International Journal of Open-Access, Interdisciplinary & New Educational Discoveries of ETCOR Educational Research Center (iJOINED ETCOR)

Effectiveness of ICT-Based Strategic Intervention Material (I-SIM) in the Acquisition of Science Concepts in Grade 4

Erick L. Medrano
Department of Education - Schools Division of Ilocos Norte, Philippines
*Corresponding Author e-mail: *erick.medrano@deped.gov.ph*

Received: 12 October 2022 **Revised**: 25 October 2022 **Accepted**: 10 December 2022
Available Online: 11 December 2022

Volume I (2022), Issue 4, ISSN: 2945-3577

Abstract

Aim: For learning to become optimum, instructional materials must be meaningful, relevant, and appropriate to address the diverse needs of the learners. Thus, this study was conducted to investigate the ICT-Based Strategic Intervention Material (I-SIM)'s effectiveness in acquiring Science concepts in Grade 4.

Methodology: This study was anchored on a quasi-experiment employing the two-group pretest and posttest research design. Twenty-two (22) Grade 4 learners were involved in the study. A 30-item teacher-made concept test was used to determine the respondents' conceptual understanding level. Moreover, a semi-structured survey questionnaire was used to elicit feedback from the learners after using the I-SIM. Mean and t-test were utilized to interpret the quantitative data and thematic analysis for the qualitative data.

Results: The findings showed that the level of conceptual understanding of the Grade 4 learners exposed to I-SIM was higher than those who were not. Moreover, there is a significant difference between the conceptual understanding of the two groups. This means that the experimental group performs better than the control group. Additionally, the interview result showed that learners' feedback or responses after using the I-SIM were categorized into cognitive, affective, and psychomotor aspects.

Conclusion: The use of technology had a positive impact on the learners in the acquisition of concepts. Therefore, I-SIM has an interactive feature that improves the conceptual understanding of Grade 4 learners. As a recommendation, the schools should employ I-SIM as a learning resource to improve learners' conceptual understanding of Science.

Keywords: Information Communication Technology, Strategic Intervention Material, Instructional Material Development, Science Concept Acquisition, Least Mastered Competency, Grade 4 Science

INTRODUCTION

Nowadays, the search for better instruction is one of the major concerns of every educator. Hence, new emergences and research on teaching strategies and instructional materials development evolved (Dizon & Sanchez, 2020). Today, our country is confronted with vast knowledge from many disciplines in and out of the classroom. An immeasurable value of ideas reaches contemporary learners quickly. This knowledge is essential to keep pace with the fast-changing world and improve difficulties of adjustment post by rapidly transforming society.

Filipino learners need lifelong learning to survive and meet the challenges of the 21st century. Empowering learners through innovative and interactive learning materials and strategies is needed to attain functional literacy. However, our educational system is in a state of degradation. Many confounding problems hinder the performance of Filipino learners. The 2003 Trends in International Mathematics and Science Studies (TIMMS) achievement test revealed the poor performance of learners. Of the 45 countries, the Philippines ranked 41st in Science (Philippine Star, 2005). More so, the 2006 National Achievement Test showed poor performance of learners in both elementary and secondary schools and failed to meet the 75% passing rate. Luistro (2012) presented the cohort survival rate of Filipino learners: for every 100 school children enrolled in Grade 1, only 51 will graduate. These scenarios revealed the actual and dismal performance of Filipino learners. This means that the educational system in our country does not empower learners for self-sufficiency and lifelong learning. This situation is alarming and signifies a severe effect on society.

Today, the basic objective of teaching is to provide pupils with suitable and effective instruction. Thus, the Science teacher's responsibility is to create and offer the essential materials for use in science lessons (Dy, 2011). Teaching chemistry is more effective when available, sufficient, and strategically developed educational materials matched to the student population. Instructional strategies may succeed or fail depending on the student's learning requirements. Teachers must address the emotional needs and learning styles of their students. Creating instructional materials is a crucial component of the teaching-learning process. According to Dahar 2011, the use of instructional materials substantially correlates with the academic performance of secondary students.

For one, developing instructional materials is necessary and timely. The K to 12 Basic Education Curriculum emphasized integrating information and communications technology in the teaching and learning of Science. In this context, ICT-Based Strategic Intervention material was introduced to help learners achieve functional literacy in Science. The I-SIM is a prescribed instructional material by the Department of Education to improve learners' performance. This undertaking utilized an intervention suited and aligned to 21st-century teaching and learning.

