International Journal of Business, Law, and Education
E-ISSN : 2747-134X
Publisher: IJBLE Scientific Publications Community Inc.
Volume 5, Number 1, 2024
https://ijble.com/index.php/journal/index

Computer-Aided Strategic Intervention Material (CA-SIM) in Chemistry 7

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ABSTRACT
This research study developed Computer-Aided Strategic Intervention Materials (CA-SIM) in Chemistry 7 to promote students' academic performance in science. The study aimed to answer four specific questions related to the format, steps in development, acceptability, and attitudes towards the CA-SIM. The study utilized a descriptive-developmental design and employed survey questionnaires and evaluation checklists for experts and students as research instruments. The data revealed that the CA-SIM is highly acceptable and satisfying for both teachers and students, with a rating of 2.57. The CA-SIM has ten lessons based on the competencies given by the new curriculum and follows the ADDIE model. The study concludes that the CA-SIM is a modern and effective way to teach Chemistry 7, making teaching and learning easier and more enjoyable. It is recommended that teachers can modify the CA-SIM based on learners' needs and contextualize the materials. The study provides a useful reference for other schools and teachers who teach Chemistry 7.

Keywords: Computer Aided Strategic Intervention Material (CA-SIM); Academic Performance; ADDIE Model; Contextualization, Teaching and Learning;

INTRODUCTION

Developing countries such as the Philippines try to bring a new point of view in the education system. Instead of rote, unproductive and passive learning, the education system focuses more on productive, searching, innovative and active learning. The perception of traditional teaching methods has been left and the perception of growing student-centered information searching, free, productive individuals has become a more accepted approach in education (Akcay et al, 2011). Today the traditional teaching method's inability to respond to the expectations bring about the necessity of change in the education system. One of the new technologies commonly used in education is computer which is considered as the most effective communication tool (Calmnlbur, 2008). People are adapting to gradually completing community teaching and learning activities' regulation to meet necessities of the individuals and to make it productive hence, the use of computers in education becomes essential. However, evaluating individuals' attitude towards computers has become imperious (Hannefin & Peck, Acar, 2011).

Use of computers in the field of teaching and learning has brought about the concept of Computer Aided Instruction (CAI). CAI means use of computers to make students more successful in the process of teaching -learning. It is said that students' recognition of their mistakes and deficiency via interaction, taking feedback and control of their own learning, to make students more concerned with the lessons with the help of graphics, sounds animations and diagrams using computers can be called CAI (Baki 2004 et. al). The method of computer-aided instruction is also accepted as a teaching method which is a self-learning principle unifying with computer technology (AbuSeileek, 2012; Celik& Yesilyurt, 2013).

The 2017 National Achievement Test result of Hobo National High School showed that the performance level of students in Science fell into a 34.24 Mean Percentage Score (MPS) which is below the 75 percent baseline. This result showed a decline in the NAT performance of the school as compared to the previous school year's result. Relative to this, the Department of Education issued Division Memorandum No.117, series of 2005 entitled "Training Workshop on Strategic Intervention Material (SIMs) for Successful Learning" which provided Secondary Science teachers the training in the preparation of Strategic Intervention Materials. (www.phillipinesbasiceducation.us,July 2017).

The teachers as well as the students are having a hard time to master the competencies in Chemistry 7 that is why DepEd provides teachers seminars and trainings to further develop themselves as an effective facilitators in Science and to use effective instructions parallel with the modern world trend (Solomo, 2019). This is one reason why the educational institutions must provide effective instructional design for the betterment of the Filipino learners.

Computer-aided Instruction is using computers in the teaching and learning process in an educational environment. The teachers' realization of activities such preparing the educational environment, recognizing the students' talents, individualizing appropriate to students' talent, steering, training and repetition requires them to use the computer according to the construction of the subject they will teach, the teaching aims they predetermined and the use of computer in different places, times, and ways (Ogut et al). However, in CAI, computers' involvement in the teaching environment is not an option to replace teachers but to complete the system and strengthen it is a basis (Usun, 2004 et. al).

