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Utilization of Manipulative and Interactive Strategic Intervention Material (MI-SIM) in Chemistry 9

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ABSTRACT

Variation in students' learning makes the teacher creative in delivering lessons. To cope with the 21st-century learners with different learning styles that learn best through experience, the researcher made an innovation, "Manipulative and Interactive Strategic Intervention Material (MI-SIM)." MI-SIM is a combination of manipulative and interactive instructional tool that aims to improve the Least Mastered Skills in Science. Cluster random sampling was used for the selection of respondents at Manila Science High School. A pretest was conducted before the treatment to the experimental group. Posttest was then initialized after the treatment. Mean Test and Standard Deviation were used to evaluate the MI-SIM's effectiveness. Results showed that it had exceeded standards in sub-tasking and congruence; consequently, it had met the standards in functionality and technicality. The overall evaluation of MI-SIM revealed that it had exceeded standards and was highly acceptable. Analysis of Covariance was used to test the difference in mean posttest scores of students who experienced conventional and MI-SIM teaching methods. Results indicated that the conventional group's mean posttest score was 36.80 (±5.00), while MI-SIM's group was 31.57 (±4.86). The null hypothesis for the covariate pretest score was rejected while the intervention/method of teaching was not. The researcher recommends further study and evaluation of MI-SIM utilization.

Keywords: *Education, Chemistry 9, learning style, manipulative, interactive, intervention and strategy, Philippines*

INTRODUCTION

In a world where change is inevitable, the only constant is modification. In every aspect of life, people modify things to cope with some changes. These quick changes and increased complication of today's world show new challenges and put new strains in the education system (Bar-Yam, Rhoades, Sweeney, Kaput, & Bar-Yam, 2002). To cope with these changes, teachers tend to modify things to hook students' interest which is so limited nowadays. Students' focus is more on gadgets that could distract them in their studies.

In the field of pedagogy, the kind of learners changes as time goes by. These deviations and improvements in technology have led many educationalists to re-evaluate outdated, uniform teaching methods and stress the significance of seeing student's learning styles in the design and provision of course content (Romanelli, Bird & Ryan, 2009). There has been in general an increasing consciousness of the need to alter and improve the preparation of students for creative functioning in the frequently changing and extremely challenging setting (Bar-Yam et al., 2002).

Students of the new generation have different learning styles. Learning styles vary in every person. Some students learn best when things are projected, heard, uttered, moved, rational, groups and alone. Other students gain knowledge through hands-on activities which they can only acquire by experiencing the manipulation of instructional tools. The learners of today exhibit different learning styles. How do teachers cope with this change? The answer is *"innovation."* Innovation develops the creativity of classroom facilitators. This made the researcher to create a simple box used in traditional teaching and modify it into something new to meet the desires of the learners with different learning styles. The "Box of Learning and Fun", that is created by the researcher is equipped with varied manipulative and interactive activities in Chemistry based on the least mastered skills in Chemistry 9.

Manipulative and Interactive Strategic Intervention Material (MI-SIM) is "A Box within a Box", an instructional tool that would aid students in learning chemistry topics the easiest way. It aims to improve the least mastered skills of certain topics in Grade 9 Chemistry.

The study was conducted at Manila Science High School - the Philippines' pilot Science High School. Students in this institution are screened well. For them to qualify in the entrance examination, they should have NO grade lower than 85. They must pass the entrance exam and interview. Though they are selected well, there are still students who find difficulty in meeting the standards of the school. This may be due to the fundamental aspects that further affect their educational performance in school. This made the researcher developed an instructional tool that can support the learners on their academic endeavor, specifically their science subject-chemistry.

Furthermore, most of the respondents belong to the middle-class family. Based on their Form 137, seventy-five percent came from private schools during their grade school. They live in different places such as Laguna, Cavite, Bulacan, Quezon City. Most of them are from Manila. In the class size of thirty-five, half are boys; half are girls. Most of them have a high-intellectual ability, and some of them graduated as valedictorians and salutatorians in their classes, and others are with honors. There are also average students.