Therefore, it is imperative to conceptualize and develop innovative and interactive learning materials like ICT-Based Strategic Intervention to uplift learners' performance (Sanchez & Sarmiento, 2020). Through this innovation, learners will be motivated to learn and sustain their interest in exploring scientific concepts.

Statement of the Problem

This research aimed to determine the effectiveness of the I-SIM in acquiring Science concepts in Grade 4.

Specifically, it answered the following questions:

1. What is the level of conceptual understanding of the Grade 4 learners in Science in the control and experimental group before and after the intervention?
2. Is there a significant difference in the conceptual understanding of the Grade 4 learners in Science in the control and experimental groups before and after the intervention?
3. What is the feedback of the Grade 4 learners after using the ISIM?

Research Design

This quasi-experimental study used the pretest-posttest research design with control and experimental groups. According to Creswell (2014), this design determines the causal relationships by applying a treatment or condition to one group and comparing the outcome. This design fits the study because it involved two groups of learners, the control and experimental, to determine the effectiveness of I-SIM in improving conceptual understanding in Grade 4 Science.

Population and Sampling Procedure

The participants of the study involved twenty-two (22) Grade 4 learners of Quiaoit Memorial Elementary School in the Schools Division of Ilocos Norte. The experimental and control group consists of eleven learners each.

Before administering the intervention, the researcher administered a diagnostic test. The scores were analyzed using a t-test. Consequently, the results showed that the two groups had no significant differences in their level of performance in Science. Table 1 shows the distribution of the Grade 4 learners.

Table 1 Distribution of the respondents

Group	f
Control	11
Experimental	11
Total	22

Instrumentation and Data Collection

Before the study, the researcher asked permission from the authorities, particularly the division superintendent and school principal. After the approval and administration of the intervention, a diagnostic test was administered, and learners were ranked according to their scores. In the ranking, all learners with even numbers were grouped the same as those with odd numbers. Using a tossed coin, Group 1 was considered the experimental group, while Group 2 was the control.

A validated 30-item concept test on skeletal and muscular systems was used to determine the respondents' conceptual understanding level. It was utilized as the pretest and posttest assessment tool in the study. Also, a semi-structured survey questionnaire was employed to elicit respondents' responses to the ISIM feedback.

The quantitative and qualitative data were gathered, tabulated, analyzed, and interpreted using different statistical tools.

Data Analysis

Data were analyzed and interpreted using different statistical tools to answer the questions posed in this study.

For the level of conceptual understanding, the following categorization was used;

Range of Mean	**Descriptive Interpretation**
24.01-30.00	Outstanding (O)
18-01-24.00	Very Satisfactory (VS)
12.01 - 18.00	Satisfactory (S)
6.01 - 12.00	Poor (P)
0.00 - 6.00	Need Improvement (NI)

T-test was used to describe the significant difference between the respondents' pretest and posttest mean scores. On the other hand, thematic analysis was utilized to interpret the data gathered on the feedback of the respondents after using the I-SIM.

RESULT AND DISCUSSION

RESULT

Pretest and posttes mean scores of the Grade 4 learners in Science before and after using the ISIM

Table 1 contains the mean scores of both the control and experimental groups in their pretest and posttest. These scores are evaluated based on the categorized level of conceptual understanding of Science concepts. The control and experimental groups' pretest results are 6.45 and 6.36, respectively, both of which are under the poor level. However, the posttest result from the control group is 15.55. This is better than their pretest; it is significantly lower than the experimental group, with a result of 24.27. The experimental group is at the outstanding level, while the control group is at the satisfactory level.

Table 2. Pretest and posttest results of control and experimental groups with corresponding levels

Group	Pretest	Level	Posttest	Level
With ISIM	6.45	Poor	24.27	Outstanding
Without ISIM	6.36	Poor	15.55	Satisfactory

Significant difference between the pretest and posttest mean scores of the Grade 4 learners before and after the exposure to ISIM

Table 2 reveals a significant difference between the conceptual understanding of Grade 4 learners in Science in the control and experimental group, as indicated by the significance value of .0001. The calculated t-value is 4.098. In addition, the mean difference of 5.08 is significant at a 0.05 confidence level.