Many researchers developed and studied innovations in teaching which improve the performance of the students. But because of modernization, technologies are becoming vast in many ways and most of the time utilized in teaching because of the easy way of teaching-learning process. Use computers and other similar gadgets are found everywhere offering different kinds of games that could easily attract the attention of young children. These materials attract the students' attention more which make them deviate from their studies. These scenarios greatly affect their performance in school which may result in poor academic performance. It is for these reasons that this study is conducted.

Internationally, educational researchers have expressed high expectations for the computer and technology in improving the teaching and learning of Science. The utilization of technology in science classrooms can range from simple information delivery and drill-and-practice exercises to an environment of authentic practices and problem solving. Falabi (2010) cited that science education promotes the development of the thinking skills, learning process and positive attitudes required for life-long learning that is why science teachers should provide and give the students many opportunities and other ways of understanding the subject matter for them to be able to explore scientific knowledge.

There are current difficulties and encounters in promoting e-learning. The purpose of this study is to develop dynamic instructional materials, using appropriate combinations of multimedia technologies such as text, animated graphics, sounds and videos. This technique can attract students, thereby increasing their learning attention.

METHOD

This study utilized the Descriptive-Developmental method to create and evaluate a computer-aided strategic intervention material (CA-SIM) in Chemistry for Grade 7 students. The ADDIE model was used for instructional design, consisting of Analysis, Design, Development, Implementation, and Evaluation stages. The research gathered data from 20 Grade 7 students and five teachers-evaluators through expert and student evaluation checklists, and student survey questionnaires. Data were interpreted using rating scales, with a score of 2.33 to 3.00 being highly acceptable, 1.67 to 2.32 acceptable, and 1.00 to 1.66 not acceptable. The study resulted in the development of 10 lessons that covered topics such as acids, bases, pH scales, and the periodic table of elements, among other

RESULTS AND DISCUSSION

Steps in Developing the Computer-Aided Strategic Intervention Material (CA-SIM)

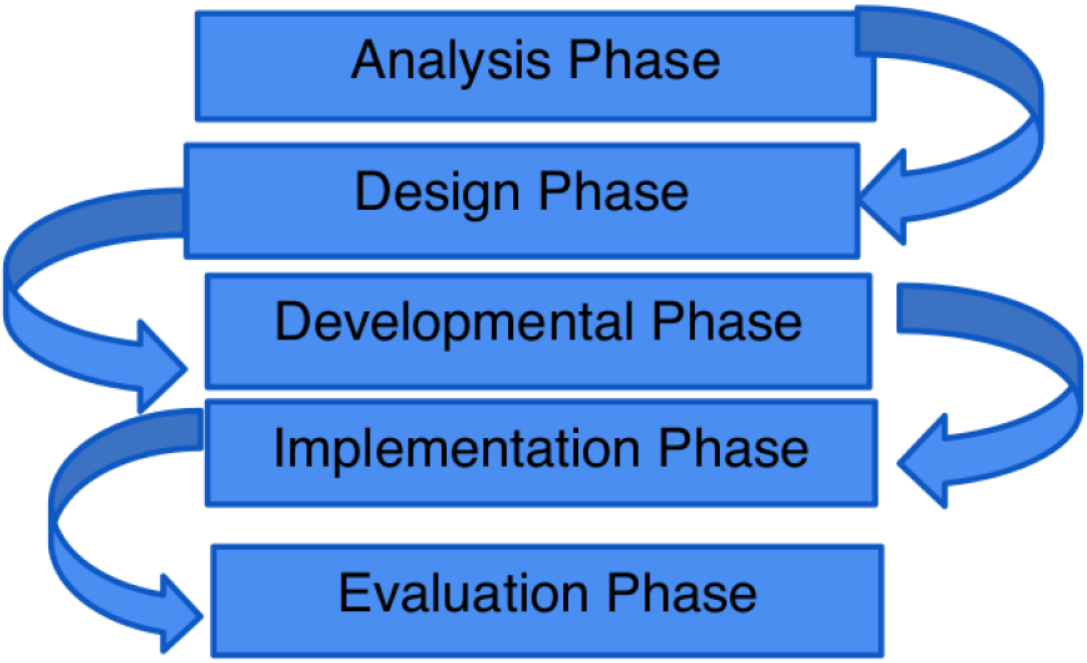

Figure 1: Flowchart of Developing Computer-Aided Strategic Intervention Material

Steps in Developing the Computer-Aided Strategic Intervention Material (CA-SIM)