FRAMEWORK

This study is governed by the experiential learning theory, which is supported further by social cognitive theory. *Experiential Learning theory* offers an avenue for the growth and development of the individual by learning the process of pedagogy through experience (Kolb, Boyatzis, & Mainemelis 2000). The emphasis is that "experience plays a vital role in the learning process of students."

In the utilization of MI-SIM by the learners, they were able to experience learning by playing a variety of manipulative and interactive activities that promote the application of science concepts which further improve the least mastered skills in that field. Some grasp the learning through *concrete experience* through tangible activities in the different activity cards and assessment cards of the MI-SIM. Others acquire knowledge through *abstract conceptualization* by analyzing the problems to be solved in the activity cards, assessment cards and enrichment cards and methodically planning schemes to get stubs as an incentive for a job well done. Similarly, some students prefer to reflect on what is happening thus observing the process in general – *reflective observation*. In the same way, others are directly involved in the activities - *active experimentation*. This means that though learners learn in different aspects, the ultimate end of this instructional tool is for the students with different learning styles to understand science concepts in great depth.

Social cognitive theory is the other fundamentals of this study for it involves interactive learning. According to this theory, learners gain knowledge by converging environmental factors with personal experience (Bandura, 1986). This is best applied in interventions like strategic intervention material. The researcher modified the old SIM into MI-SIM, creating an innovation that will surely engage learners to improve their academic performance not only in science but in other subjects as well.

On the other contrary, the *diffusion innovation theory* (Rogers, 1995) believes that adoption and rejection are a decision. A process in which innovation is linked through networks over time among the associates of the community. Applying this in this study, it may be generalized that students may fully adopt the MI-SIM and maximize its full potential use or choose not to adopt the innovation. Below are the researches relevant to strategic intervention material that led to the modification of SIM:

Kristine Joan DA Barredo, TII of Tunasan Elementary School conducted a study on *"Development on the Academic Performance in Science using SIM"* that aims to improve the academic performance of her grade four students in science. She conducted an experimental research that tested the effectiveness of SIM in reaching the researcher's goal. The researcher developed a SIM and used it in the experimental group. The control group was exposed to the traditional way of teaching Science. Pretest was also administered. After the intervention, posttest was conducted. Evaluation of pretest and post test results exposed that SIM contributed to the mastery of the presented lesson.

Andy L. Soberano of Muntinlupa Science High School conducted a research study entitled *"SIM in Chemistry: Development and Effectiveness."* She suggested that SIM contributed to the mastery of science concepts. The researcher conducted a true experimental research using pretest-posttest comparison scheme. Respondents were grouped according to their mental ability. They were exposed to Otis Lennon Mental Ability Test to determine their intelligence level. The researcher made a sixty-five-item test. Nine experts from their school validated the teacher-made exam and SIM. Students took the pretest. Intervention using SIM was administered to the experimental group while the control group was subjected to a traditional way of teaching chemistry. T-test was used to treat the collected data. Result presented that there was no significant difference in the pretest score and there was a significant difference in the posttest score of both groups.

Moreover, in the study entitled *"The efficacy of SIM to the achievement in Physics of a selected group of Public-School Students in Las Nieves, Agusan del Norte"* by Fernando T. Herrera and Abraham T. Soriano, SIM was found to be effective as well in increasing the posttest scores of students utilizing the SIM. The main purpose of the researchers' study was to gauge the efficacy of SIM to the achievement in Physics of the selected group of fourth-year students at Mat-I, Las Nieves, Agusan del Norte. The researchers conducted a pretest-posttest quasi-experimental method. The SIM emphasizes on: analysis, design, development, implementation and evaluation – ADDIE model. The SIM further concentrates on the ten suggested Physics topics that were evaluated by credible evaluators and the students themselves.

Another study entitled *"Strategic Intervention Material-Based Instruction, Learning Approach and Student's Performance in Chemistry"* by Edwin L. Saviejo, Fidela Q. Aranes, Allen A. Espinosa revealed that SIM-BI was effective in improving students' performance and learning approach. Fourth-year students were classified into deep learners and surface learners. The researchers carefully studied the records of the students in CLAI – chemistry learning approach inventory and CAT- chemistry achievement test. There were used as the pretest and posttest of the students. Students were then asked to answer student's perception survey which revealed that students wanted to utilize SIM not only on their chemistry subject but also on other subject as well.

