may help also in coping their learning difficulties towards a certain subject area.

The results may serve future researchers by providing valuable source of data in conducting other studies.

Methodology

In this study, the researchers utilized a quasi-experimental type of research specifically pre-test and post-test design to measure the effect of the integration of SIM in teaching grade seven science to low achieving learners.

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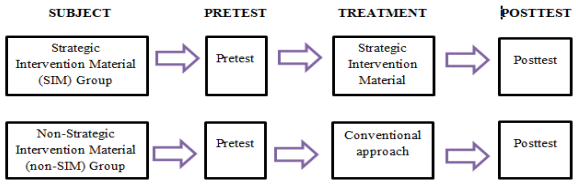

Figure 2. Quasi-experimental design specifically pre-test-post-test design.

Sampling

This study was conducted at one of the public secondary school in the Municipality

Panitan, Capiz. The respondents of this study were the grade seven students who are officially enrolled for S.Y. 2017-2018 in one of the public secondary school in the Municipality of Panitan, Capiz.

The researchers employed a purposive sampling in selecting the respondents to assure that they are low achieving learners. To qualify as one of the respondents of the study, the researchers used the following inclusion criteria: he or she must be a grade seven student of the current academic year, the science grade in the first quarter period must be 79 and below. 135 grade seven students, from different sections, qualified as respondents of the study. Out of 135 qualified respondents, 100 were chosen as samples of the study using the Yamani's formula in identifying the sample size. These 100 samples were then given the pre-test to determine the least mastered science concepts of the first quarter. After the pre-test, low achieving learners were match paired by the researchers to assure that the respondents in both groups have and will start using the intervention on the same level. They were divided into two groups; one group is the experimental or assigned as the SIM group, the other one is the control group or assigned as the non-SIM group. The SIM group was the group that used the researcher-made SIM while the non-SIM group was the group that did not use the researcher-made SIM. Each group was consisted of 50 students or respondents.

On the other hand, those learners who obtained a grade of 80 and above were not included as respondents of the study.

Research Instrument

This study utilized a researcher-made test based on the science curriculum guide in grade seven. Pre-test and post-test were used to measure the science performance of the respondents, the pre-test and post-test consisted of 40 items multiple choice. To ensure that all skills are met and completely distributed, a table of specification (TOS) consisting of topics, skills and corresponding number of items was prepared.

The researcher-made instrument was subjected to validity test with the following experts namely 5 science teachers with master's degree major in science and an expert in the field of research. An item was considered to be valid when all of the validators considered it to be essential and accepted as part of the researcher-made test. After the validation corrections, if there are, were incorporated. The revised and finalized research pre-test-post-test instrument was subjected to pilot testing to the students who were not part of the study but were also categorized as low achievers. After pilot testing, the instrument was subjected to reliability test and obtained the coefficient alpha value of 0.715 using the KR-20 test. In Kuder-Richardson test the scores for KR-20 range from 0 to 1, where 0 is no reliability and 1 is perfect reliability. The closer the score is to 1, the more reliable the test. In general, a score of above .5 is usually considered reasonable (KR20 & Coefficient Alpha, 2007)

The least mastered topics were then identified by the researchers based on the result of the pre-test. Three topics were identified as least mastered by the respondents. These are pure substance and mixture, metals and non-metals, and solution.

Strategic intervention material was then designed and developed by the researchers and integrated to the SIM group or the experimental group of the study. On the other hand, the control group were given the lecture and activities found in the curriculum guide and the learners module in grade seven science

Post-test was given after the application of the intervention.

The Strategic Intervention Material (SIM)

This teaching-learning kit is devised for the benefit of both teachers and students. Its goals are to encourage pupils' interest; learn science concepts and skills; and apply

learned skills and concepts into real life situations.

After determining the least mastered topics in grade seven science, the researchers then developed a strategic intervention material in science using the following format:

Cover Page. The cover page must be creative and attractive to the level of pupils being handled. This must contain the school name and address as the heading. The middle part is the eye-catching but topic related title of SIM. Next to the title part is the level of SIM. The level depends on the grade or year of the students. Lastly, the names of the author/proponents complete the parts of the cover page.

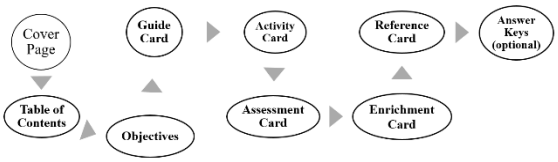

Figure 3. Contents of a strategic intervention material in science

Table of Contents. Like a typical book, table of contents is needed to guide pupils of the contents or pages. This includes the pages of Guide Card, Activity Card, Assessment Card, Enrichment Card, and Reference Card.