This instructional material was developed using a developmental design method that involved five simplified steps. The researcher also utilized the ADDIE model in creating the CA-SIM.

In the Analysis Phase, the researcher consulted with 20 student-respondents and IT and Science professionals from BISCAST and PSU to ensure that the lesson methods, media, and materials were appropriate for learners in grade 7. The relevance

of the topics to the curriculum guide was also analyzed. During the Design Phase, the study's learning competencies and required duration were reviewed and revised based on suggestions from IT and Science Professionals. The CA-SIM was thoroughly checked before implementation, and a table of specification was prepared as a prerequisite for test preparation. The study covered topics on Diversity of Materials, including Introduction to Acids and Bases, Acids and Bases, The pH Scale and Salts, Homogeneous and Heterogeneous Mixtures, Solutions, A Classification Scheme for Matter, Elements and Compounds, The Periodic Table of Elements, and Most Commonly Used Elements and their Applications. Each lesson had General Instructions, Objectives, Review, Motivation, Activities, Quizzes, and Discussion for each subtopic, as well as graphic design.During the Design Phase, the study's learning competencies and duration were reviewed and revised based on feedback from IT and Science Professionals. The CA-SIM was checked and a table of specification was prepared. The study covered topics on Diversity of Materials, including Acids and Bases, The pH Scale, Mixtures, Solutions, Matter, Elements, Compounds, and the Periodic Table. Each lesson had General Instructions, Objectives, Review, Motivation, Activities, Quizzes, and Discussion for each subtopic, with graphic design.In the Implementation Phase, teachers used the CA-SIM to teach Science topics based on the K-12 curriculum guide. The topics included acids and bases, pH scales, salts, and classification of matter. The study gathered data to determine the acceptance level of the CA-SIM and analyzed it using statistical tools. The teachers and students found the CA-SIM easy to use and helpful in learning chemistry. The researcher revised and improved the CA-SIM based on the feedback. In the Evaluation Phase, an evaluation test and survey were conducted to determine the attitudes of students towards Chemistry and the level of acceptability of the CA-SIM. The CA-SIM was evaluated based on its content, format, presentation, organization, and accuracy of information. Developing computer-aided instructional materials may encounter problems such as lack of materials, time constraints, and insufficient knowledge about computer instruction. Multimedia representation materials can enhance learning performance and retention, and the integration of technology as a cognitive tool for learning corresponds with modern technology theories. Effective instructional design combined with information technology can help learners achieve their learning goals in a fast and effective way.

Level of Acceptability of Computer-Aided Strategic Intervention Material in Chemistry 7

Table 1 show the level of acceptability of the Computer-aided strategic intervention material was determined based on its content, format, presentation and organization, and accuracy and up-to-dateness of information.

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Table 1a: Level of Acceptability towards CA-SIM in Chemistry 7 in terms of Content

Table 1a
Level of Acceptability towards CA-SIM in Chemistry 7 in terms of Content

CRITERIA	Students		Evaluators	
	Weighted mean	Interpretation	Weighted mean	Interpretation
Content is suitable to the students' level of development.	2.49	All Criteria were interpreted as Highly Acceptable	2.80	All Criteria were interpreted as Highly Acceptable
Material contributes to the achievement of specific objectives of the subject area and grade/year level for which it is intended.	2.64		2.80	
Material provides for the development of higher cognitive skills such critical thinking, creativity, learning by doing, inquiry, problem solving, etc.	2.77		2.60	
Material has the potential to arouse the interest of target learners.	2.46		2.60	
AVERAGE:	2.59		2.70	