Lastly, in the study entitled *"Perspective of Secondary Teachers in the Utilization of Science Strategic Intervention Material (SIM) in Increasing Learning Proficiency of Students in Science Education"* by Leo Peter Narciza Dacumos, five participating teachers from different schools at Baguio City viewed SIM as a "re-teaching tool" and "abridgement tool." One of the teachers quoted that "As a Science teacher, I used the strategic intervention materials to re-teach the lessons which were not so much clear to my students and to help them gain mastery of the topic." In her perspective, SIM can be used as re-teaching tool. Others foresee SIM as abridgement tool for it is a simplification material for challenging lessons.

Most of the related studies of SIMs from varied areas in the Philippines have profound effects both from learners and teachers. It achieves its goal – development of least mastered skills. Researchers visualized it in different perspective, applied it in varied techniques, and used it in different statistics to test the treatment applied in different groups. SIM is found to be effective in improving the academic performance of the students in least-learned concepts in Science. Innovation of this SIM will further hook the attention of the students with different learning styles. This is the focus of the researcher's study – a combination of manipulative and interactive strategic intervention material that is equipped with modules that will guide learners in using the MI-SIM.

OBJECTIVES OF THE STUDY

Learners learn in different ways. Their learning depends on their learning styles. Some students learn best when things are touched, seen, heard and felt. This variation of students' learning makes the teacher more creative in delivering the lessons. These lessons are well-delivered using an instructional tool. This made the researcher create an innovation from an old SIM. The innovation will be compared with the instructional tool used in conventional way of teaching. Specifically, it aimed to: (1) determine the effectiveness is MI-SIM in relation to (a) sub-tasking; (b) congruence; (c) functionality; and (d) technicality; and (2) compare the pretest and posttest scores of students who experienced Conventional and MI-SIM teaching methods.

METHODOLOGY

Use of MI-SIM

Manipulative and Interactive Strategic Intervention Material (MI-SIM) is an innovative instructional tool that primarily aims to develop the least mastered skills in Chemistry 9. Pretest Scores revealed that students had difficulty in the following topics: Mole Concept, Molar Mass and Percentage Composition.

This made the researcher developed an instructional tool that would serve as an intervention for the development of Least Mastered Skills in Consumer Chemistry. The MI-SIM is composed of Guide Card, Activity Card and Assessment Card. It is also equipped with Manual which the Mole Concept, Molar Mass and Percentage Composition, are discussed in detailed.

Figure 1. Guide Card 1

Figure 2 a. Activity Card 1


Figure 2b. Activity Card

Score Sheets were handed to the students prior to the use of MI-SIM. This is where they will paste the collected science badges gained for every correct answer in the activity cards and assessment cards. In Figure 2, the instructions for using the activity card 1 are carefully explained in Guide Card 1. This will lead the students in answering the Activity Card 1 as shown in figure 3.a and 3.b.

The title of the activity is SPIN-NAME-SOLVE. In this activity, students will spin the wheel. First, they need to name the element for the corresponding atomic number and symbol, only then that they can answer the question once the element is identified correctly. Students have only five chances of spinning the wheel. Students will then answer Assessment Card 1 which is shown in Figure 4. Topics enclosed in this segment of "Box of Learning & Fun" is "The Mole Concept."

Figure 3. Assessment Card 1

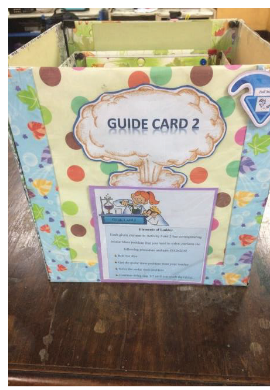

Figure 4. Guide Card 2

In Figure 5, directions for answering the Activity Card 2 are carefully explained in details. Activity Card 2 is shown in Figure 6.a and 6.b below.