Learning Objectives. For every task, list of objectives is very important. This set the goals of every activity. Just like when starting a lesson, SIM needs objectives. Learning objectives give teachers ideas of what to measure at the end of the lesson. This part is composed of the general and specific objectives or tasks.

Guide Card. This part of the SIM gives a preview of what the students will learn and presents the focus skills. It also challenges the learners in performing the task. For catchier Guide Card, an animated icon may be utilized.

Activity Card. This provides the activities that are organized. This is based on the sequence of the focus skills. It also provides examples to concretize the concepts, particularly drawn from real-life experience. It also provides questions and elicits explanations, not one-word answer. This serves as easy-part activities for students.

Assessment Card. This contains a formative assessment which provides exercises to assess their understanding of what they learned and correct errors when appropriate. It also monitors their learning and use feedback about their progress.

Enrichment Card. This provides opportunities for pupils to apply what they have learned in other subject areas or in new contexts. It also provides activities that will support and help child master the concepts presented.

Reference Card. It provides list of resources that will reinforce concepts or skills learned and provide additional content not found in the textbook.

Answer Key Card. This reveals answers to the given activities. This must be covered so that pupils will not be checking or copying the correct answers.

Data Gathering Procedures

In gathering the data for this study, the researchers secured a permission letter from the secondary national high school in the District of Panitan. After the approval of the school administrator, the researchers set the schedule for the intervention. The researchers also secured a permission and set a schedule to communicate with the advisers of grade seven students of their respective school to gather information about their students first quarter grades in Science.

Pre-test was given to the student prior to the interventions, after giving the test and establishing the comparability of the respondents they were divided into two groups; one group for experimental or the SIM group which was subjected to the use of the researcher-made SIM, the teacher's guide and the learner's module. On the other hand, the second group was the non-SIM group which was not subjected to the conventional way of teaching using the learner's module and the teacher's guide only. The class to both groups was arranged and scheduled

during the students' lunch break so as not to interfere with the official class schedule. Also, the researcher's made sure that students' physiological needs were addressed first before the start of the class. This class session took place for two consecutive weeks also in the respondents' school. Lastly, prior to the start of the intervention, parental consents were also sought considering that students will be in school during their lunch break.

The same but re-arranged, test items were given as post-test test after the intervention. After gathering the needed information in this study, the raw data was encoded.

Data Analysis Procedure

The data of the pre-test and post-test performance of SIM group which was the experimental group and the non-SIM group or the control group were gathered and subjected to statistical analysis using the Statistical Packages Social Sciences (SPSS).

Frequency count and means were used in consolidating the respondents' pre-test and post-test performance of SIM and non-SIM group.

In this study, Scores were interpreted using the scale:

Scores	Verbal Interpretation
35 and above	means low achieving learners have mastered the lesson and can explain and describe concepts in science thoroughly.
18 – 34	means that low achieving learners have adequately mastered the lessons and can explain and describe the lesson but not thoroughly
17 and below	means that low achieving learners have not mastered the lesson, cannot explain and describe the lessons in Science

The *t*-test for independent sample was used to test the significant difference between SIM and non-SIM as performance of both groups are independent from each other. In this test two independent means will be compared.

Paired sample *t*-test was used to test the significant difference between SIM pre-test and SIM post-test and the significant difference between non-SIM pre-test and non-SIM post-test. A paired t-test is used to compare two population means where you have two samples in which observations in one sample can be paired with observations in the other sample.

Pre-test performance of the SIM and non-SIM group

Reflected in Table 1 is the pre-test performance of SIM and Non-SIM groups. The performance of the students in the control group is generally low (M = 11.38, SD = 2.88) while the performance of the students in the experimental group is also generally low (M = 11.34, SD = 2.79).

Table 1. Pre-test performance of SIM and non-SIM group.

Group	Mean	sd	Verbal Description
Pre-test			
SIM	11.34	2.79	Low
Non-SIM	11.38	2.88	Low

Difference in the pre-test performance of the SIM and non-SIM group.

Data in the test of significant difference between the pre-test performance of low achieving learners in both SIM and non-SIM groups are presented on table 2. It showed that there is no significant difference between the pre-test performance of low achieving learners of both the SIM and the non-SIM group ($t = 0.070$, $df = 49$, $p = .944$) before the conduct of intervention. This goes to show that before the conduct of the study all of the participants are homogenous in terms of their science learnings. This was done to eliminate bias before the implementation of the researcher-made SIM.

Table 2. Pre-test performance of SIM and non-SIM groups.