***Legend**: 2.33 - 3.00 – (HA) Highly Acceptable, 1.67 – 2. 32 – (MA) Moderately Acceptable, 1.00 – 1. 66 – (NA) Not Acceptable*

The Level of Acceptability towards CA-SIM in Chemistry 7 in terms of Content reflected in table 1a. These table shows that in indicator "material provides for the development of higher cognitive skills such critical thinking, creativity, learning by doing, inquiry, problem solving, etc." was interpreted as highly Acceptable among the other indicators this is from the fact the CA-SIM is a manipulative instructional materials that all students in grade 7 find it ease in understanding the content in CA-SIM. While the evaluators both indicators "Content is suitable to the students' level of development and Material contributes to the achievement of specific objectives of the subject area and grade/year level for which it is intended" are the most highly acceptable by the evaluators since the CA-SIM was easy to be taught because most of the important topics in science are in CA-SIM and based from the learning competencies in the department of education curriculum. It shows that an interactive multimedia-based computer-aided instruction must be utilized in the effective way of teaching (Rensburg, 2017). So that, both the respondents perceived the IM is highly acceptable.

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Table 1b: Level of Acceptability towards CA-SIM in Chemistry 7 in terms of Content

Table 4b
Level of Acceptability towards CA-SIM in Chemistry 7 in terms of Format

CRITERIA	Students		Evaluators	
	Weighted mean	Interpretation	Weighted mean	Interpretation
Size of the letters is appropriate to the intended user	2.44	HA	2.60	HA
Spaces between letter and words facilitate reading,	2.59	HA	2.80	HA
Font is ready to read	2.54	HA	2.60	HA
Simple and easily recognizable	2.67	HA	2.60	HA
Clarify and supplement the text.	2.54	HA	2.60	HA
Properly labelled or captioned (If applicable)	2.49	HA	2.60	HA
Realistic/appropriate colors	2.56	HA	2.60	HA
Attractive and appealing.	2.51	HA	2.40	HA
Culturally relevant.	2.59	HA	2.40	HA
Attractive and pleasing to look att.	2.56	HA	2.60	HA
Simple (i.e. does not distract the attention of the students.	2.51	HA	2.60	HA
Adequate illustrations, videos in relation to text.	2.62	HA	2.40	HA
Harmonious blending of elements.	2.56	HA	2.40	HA
AVERAGE:	2.55	HA	2.57	HA

Legend: *2.33 - 3.00 – (HA) Highly Acceptable, 1.67 – 2. 32 – (MA) Moderately Acceptable, 1.00 – 1. 66 – (NA) Not Acceptable*

Table 1b shows that the level of Acceptability towards CA-SIM in Chemistry 7 in terms of Format. It is perceived by the students Highly Acceptable specifically the "Simple and easily recognizable" since that the CA-SIM has lots of entertaining manipulative commands where the students just only click each icon to go to another discussion and activities. The format of the CA-SIM was really suited to the level of students who are having a hard time in the class discussion. The IM shall also be the tutorial technology of each student. Meanwhile, the evaluators perceived the "Spaces between letter and words facilitate reading" very highly acceptable this is because the IM's format was very interesting and a kid friendly style for the learners easily understood and they can cope up immediately with the lessons and shall motivate in all activities provided in the CA-SIM. Generally students and the evaluators find the format of the IM highly acceptable because computers-aided with good format can increase the academic achievement of the learners (Muir, 2000 and Patterson, 2005).