Figure 5a. Activity Card

Figure 5b. Activity Card 2

The title of activity card 2 is ELEMENTS OF LADDER. In this activity, learners will roll the dice. The number in the dice corresponds to the moves of the player to the tile from the starting point. Before they can move to the next tile, they need to answer the allotted problem question for each tile. If they get the correct answer, only then that they can roll the dice and will move to the next tile. If the move points to a ladder, they will move up. If the move points to a snake, they will move down. The GOAL is to reach the number 30 elements, only then that the player will win the game. Five players are allowed to play this game. Science badge is acquired for every correct answer. Students will then proceed to answer the Assessment Card 2 as presented in Figure 7 below.

Figure 6. Assessment Card 2

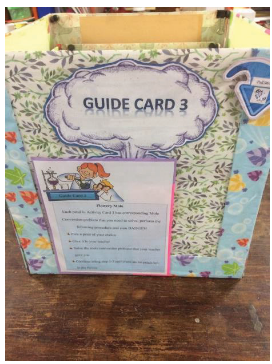

Figure 7. Guide Card 3

Figure 8a. Activity Card 3

Figure 8 above shows the Guide Card 3. In Guide Card 3, procedures for Activity Card 3 are explained in details. The title of Activity Card 3 in Figure 9.a (above), 9.b and 9.c (below) is Flowery Mole. In this activity, students will pick a petal of their choice. Each petal has a corresponding Mole Conversion problem which the students need to answer as prerequisite to the picking of next petal. Students cannot proceed to the next petal if their answer in the previous petal is incorrect. Students are allowed to pick five petals only. Badges are earned for every correct answer in the Mole Conversion problem solving. Students will then answer the Assessment Card 3 as displayed in Figure 9.

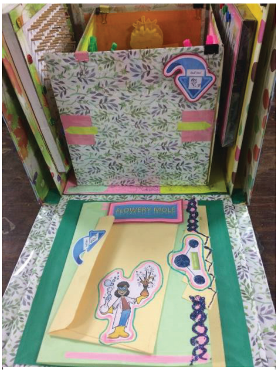

Figure 8b. Activity Card 3

Figure 8c. Activity Card 3

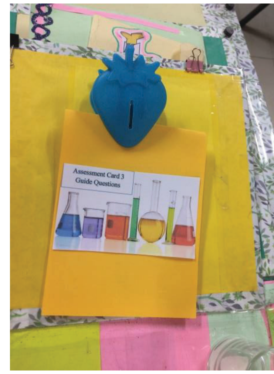

Figure9. Assessment Card 3

Figure 10 illustrates the Guide Card 4. Guidelines in answering Activity Card 4 in Figure 12.a and 12.b are explained in details. The title of Activity Card 4 is Ball in the Hole. In this activity, learners are invited to drop the ball. Each hole contains percentage a composition problem which the students need to answer correctly to drop another ball for the next problem. Students are only allowed to drop the ball five times.

Figure 10. Guide Card 4

Figure 11a. Activity Card 4

Figure 11b. Activity Card 4

This activity will lead the students in answering the Assessment Card 4 as shown in Figure 12.

Figure 1 2. Assessment
Card 4

MI-SIM is also equipped with Guide Card 5, Activity Card 5, Assessment Card 5 and Enrichment Card (placed in a flash drive for interactive activity). It also contains Answer Card which is found in the module and box itself. Enrichment Card is used as additional supplemental activity to enrich the knowledge of the students in difficult subjects in Chemistry.

Answer Card is provided so the teacher and students can directly check whether answers are correct. It is also used to check if they are on the right track in solving problems in the MI-SIM. All the topics are aligned in the K to 12 Standards. Learning Competencies in the said curriculum are implemented in the MI-SIM.

FRAMEWORK

The researcher used the Design-Based Research (DBR) as its research design.

Design-Based Research is an organized but flexible procedure which aims to have a progressive educational practice through iterative inquiry, design, growth, and implementation, based on cooperation of researchers and experts in real-world scenario, and leading to contextually-sensitive design principles and theories (Wang & Hannafin, 2005).