Table 3. *Significant difference between the level of conceptual understanding of Grade 4 learners after the exposure to ISIM*

Mean Difference	t-value	p-value	Interpretation
8.72	4.8048	0.0001	Significant

Feedback from Learners after using the ISIM

The table below shows the extracted responses and emerging themes of the Grade 4 learners after using the ISIM. Using the thematic analysis, three (3) emerged themes were culled out from the responses. These are the following: cognitive, affective, and psychomotor.

Table 4. Feedback from Learners after using the ISIM

Extracted Responses	Extracted Responses
• *Maawataknga sigu ddagitay topics. (I can easily understand the topic) – Student C* • *Napintasdagitoy presentations na. Al-alistokmapick-up kasi adda pictures na. (I am amazed by the presentations. I can easily pick up the concepts because of the images) – Student K* • *Basbassittibasaensaanngakaslalibro. (I read shorter text, not like a book.) – Student A* • *Nalaklakati activities na. (It has easier activities) -Student D*	Cognitive
• *Makainspire ken makapaguyugoyriknangaaglearn pay ti concepts ti science. (I am inspired and encouraged to learne the concepts)- Student I* • Alistongamasursurodagiti direction na. (I can easily understand and follow the direction) • I had fun reading and doing all activities – Student E • *Alistokmasungbatandiay application part na kasi mairelate ko jay experience ko. (I can easily respond and answer the application part because it is related to my experience) Student B* • *Maapreciate ko detoy ISIM ngemMaymayatsiguro no maiyawid mi jay balay ta mabalin kami agpatulong ken parents mi. (I appreciate the ISIM but it is better when it is done at home with the help of my parents.)-Student F*	Affective
• *Pwedengi-print for future use gaya ng gagawing reviewer. (We can print the material for future use like the reviewer.- Student G* • *Nakakatuwayongmga image nagumagalaw. Minsan nagdodrawing din ako. (I like and love the images/picture, actually it inspire me also to draw.) -Student H* • *I can demonstrate the concepts on my own, like drama,*	Psychomotor

especially on how to take care of our bones and muscles – Student J • *The ISIM can help me improve my computer and typing skills.- Student A*	

DISCUSSION

Pretest and posttest mean scores of the Grade 4 learners in Science before and after using the ISIM

Twenty-two (22) Grade 4 learners received the same pretest covering muscular and skeletal systems competencies. Before the utilization of the intervention, the conceptual understanding of the Grade 4 learners towards the lessons in Scienceisnot satisfactory. Consequently, this implies that learners encountered hindrances in understanding and analyzing the concepts, situations, and information presented in the lesson as their category falls under the poor level. After the intervention, an improved test result was observed, as reflected in the posttest scores. The group that experienced the intervention had significantly better improvement than the other. However, the conceptual understanding of the Grade 4 learners exposed to the use of ISIM has improved from a poor level to an outstanding level.

The standard teaching method affects students' performance. According to Ahlfeldt et al. (2005, p.6), educators want to engage pupils in learning. This requires an effective technique or strategy that encourages learners to interact, increase their conceptual understanding, and realize its value and importance.

This investigation confirms Dahar(2011), Salviejo et al. (2014), and Anadia et al. (2016) that the strategic intervention material is effective, and their findings showed that SIM boosted student performance.

Significant difference between the pretest and posttest mean scores of the Grade 4 learners before and after the exposure to ISIM

As reflected, there was a significant difference in the level of conceptual understanding of the learners before and after their exposure to ISIM. Thus, this proves that the intervention successfully comprehended and understood the Science concepts. From the result, the learners generated an outstanding level in the posttest. The researcher observed that the learners could easily answer the questions and interact with their classmates after the intervention. Moreover, they can also participate in class discussions. The analysis of the study specified that the ISIM in teaching stimulated and motivated the learners' conceptual understanding. This only means that immersion to an intervention, that of an experience for example, promotes progress (Sanchez, 2022).

According to Hake (1998), learners' experience is a potential catalyst for comprehending complicated concepts, with various activities related to the diversity of mental processes. This is also a similar point emphasized in Sanchez, et al. (2022). Learners are more motivated when they can contribute actively (Marx et al., 2004). Moreover, Delacruz (2008), Soberano (2009), and Gultiano (2012) suggested that interactive strategic intervention materials generate and maintain enthusiasm in the teaching and learning of Science.