Table 1c: Level of Acceptability towards CA-SIM in Chemistry 7 in terms of Presentation and Organization

Table 1c
Level of Acceptability towards CA-SIM in Chemistry 7 in terms of Presentation and Organization

CRITERIA	Students		Evaluators	
	Weighted Mean	Interpretation	Weighted Mean	Interpretation
Presentation is engaging, interesting and understandable	2.54	HA	2.80	HA
There is logical and smooth flow of ideas.	2.56	HA	2.60	HA
Lessons are discussed and explained thoroughly and are aided by graphic illustrations.	2.62	HA	2.60	HA
Important concepts, principles are given emphasis	2.56	HA	2.80	HA
AVERAGE:	2.57	HA	2.70	HA

Legend: *2.33 - 3.00 – (HA) Highly Acceptable, 1.67 – 2. 32 – (MA) Moderately Acceptable, 1.00 – 1. 66 – (NA) Not Acceptable*

Table 1c shows level of Acceptability towards CA-SIM in Chemistry 7 in terms of Presentation and Organization with indicators of presentation is engaging, interesting and understandable, there is logical and smooth flow of ideas, lessons are discussed and explained thoroughly and are aided by graphic illustrations and important concepts, principles are given emphasis. These indicators/criteria on the presentation and organization of the CA-SIM were found highly accepted by the evaluators and the students. It is in consonance with the results study of Martinez (2012) who stated that the teachers should explain and create an effective innovation on the utilization of technology for the improvement of ways of teaching's strategies. This CA-SIM was presented in an organized manner of topic that is why the CA-SIM found very effective for the grade 7 science students.

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Table 1d: Level of Acceptability towards CA-SIM in Chemistry 7 in terms of Accuracy and Up-to-dateness

Table 1d
Level of Acceptability towards CA-SIM in Chemistry 7 in terms of Accuracy and Up-to-dateness

CRITERIA	Students		Evaluators	
	Weighted Mean	Interpretation	Weighted Mean	Interpretation
Conceptual and factual errors (e.g. misconceptions, wrong explanations of concepts)	2.64	HA	2.40	HA
Grammatical errors (language structure, S-V agreement)	2.38	HA	2.80	HA
Computational errors	2.46	HA	2.40	HA
Obsolete information	2.33	A	2.40	HA
Typographical and other minor errors (e.g Inappropriate or unclear illustrations, missing labels, wrong captions, etc.)	2.33	A	2.40	HA
AVERAGE:	2.43	HA	2.48	HA

Legend: *2.33 - 3.00 – (HA) Highly Acceptable, 1.67 – 2. 32 – (MA) Moderately Acceptable, 1.00 – 1. 66 – (NA) Not Acceptable*

Table 1d, shows the Accuracy and Up-to-dateness of the designed CA-SIM in Chemistry 7, the students perceived that “Conceptual and factual errors (e.g. misconceptions, wrong explanations of concepts)” highly acceptable due to the fact the students find the IM has less errors that is why they love to use the IM because of its efficiency in providing important information towards chemistry in grade 7. However, the evaluators perceived the “Grammatical errors (language structure, S-V agreement)” highly acceptable since the evaluators are all professional and they found it highly acceptable. With correct uses of subject-verb agreement in the creation of IM, this CA-SIM is very suitable and can be used by other teachers in science for our grade 7 students.

It was rated as highly acceptable on the accuracy and up-to-dateness in the CA-SIM that were no errors that the respondents found in the CA-SIM. This is also in line with the competencies used by the researcher in creating the CA-SIM where the lessons are based from the latest curriculum guide provided by the department of education (Soberano, 2014).

Table 1e show the level of acceptability of the Computer-aided strategic intervention material was determined based on its content, format, presentation and organization, and accuracy and up-to-dateness of information.

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Table 1e: Level of Acceptability of Computer-Aided Strategic Intervention Material in Chemistry 7

Table 4e
Level of Acceptability towards CA-SIM in Chemistry 7

CRITERIA	Students		Evaluators	
	Weighted Mean	Interpretation	Weighted Mean	Interpretation
Content	2.59	HA	2.70	HA
Format	2.55	HA	2.57	HA
Presentation and Organization	2.57	HA	2.70	HA
Accuracy and Up-to-datedness	2.43	HA	2.48	HA
AVERAGE:	2.54	HA	2.61	HA

Overall, table 4e shows the level of acceptability showing all the categories; a.) Content, b.) Format, c.) Presentation and Organization, and d.) Accuracy and up-to-dateness of information. Both students and evaluators towards the CA-SIM in Chemistry 7 as Highly Acceptable giving an average score of 2.54 and 2.59 respectively.