Design-Based Research has seven basic characteristics: "Pragmatic, Grounded, Interactive, Iterative and Flexible, Integrative, and Contextual." *Pragmatic* in the sense that it solves the problem of teachers in teaching the 21st-century learners. It is grounded by theory and real-world context. The research process is *interactive* for it is a collaboration of teachers and students, *iterative* for it involves the computation for mean, standard deviation and Ancova and *flexible* for it can still be modified to provide quality in research study. *Integrative* because it is the combination of research methods. *Contextual* because research is connected with the design process.

Cluster Random Sampling is the sampling procedure used by the researcher. This type of sampling is one in which one in the population of the inquiry has an equal chance of being selected to be contained within sample (Amante, 2008).

The researcher believed that it was the most appropriate sampling technique because it eliminated sampling bias. Two sections from Grade 9 of Manila Science High School were designated arbitrarily using the method of lottery (Crossman, 2017). There were thirty-five students per group.

Data Gathering Methods

The researcher administered a Pretest in the two sections which were randomly selected from Grade 9 students of Manila Science High School. This was directed to determine the least mastered skills in Grade 9 Chemistry. After determining the least mastered skills in Chemistry 9, Manipulative and Interactive Strategic Intervention Material (MI-SIM) was used as an intervention for the improvement of the Least Mastered Skills. It was utilized as an instructional tool. Post Test was then conducted after the intervention. Respondents answered the researcher-made survey questionnaire to evaluate the use of MI-SIM. The science department head and master teachers of the school validated the researcher made survey questionnaire. Data were gathered and tabulated for Pretest and Post Test Exam and Survey Form in MS Excel.

Data Analysis

The data gathered from the pretest and posttest score were treated using the ANCOVA. It evaluated whether the means of dependent variable are identical across levels of categorical independent variable (treatment) while monitoring for the effects of continuous (covariates) variables which were not the main interest in the study.

To analyze the data in the survey form, mean and standard deviation were employed for the treatment to treat the gathered data in the survey questions.

Ethical Considerations

Ethical considerations are important in the research study. It is critical because it helps distinguish right from wrong. This prevents falsification of documents, which is the main goal of the research, honesty in stating the correct data. It is accompanied with ethical behavior that promotes trust, accountability and respect among researchers. This includes copyright, co-authorship and confidentiality.

According to Bell and Bryman (2007), below are the important principles related to ethical considerations:

1. Research participants should not be subjected to harm.
2. Reverence for the self-esteem of research respondents should be prioritized.
3. Permission should be attained from the participants aforementioned to the study.
4. The security of confidentiality of research participants has to be safeguarded.
5. Satisfactory level of discretion of the gathered data should be ensured.
6. Concealment of individuals and groups joining in the research has to be make certain.
7. Any dishonesty or overstatement about the goals and purposes of the research must be evaded.
8. Associations in any forms, sources of subsidy, as well as any possible conflicts of interests have to be stated.
9. Any type of statement relative to the study should be completed with uprightness and clearness.
10. Any type of deceptive info, as well as depiction of primary data results in a prejudiced way must be dodged.

The researcher followed the guidelines listed above for the conduct of this study. One of the most vital ethical considerations in this study was the participation of respondents in answering the pretest and posttest exam, survey form and the use of instructional tool. Respondents participated in their own free will and were fully informed of the research project. Parent's consent were also gathered prior to the conduct of research (attached in appendices) Data were also presented with full honesty.

Timeframe of the Study

Below is the Action Research Work Plan of the study. Timeline is divided into three: Pre-implementation, implementation proper and post-implementation. The researcher is expected to begin on June 05, 2017 and projected to end on October 31, 2017.

Table 1. Action Research Work Plan and Timelines

Pre-implementation	• Making of Pretest • Checking the validity of Pretest • Production of Pretest • Creating a blueprint for MI-SIM • Delivery of Pretest • Identification of Student's Prior Knowledge in Chemistry Concept • Item Analysis • Gathering of Data, Making Graph	•06/05-09/2017 •06/12-16/2017 •06/19/2017 – 08/18/2017 •08/21-25/2017 •08/28-31/2017 •09/04-22/2017
Implementation proper	• Utilization of MI-SIM • (Application of Treatment in two groups) • Delivery of Post Test • Item Analysis • Data Collection	•09/25-29/2017 •10/02-06/2017 •10/09-13/2017 •10/16-20/2017
Post-implementation	• Application of Statistical Treatment in the Gathered Data • Analysis of Data using the degree of significance • Finalization of the Research Paper • Submission of Final Action Research Paper	•10/23-31/2017