Pre-test	Df	Mean	t-value	Sig
SIM	49	11.34	0.070	.944
Non-SIM		11.38		

Note: *$p \leq .05$

Difference in the pre-test and post-test performances of the SIM and non-SIM group

Table 3 reflects the pre-test and post-test performances of both the SIM group and the non-SIM group. A significant difference existed in the performance of both the SIM group (t = -28.623, df = 49, p = .000) and the non-SIM group (t = -3.096, df = 49, p = .003) before and after the intervention was given. Considering their mean scores, students in the SIM group performed low in the beginning but after the intervention gained a satisfactory performance in science. Meanwhile, students in the non-SIM group maintained the low performance before and after the intervention.

Comparing the post-test performance of the SIM and non-SIM group, the SIM group performance increases *(M= 27.98, SD=2.88)* with satisfactory as its verbal description. The non-SIM group's performance on the other hand, remains low *(M=13.08, SD=3.30)*. Based on the data presented below, SIM group obtained a higher post-test score than the non-SIM group. This is probably because of the SIMs which are meant to reteach least mastered topics/concepts and skills were used. On the other hand, the post-test result of non-SIM group remained low maybe because they were not exposed to the use of SIMs.

This result conforms with the findings of the study of Soberano (2011) who mentioned that SIMs were effective in mastering the competency-based skills in chemistry based on the mean gain scores in the post-tests of the experimental and control groups. He found out that there was a positive transfer of learning in both groups. However, the higher mean was observed from the experimental group after the presentation of the intervention materials.

Difference in the Post-test Performances of SIM and non-SIM group

Data on table 4 revealed that significant difference (t = -23.672, df = 49, p = .000) existed between the science performance of the two groups after the implementation of the intervention. The null hypothesis was not accepted, as there exists a very high significant difference (p = 0.000) in the science performance of the two groups. Considering their means, it showed that the post-test mean of students in the SIM group is way higher than the post-test mean of students in the non-SIM group. Although both groups did not reach the 75% passing score of 50, which is 38. This means that students in the SIM group scored better in the post-test than students in the non-SIM group.

Table 3. Pre-test and post-test performances of the SIM and non-SIM group

	df	Mean	sd	Verbal Description	t-value	Sig.
SIM						
Pretest	49	11.34	2.79	Low	-28.632	.000*
Posttest		27.98	2.88	Satisfactory		
NON-SIM						
Pretest	49	11.38	2.88	Low	-3.096	.003*
Posttest		13.08	3.30	Low		

Note: *$p \leq .05$

Post-test performance of SIM and non-SIM groups.

Table below reflects the significant difference in the performance of both the experimental group and the control group after the intervention. It can be noted the there is a significant difference (p = 0.000) between the performance of the two groups. Considering their post-test mean score, the scores of the experimental group is higher compared to the scores of students in the control group. With this, it can be resolved that the use of SIM was effective in improving the science performance of low achieving learners.

Table 4. Difference in the post-test performance of the SIM and non-SIM group.

Post-test	df	Mean	t-value	Sig
SIM	49	27.98	-23.672	.000*
Non-SIM		13.08		

Note: *$p \leq .05$

This result is also related to the studies conducted by Barredo (2012) and Plenos (2014). Barredo (2012) stated in her study that there was a significant difference of the experimental group in the pre-test and post-test. However, higher mean was observed from the experimental group after the presentation of the intervention material. Moreover, Plenos (2014) in her study entitled, "Effectiveness of the teacher-made science strategic intervention material in increasing the performance level of grade six pupils of Bacongco Elementary School in the specified competency", revealed that there was a 100% increase in the passing rate of all pupils who used the science strategic intervention material.

Conclusion

As evidenced by the significant difference and an increase in the performance of students in the experimental group, and the shift form low science performance to satisfactory science performance before and after the intervention, the researchers conclude that the researcher-made strategic intervention materials were effective in improving the science performance of low achieving learners.

Though it was also noted that a significant difference and an increase in students' post-test score in the control group, still their science performance remained low. This shows that still there is a need to exert more effort so that their science performance could be improved. The increase in their score could be attributed to the fact that the subject taught using the learner's module and the teacher's guide is just a repetition of what have been given to them in the previous grading.

Meanwhile, students' in the experimental group improved their science performance from low to satisfactory which clearly shows that the use of teacher's guide, learner's module and the strategic intervention material could greatly help in improving the performance of the low achieving students.

Recommendations

Based on the conclusion given, the researchers would like to recommend the following:

Science teachers to use the developed strategic intervention material in teaching or remediating their low achieving students. In the same manner, science teachers may develop and integrate the use of strategic intervention materials in teaching difficult science concepts to low achieving learners through their in-service trainings.

In addition, school administrators may provide facilities and equipment that would aid teachers, not only Science teachers, in integrating strategic intervention material in their respective classes that can help improve the teaching and learning process inside the four walls of the classroom.

Lastly, it is highly recommended that researches would further the use of SIM in other disciplines.

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