Table 2 reveals that both teachers and students rated the Computer-Aided Strategic Intervention Material in Chemistry 7 (CA-SIM) as highly acceptable across all four components. This suggests that the instructional material is designed to meet the needs of all learners, as noted by Diaz in 2017.

Table 2: Acceptability Level of the Designed CA-SIM as Perceived by Teachers and Students

Components	**Weighted Mean**								
	Teachers (n=5)	Verbal Interpretation	Rank	Students (n=20)	Verbal Interpretation	Rank	Average	Verbal Interpretation	Rank
Content/Comprehensibility of the Text	2.70	HA	1st	2.60	HA	1st	2.65	HA	1st
Format	2.57	HA	3rd	2.57	HA	2nd	2.57	HA	3rd
Presentation and Organization	2.70	HA	1st	2.50	HA	3rd	2.60	HA	2nd
Accuracy and Up-to-datedness of Information	2.48	HA	4th	2.42	HA	4th	2.45	HA	4th
Over-all Weighted Mean	**2.61**	**HA**		**2.52**	**HA**		**2.57**	**HA**	

Table 5 indicates that the Content/Comprehensibility of the Text and Presentation and Organization components of the CA-SIM were rated equally highly by both teachers and students. These are crucial components for effective instruction, and the CA-SIM's high acceptability in these areas suggests that it is a promising strategy for enhancing the academic performance of grade 7 chemistry students. Students particularly appreciated the interesting topics found in the CA-SIM, which they could engage with and manipulate to facilitate their learning and acquisition of new information. Overall, the CA-SIM's strong design and effective use of these

components can lead to positive outcomes in the total learning development of students in chemistry 7.

Levels of Acceptability of the designed lesson on CA-SIM as Perceived by the Evaluators

The results of the evaluated lessons used in developing the Computer-Aided Instruction in Chemistry 7 were based on the competencies outlined in the DepEd K+12 Curriculum. These evaluated lessons formed the foundation for the effective development of the Computer-Aided Instruction, ensuring that it aligned with the curriculum and addressed the needs of students in grade 7 chemistry. By utilizing these evaluated lessons, the Computer-Aided Instruction can help students develop the necessary competencies and skills needed to succeed in their chemistry studies. Overall, the use of evaluated lessons in the development of the Computer-Aided Instruction is a sound approach that can lead to positive outcomes in student learning and success.

Table 3: The Acceptability level of lessons in CA-SIM as perceived by the Evaluators

Lesson in CA-SIM	Content	Format	Presentation and Organization	Accuracy and Up-to-dateness of information	Total	V.I
Introduction of Acid and Bases	2.7	2.57	2.5	2.56	2.58	HA
Acids and Bases	2.5	2.54	2.55	2.6	2.55	HA
The pH Scales and Salts	2.8	2.62	2.55	2.6	2.64	HA
Homogeneous Mixtures	2.75	2.56	2.55	2.68	2.63	HA
Heterogeneous Mixtures	2.75	2.64	2.65	2.64	2.67	HA
Solutions	2.7	2.57	2.45	2.72	2.61	HA
Introduction: A classification Scheme for Matter	2.7	2.57	2.5	2.56	2.58	HA
Elements and Compounds	2.7	2.57	2.5	2.68	2.61	HA
The Periodic Table of Element	2.75	2.64	2.65	2.72	2.69	HA
Most Commonly Used Elements and their Applications	2.7	2.65	2.8	2.72	2.72	HA
Total:	***2.705***	***2.59***	***2.57***	***2.648***	***2.63***	**HA**

The evaluation of the Computer-Aided Strategic Intervention Material (CA-SIM) in Chemistry 7 shows that all the lessons presented were highly acceptable to the evaluators. While the lesson "Most Commonly Used Elements and their Applications" was perceived as the most acceptable among the lessons, all lessons incorporated in the CA-SIM were still deemed highly acceptable and effective in the Computer-Aided format. This suggests that the CA-SIM is a promising tool for facilitating effective and engaging learning experiences in Chemistry 7.