RESULTS AND DISCUSSION

Randomly selected respondents were asked to use the MI-SIM. After using the MI-SIM, respondents were asked to answer the researcher made survey by completing the 19-item Likert scale, evaluating the use of MI-SIM in terms of 1) Sub-tasking; 2) Congruence; 3) Functionality, and 4) Technicality. The scoring and interpretation of the data gathered on 1) Sub-tasking; 2) Congruence; 3) Functionality, and 4) Technicality, and overall evaluation, as shown in Table 2, were adapted from the book "Action Research" (Domingo, 2017).

Table 2. Scoring and verbal interpretation

Score Range	Verbal Interpretation	Remarks
4.40 – 5.00	Exceeds Standards	Highly Acceptable
2.80 – 4.39	Meets Standards	Acceptable
1.00 – 2.79	Below Standards	Not Acceptable

Table 3 shows the mean, standard deviations, and verbal interpretations of the participants' evaluation of the use of MI-SIM in relation to the 19 items in the researcher-made questionnaire. Results showed that the use of MI-SIM had "Exceeded Standards" and therefore Highly Acceptable in relation to Items 1 to 4 and Items 6 to 19. In relation to item 5, the activities in MI-SIM had "Met the Standards" and was acceptable, with a mean of 4.37 (±0.68) in relation to Item 5, it was aligned to the K to 12 Content Standards.

Table 3. Mean, standard deviations, and verbal interpretation of evaluation of the use of MI-SIM in relation to the 19-Item Likert Scale (n=35)

Aspect	Mean	SD	Interpretation
Item 1	4.63	0.54	Exceeds Standards
Item 2	4.40	0.64	Exceeds Standards
Item 3	4.54	0.55	Exceeds Standards
Item 4	4.57	0.65	Exceeds Standards
Item 5	4.37	0.68	Meets Standards
Item 6	4.51	0.55	Exceeds Standards
Item 7	4.46	0.65	Exceeds Standards
Item 8	4.66	0.53	Exceeds Standards
Item 9	4.49	0.65	Exceeds Standards
Item 10	4.60	0.60	Exceeds Standards
Item 11	4.40	0.60	Exceeds Standards
Item 12	4.57	0.69	Exceeds Standards
Item 13	4.54	0.55	Exceeds Standards
Item 14	4.40	0.64	Exceeds Standards
Item 15	4.60	0.60	Exceeds Standards
Item 16	4.60	0.55	Exceeds Standards
Item 17	4.57	0.55	Exceeds Standards
Item 18	4.54	0.55	Exceeds Standards
Item 19	4.51	0.55	Exceeds Standards

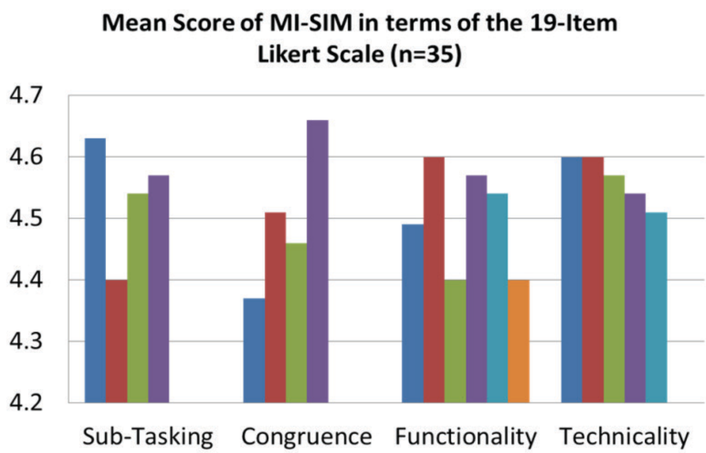

Figure 13. Mean Score of MI-SIM in relation to the 19-Item Likert Scale (n=35)

Similarly, results of the evaluation on the use of Manipulative and Interactive Strategic Intervention Material (MI-SIM) showed in Table 4 that it had Exceeded Standards in terms of Sub-tasking with a mean of 4.41 (±0.10) and Congruence with a mean of 4.40 (±0.10). Data showed that it had Met the Standards in terms of Functionality with a mean of 4.34 (±0.11) and Technicality with a mean of 4.34 (±0.13). Subsequently, the overall evaluation of the MI-SIM showed that it had Exceeded the Standards and was Highly Acceptable with a mean of 4.37 (±0.01).