Feedback From Learners after using the ISIM

Cognitive. This theme arose from the extracted responses of Grade 4 students who completed the ISIM. This indicates that I-SIM assisted students in comprehending and analyzing the presence of subjects and concepts. In addition, the content utilized terms and other information appropriate for their reading comprehension level. In addition, the ESIM's activities and tasks were transparent and suited to the learners' needs.

According to Lagata (2012), the Strategic Intervention Material enhanced learners' ability to spot errors and evaluate cause-and-effect linkages. Diverse educational resources facilitate learning. According to Dacumos (2015), strategic intervention materials can be used as a condensing technique to assist students in concentrating on the fundamental scientific concepts required for science competency.

Affective. This topic shows that the ISIM inspired and motivated students to read and complete the integrated activities. Several studies support this outcome. According to Togonon (2011), most students find science subjects interesting, mainly if the instructional materials are well-designed. According to Barredo(2013), SIMs are essential for enhancing students' retention of subject matter, maintaining their interest in learning, and integrating lessons into their real-world experiences, because students identify with the characters they see in the videos, films and other audio-visual materials.

According to Barredo (2014), SIMs are essential for enhancing students' retention of subject matter, maintaining their interest in learning, and integrating lessons into their real-world experiences, because students identify with the characters they see in the videos, films and other audio-visual materials.

Psychomotor. The fourth-grade students stated that using ISIM had helped them increase their conceptual comprehension because the content was simple to operate and had an aesthetically pleasing graphic appearance. Moreover, the students loved participating in and responding to the interactive activities and computer-assisted training Javier-Villareal (2013).

According to Romano's (2015) research, learners choose things that pique their curiosity. Students love manipulating complex scientific concepts as a means of understanding them. As a result, teachers are urged to be as creative as possible while developing a successful SIM that will assist students in enhancing their science skills.

CONCLUSION AND RECOMMENDATION

After thoroughly analyzing the gathered data, the researchers concluded that the ICT-Based Strategic Intervention Material is a more effective teaching strategy for acquiring Science concepts than the traditional teaching method. The utilization of the ISIM benefits learners in terms of the cognitive, affective, and psychomotor aspects.

In light of the findings and conclusion of the study, it is recommended that teachers adopt ISIM in the teaching and learning of Science concepts. Also, the development and validation of ISIM be included as one of the topics during School-Based LAC Sessions.

REFERENCES

Ahlfeldt, S., Mehta, S., & Sellnow, T. (2005). Measurement and analysis of student engagement in university classes where varying levels of PBL methods of instruction are in use. Higher Education Research and Development, 5-20.

Anadia, A J., & Membrebe, B N. (2016). Improving student achievement for Science in grade seven using strategic intervention materials (SIM). Science Education and Teaching.

Barredo, K. (2013). Development of academic performance in Science using strategic intervention material. Unpublished Action Research. Schools Division of Muntinlupa City. Department of Education, National Capital Region. 8.

Barredo, K. (2014). Evaluating the effectiveness of strategic intervention material in improving the academic performance in science strategic intervention material. Unpublished Action Research. Schools Division of Muntinlupa City. Department of Education, National Capital Region.

Bernardo Portillo III. "Finding Probability" (E-SIM): A Tool to Develop Mastery in Solving Mendelian Genetics & Basic MS Application. Journal of Innovations in Teaching and Learning. 2021; 1(2):83-86. DOI: 10.12691/jitl-1-2-4.

Cordova, R., Medina, J. G., & Ramos, T. (20019–06-19). Effectiveness of Competency-Based Strategic Intervention Materials in English 7. Dlsu.edu.ph https://www.dlsu.edu.ph/wp-content/uploads/pdf/conferences/research-congress-proceedings/2019/lli-II-019.pdf.

Cubillas, T. (2018). Usability validation of strategic intervention materials (SIMs) in teaching elementary English 4. Retrieved from https://www.journalijdr.com.

Dacumos, L.N., (2015) perspective of secondary teachers in using Science strategic intervention material (sim) to increase students' learning proficiency in science education.

Dahar, M. (2011). Effect of the availability and the use of instructional material on academic performance of students in Punjab, Pakistan. Euro Journal Publishing Inc.

