

Least Learned Competencies in Grade 9 Biology: Basis for Development of Strategic Intervention Material (SIM)

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Abstract: *This study aimed to develop Strategic Intervention Materials (SIM) in Biology for Grade 9 students. Specifically, it ascertained the least learned competencies in Grade 9 Biology. It also assessed the quality of the developed materials in terms of content, format, presentation and organization, and accuracy and up-to-datedness. The evaluation of the teachers and experts on the quality of the materials were compared. The quality of the materials with respect to the four aspects was also compared. This study used a developmental, descriptive and inferential research designs. Data were gathered using a Likert-type instrument from 19 science teachers and 5 experts. Data were analyzed using frequency count and percent for the least learned competencies, mean and standard deviation for the quality of SIM, Mann-Whitney U test for the difference between the evaluations of teachers and experts, and Friedman Test and Wilcoxon Post Hoc Test with Bonferroni Correction Alpha for the difference on the quality of SIM among the four aspects. Results revealed that the developed SIM had six identified competencies in Grade 9 Biology class, the quality of the developed SIM is very satisfactory in terms of content, format, presentation and organization, and accuracy and up-to-datedness. There is no significant difference on the evaluations of teachers and experts on the quality of the developed SIM. The quality of the aspects of SIM in terms of content, format, presentation and organization, and accuracy and up-to-datedness significantly differ with each other.*

Keywords: Least Learned Competencies, Strategic Intervention Material (SIM), Mann-Whitney U test

1. Introduction

Philippine education nowadays direly endeavors for a quality instruction to address the deficiency inside the classrooms in spite of insufficient funds as constraint to cater instructional materials needed (Legaspi, 2014) especially in every science subject. Intervention materials and other teaching instruction materials contribute a strong relationship with academic achievement and learning skills for students (Dahar, 2011) in science lesson which is considered a difficult subject to learn thus, student achievement in this area is affected much. According to the result from The Trends in International Mathematics and Science Study (TIMSS, 2003) revealed a sad truth of “unsatisfactory” learning outcome for Filipino students. Two of the international program assessments made known on student’s ability to solve scientific and mathematical problems such as Programme for International Student Assessment (PISA) and Trends in Mathematics and Science Study (TIMSS). These programs include International Student Assessment (PISA) and Trends in Mathematics and Science Study

(TIMSS) both of which aim to assess the extent of student's achievement especially in science. In the 2003 TIMSS, the Philippines was among at the bottom as with low performance in Math and Science which only ranked 42nd out of 45 participating countries in second year science subject while ranked 23rd of the 25 countries in grade four science all over the world. This concludes the kind of learners in the Philippines; one instance is in science subject with low academic result and below standard worldwide as compare to most students from other countries. Similarly, Dios (2013), reported a similar trend in the students' achievement during National Achievement Test (NAT) for the fourth years an annual test in the Philippines. Similarly, unsatisfactory result on students achievement during the 2005 NAT, with the lowest mean percentage score (MPS) with 39.49 among of the five (5) subjects assessed. Performances in the 2006 and 2012 TIMSS yielded the same dismaying performance with MPS of 37.98 and 40.53, respectively as stressed by Dela Cruz (2012).

DepEd Memo No. 117, series of 2005 entitled —Training Workshop on Strategic Intervention Materials (SIMs) for Successful Learning by the Department of Education which reinforce not just during workshop seminars and training for teacher induction but also to include the SIM making as one of the contests during science fairs in school, division, regional, and even in the national level competitions. Hence, the Department of Education (DepEd) encouraged Strategic Intervention Materials (SIMs) development for Successful Learning. DepEd provided science secondary teachers the training in the preparation of SIMs. As part of intensifying and developing strategic intervention materials as tool for remediating poor performance in Science and the indication that there is a significant reduction ($p < 0.05$) in the pupil's mean number of least mastered skills (Gultiano, 2012). Despite the efforts of the Department of Education, low academic performance results were evident, hence, this study was conceived with the hope that the development of strategic intervention materials could be helpful in mastering the competency based-skill through evaluation of the developed SIM both by teachers and experts/area coordinators in the entire Surigao city division. To address and further improve the deficiency in terms of the instructional problem and book scarcity inside the classrooms particularly in schools of Surigao city division, SIM would be developed and evaluated accordingly based on the least learned competencies in grade 9 Biology.