Table 4. Mean, standard deviations, and verbal interpretation of evaluation of the use of MI-SIM in terms of sub-tasking, congruence, functionality, technicality, and overall evaluation (n=35)

Aspect	Mean	SD	Interpretation
Sub-tasking	4.41	0.10	Exceeds Standards
Congruence	4.40	0.10	Exceeds Standards
Functionality	4.34	0.11	Meets Standards
Technicality	4.34	0.13	Meets Standards
Overall Evaluation	4.37	0.01	Exceeds Standards

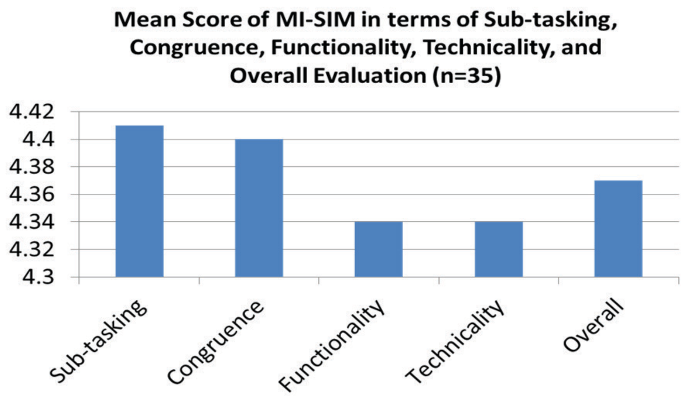

Figure 14. Mean score of MI-SIM in terms of sub-tasking, congruence, functionality, technicality, and overall Evaluation (n=35)

The box plot (Graph 3) below showed that the mean pretest and posttest scores of students who experienced Conventional teaching method appeared to be higher than the students who experienced the MI-SIM method. While the pretest scores appeared to be normally distributed, the posttest scores appeared to be not normally distributed and negatively skewed, a suspected outlier seen among the MI-SIM group.

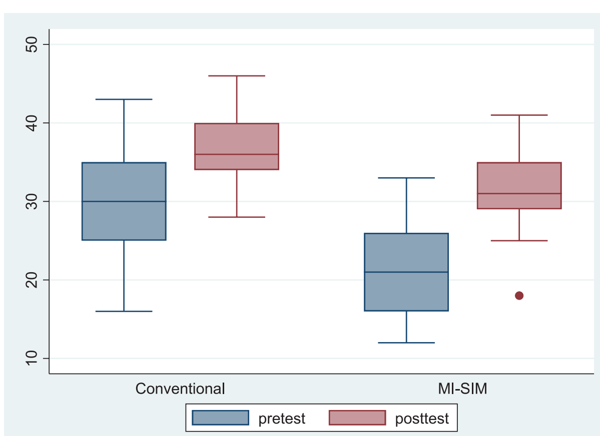

Figure 15. Box Plot of Pretest and Posttest Scores of Students in Conventional and MI-SIM Methods

Consequently, Table 5 showed that the mean pretest score in conventional group was 29.63 (±6.43), while the mean pretest score in MI-SIM group was 21.49 (±6.05). Similarly, the conventional group's mean posttest score was 36.80 (±5.00), higher than that of the MI-SIM's group mean posttest score of 31.57 (±4.86).

Table 5. Pretest and posttest scores of students in conventional and MI-SIM methods

	Conventional (Mean, SD)	MI-SIM (Mean, SD)
Pretest	29.63 (6.43)	21.49 (6.05)
Posttest	36.80 (5.00)	31.57 (4.86)

CONCLUSIONS

Analysis of Covariance was used to test the difference in the mean posttest scores of students who experienced Conventional and MI-SIM teaching methods, taking into consideration their pretest scores, the following conclusions were made:

The researcher reject null hypothesis for covariate, pretest scores ($p=0.0001$) however, the null hypothesis for intervention/method of teaching ($p=0.08$, $\alpha=0.05$) was not rejected.