De Jesus, R. G. (2019) Improving the Least Mastered Competencies in Science 9 Using "Pump It Up!" Electronic Strategic Intervention, Unpublished Action Research, Material Manuel Luis Quezon High School

Dela Cruz, E. (2008) strategic intervention material on ecological concepts, Unpublished Master's Thesis, Mariano Marcos State University

Dela Cruz, R. S. (2012). The science dilemma in Philippine schools. Retrieved from http:// www.mb.com.ph/articles/374863/thescience-dilemma-philippine-schools

DepEd Memorandum no. 117 s 2005. Training Workshop on Strategic Intervention Materials for Successful Learning.

Dios, A. (2014). Philippine Basic Education: Philippines DepEd , six months into school year , # Textbooks. Retrieved http://philbasiceducation.blogspot.com/2014/12/philippine-deped-six-months-intoschool. html on January 3, 2015

Dizon, E., & Sanchez, R. (2020). Improving Select Grade 7 Filipino Students' Reading Performance Using the Eclectic Model. Journal of World Englishes and Educational Practices, 2(2), 216-221

Dy, Jocelyn O. (2007). Strategic intervention materials (SIM) in teaching Science IV (Physics). Retrieved from http://jhody.hubpages.com/hub/teaching-physicsthrough-strategic-intervention-materials-sim

Escoreal, A. (2012), Strategic intervention material a tool to reduce least learned skills in grade four Science.

Gultiano, A. (2012). Effects of strategic intervention material (SIM) on the academic achievements in Chemistry of public high school students. Retrieved fromhttp://www.slideshare.net/neoyen/strategic-intervention-material.

Hake, R. (1998). Interactive-engagement versus traditional methods: A six-thousand-student survey of mechanics test data for introductory physics courses. American Journal of Physics, 66

Javier-Villareal, S. (2013). The effectiveness of intervention materials in improving learners' competence in grade 7 students in biology.

Lagata, G. A. (2012). Instructional leadership and school achievement: Validation of a causal model. Educational Administration Quarterly, 26, 94-125.

Marx, R. W., Blumenfeld, P. C., Krajcik, J. S., Fishman, B., Soloway, E., Geier, R., & Tal, R. T. (2004). Inquiry-based Science in the middle grades: Assessment of learning in urban systemic reform. Journal of Research in Science Teaching.

Plenos, J. (2015). Effectiveness of the Teacher-Made Science Strategic Intervention Material in Increasing the Performance Level of Grade Six Pupils of Bacongco Elementary Schools in the Specified Competency.

Sanchez, A. M. P. (2022). HR Practitioners' Perceptions on Boosting Employees' Loyalty and Commitment: Inputs for a 21st Century-Responsive Human Resource System. International Journal of Open-access, Interdisciplinary and New Educational Discoveries of ETCOR Educational Research Center (iJOINED ETCOR), Vol. I, Issue 4, 89-102.

Sanchez, R., & Sarmiento, P. J. (2020). Learning together hand-in-hand: An assessment of students' immersion program in a schools division. International Journal of Research Studies in Education, 9(1), 85-97 DOI: 10.5861/ijrse.2020.5809

Sanchez, R., Sarmiento, P. J., Pangilinan, A., Guinto, N., Sanchez, A. M., Sanchez, J. J. (2022). In the Name of Authentic Public Service: A Descriptive Phenomenological Study on the Lives of Filipino Teachers in Select Coastal Villages. International Journal of Open-access, Interdisciplinary and New Educational Discoveries of ETCOR Educational Research Center (iJOINED ETCOR), 1(1), 35-44

Salviejo, E.I., Aranes, F., & Espinosa, A. (2014) Strategic intervention material-based instruction, learning approach and students' performance in chemistry. International Journal of Learning, Teaching and Educational Research. Vol 2, No. 1, On 91-123.

Soberano, A. (2009). Strategic intervention materials in chemistry: Development and effectiveness. Muntinlupa: SEAMEO RECSAM Sun.Star Pampanga (2017). Strategic Intervention Materials (S.I.M.) For a Change. Retrieved March 24, 2017

Togonon, I. (2011). Development and evaluation of Project-based SIM (PB-SIM) in teaching high school chemistry. Master's Thesis. Technological University of the Philippines