Several studies, including those by Acuna (2014), Roman (2014), Nava (2014), and Terrano (2015), have found that the materials developed in their respective studies were highly acceptable and relevant to the needs of the students and teachers.

These studies showed that the developed materials were perceived to be usable, functional, and included relevant content.

Attitude Level of the Students towards the Designed Computer-Aided Strategic Intervention Material in Chemistry 7

Table 4: A study used a designed CA-SIM to evaluate students' attitudes towards Chemistry 7. The study measured the students' attitude level through an evaluation test that utilized the designed Computer-aided strategic intervention material

Table 4
Level of attitude towards CA-SIM in Chemistry 7

CRITERIA	Weighted Mean	Descriptors	Interpretation
The CA-SIM can arouse my interest to learn in Chemistry.	2.65	Very Much Satisfied	Most of the criteria were given Very Satisfied description and only one was given Satisfied description but all are interpreted as Positive Attitudes.
I am given equal chances to participate in class.	2.40	Very Much Satisfied	
I enjoy challenging exercise/activities with the use of hyperlinks and GIF's, presented in CA-SIM.	2.70	Very Much Satisfied	
The lessons were clearly presented and discussed.	2.50	Very Much Satisfied	
The concepts taught in SIM are within my level of understanding.	2.40	Very Much Satisfied	
I am encouraged to think critically and analytically.	2.25	Satisfied	
I feel ease in answering the activities of the CA-SIM.	2.65	Very Much Satisfied	
I want to attend CA-SIM classes with confidence and enthusiasm.	2.60	Very Much Satisfied	
I feel fun and enjoy myself while using CA-SIM in Chemistry 7.	2.55	Very Much Satisfied	
CA-SIM can add knowledge towards chemistry because of the facts and information provided by the instructional material.	2.60	Very Much Satisfied	
AVERAGE Mean	2.53	Very Much Satisfied	Positive Attitudes

A study evaluated students' attitudes towards Chemistry 7 using a designed CA-SIM. Results showed that students enjoyed challenging activities with hyperlinks and GIFs, but believed that critical and analytical thinking could be better encouraged. Overall, students were very satisfied with the CA-SIM and showed positive attitudes towards science subjects. This is consistent with previous research showing that integrating computer-designed instructional materials into subjects improves student participation and motivation, and creates positive attitudes.

CONCLUSION

The study aimed to design, develop, and evaluate a Computer-Aided Strategic Intervention Material (CA-SIM) for Chemistry 7. The developed CA-SIM included ten lessons on Diversity of Materials in the Environment, based on competencies from the new curriculum by DepEd. The study used a descriptive-developmental design, and data was collected through validated survey questionnaires and the modified "Suydam-Trueblood Attitudes towards Science Scale."

The study found that the CA-SIM format consisted of a Title, General Instruction, Content Slide, Title Slide, Objectives, Let's Recap, Motivation, Introduction, Discussion, Generalization, Assignment, and Quiz. The CA-SIM was easy to develop and followed the ADDIE model. The study also revealed five steps to produce good CA-SIM, including analysis, design, development, implementation, and evaluation.

The CA-SIM was highly acceptable and rated as 2.57 by students and teachers. The Comprehensibility of the Text/Content and Accuracy and Up-to-dateness ranked first under students and teachers. The study showed that the CA-SIM was interesting, enjoyable, and provided a better understanding of Chemistry 7. The use of modern technology made teaching and learning easier and more comfortable. The study recommended adding more related topics and materials to the CA-SIM, making it a supplementary teaching tool for high school Science subjects.

Overall, the study demonstrated the effectiveness and acceptability of the CA-SIM in teaching Chemistry 7. The CA-SIM format and development steps can be used as a guide for developing instructional materials for other subjects and levels.

This study aimed to identify the protocols and standards in school improvement implemented with regards to the limited opening of the face to face classes and the safety plans of the schools in the implementation of limited face to face classes.

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