While the researcher could say that pretest and posttest scores differed significantly, there is not enough indication that the posttest scores vary between Conventional group and the MI-SIM group. When adjustment for Pretest scores was made, results indicated no statistical difference in the Posttest scores of students who experienced Conventional Method and those who had MI-SIM ($p=0.08$, $\alpha=0.05$).

Checking for the assumptions of ANCOVA in terms of equality of slopes, there was no evidence of unequal slopes ($F=0.10$, $p=0.75$). Further, there was inadequate evidence to say that the data is not normally distributed; however, checking for the assumption of homoscedasticity, there appeared to be a defilement of the assumption.

Table 6. ANCOVA on posttest scores of students in the two groups and their pretest scores

Source	Partial SS	df	MS	F	p
Model	834.12	2	417.06	21.49	<0.0001
Teaching Method	61.31	1	61.31	3.16	0.0801
Pretest Scores	355.70	1	355.7	18.33	0.0001
Method * Pretest	1.95	1	1.95	0.1	0.75
Error	1300.47	67	19.41		
Total	2134	69	30.94		

R Squared = 0.3908 (Adjusted R-squared = 0.3726)

p significant at < α=0.05

Moreover, survey results revealed that, evaluation of Manipulative and Interactive Strategic Intervention Material (MI-SIM) had "Exceeded the Standards" and was Highly Acceptable, with the aspects of Sub-tasking, Congruence, Functionality, and Technicality.

Table 7. Action Plan in MI-SIM Utilization

Goals/Objectives	Strategies/Activities	Time Frame	Persons Involved	Expected Output	Clientele
I. Pupils Development • Engage students in seminar workshop about topics in Chemistry that they find hard to grasp. • Take active participation in Peer Tutoring • Provide seminar workshop in making modules	• Cooperative Learning Group Activity (CLG) • Interactive Activities • Manipulative Activities • Modular Activities	June to March	Pupils / Teachers/ Administrators	Increased Academic Performance in Chemistry Student-Made Module (per quarter)	Pupils

II. Teachers Development • Provide seminars that will develop the skills of teacher in making instructional tool • Involve teachers in LAC session to properly address the needs of students in their respective classes (every month)	• Seminar Workshop in Instructional Tool • Seminar Workshop in writing • Seminar Workshop in Action Research • LAC session about the conduct of Action Research • Enrolment in graduate studies for professional development	July August September October June to March	Teachers/ Administrators	Developed Skills in writing modules Improved Skills in creating Instructional Tools	Teachers

RECOMMENDATIONS

Teachers should understand how the learners learn for them to be able to create the right instructional tool to be used for each of them. This will also encourage good teacher-student relationship. Based on the findings above the following commendations were made:

School Administrators. The findings of this study may aid them in developing appropriate action plan suited to the needs of diverse learners. Developed instructional tools will also elevate the quality education that public schools portray.

Curriculum Makers. Results of this study may help them in creating curriculum thus improving the academic performance of learners to attain excellence in education.

Science Supervisors. Outcomes of this study may serve as enzyme in refining instructional methods. This will also guide them in looking at the GAP in making of instructional tools. It will further provide assistance in the implementation of strategies and other assessments necessary to obtain quality education.

Science Teachers. Commendations of the students in using MI-SIM will encourage them in creating and innovating instructional tools that will upgrade their strategies in the teaching-learning process.

Parents. Discoveries of this study may boost parent's active contribution in assisting the needs of their child. It will further mend their rapport as devotees and associates of the school in attaining substantial academic performance of their children.

Pupils. Effects of this study may be of great help to pupils. It could give them inspiration on how to manage their difficulties and persuade them to study hard to overcome their weakness in Science.

Future Researchers. This study may be of great significance for they can outsource data while conducting their own studies.

Overall, the researcher recommends further study, modification and evaluation of the use of MI-SIM.

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