Theoretical and Conceptual Framework

This study was anchored on Social Learning Theory, Social Development Theory, and Theory of Constructivism. Vygotsky (1992) pioneered the social development theory in which students construct knowledge based on their interaction to others which influences cognitive development. They construct knowledge from created personal mental model in order to give sense to their experiences. This promotes learning by doing the theory of Constructivism. The Theory of Constructivism by John Dewey (1938) suggest that that students learn not by mere facts but by incorporating knowledge and real life skills in their personal lives and experiences as human person and being part of the society. Learning here is known to be an active process, was supported by Bruner (2000), Constructive theory of Bruner (2000) or the discovery learning theory pointed out that learning is a social process and that new ideas are constructed based on the prior knowledge of a person. Lastly, Bandura (1986) advocated that people learn from others through observation and modeling called Social Learning Theory. A person can simply learn through imitating another person by actual observation. The study illustrated through Input-Process-Output (IPO) model as its research paradigm. There were three boxes in the model, the first box as the input, the second box the process and lastly the third box as the output.

In figure 1, the first box pertains to the identified least learned competencies/skills. There is a need to collate information from the teachers the least learned competencies (LLC) or less mastered competencies (LMS) based on the item Analysis of a subject teacher from the test questionnaire results during examination period. After determining these competencies, the development of SIM is the next step based on the anchored theory. The developed SIM was designed and made following the theories such as: social learning theory, social development theory, and theory of constructivism. A manipulative and experiential and interactive material must be created from the activity, instruction up to the guided questions.

The second box refers to the process necessary to evaluate the SIM both by the teachers and the experts/area coordinators; they utilized for validation and evaluation of the standardized tool from the DepEd LRMSD in Surigao City division.

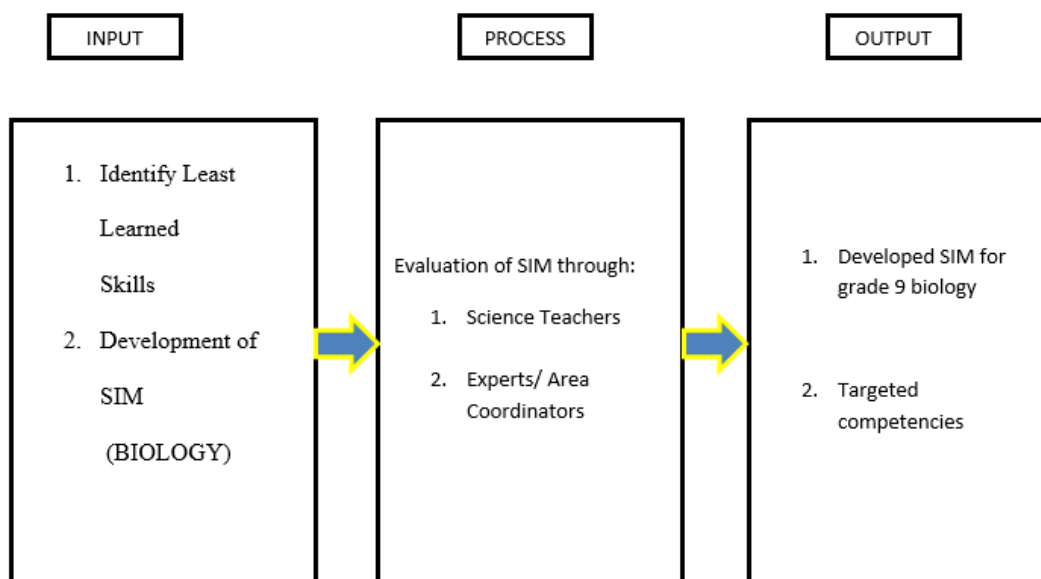


Figure1: Research Paradigm of the Study

The third and last box refers to the developed SIM as a material being crafted after evaluation and validation by experts and science teachers handling the subject. The SIM targeted the least learned competencies that would help students better scaffold their understanding in the subject particularly in Surigao City division.

Statement of the Problem

This study aimed to develop strategic intervention material (SIM) in grade 9 Biology subject in Surigao City division.

Specifically, this sought to answer the following problems:

- 1) What are the least learned competencies of grade 9 students in Biology?
- 2) What is the quality of SIM as evaluated by teachers and experts in terms of:
 - 2.1. content
 - 2.2. format
 - 2.3. presentation and organization
 - 2.4. accuracy and up-to-datedness?
- 3) Is there significant difference between evaluation of teachers and experts on SIM's quality?

- 4) Do the quality of the aspects of SIM in terms of content, format, presentation and organization, and accuracy and up-to-datedness significantly differ with each other?

Hypothesis

H₀1: There is no significant difference between evaluation of teachers and experts on SIM 's quality.

H₀2: There is no significant difference among the quality of the aspects of SIM.

Research Design

This study employed the descriptive developmental research design. The objective of the study determined the least learned competencies in Biology in order to develop a strategic intervention material (SIM) for Grade 9 students in Surigao City division. The list of least learned competencies in Science have been accounted hence it was considered as descriptive. It also aimed to develop a SIM that is why a developmental. The teacher participants and the expert/ area coordinators in Science evaluated the developed SIM based on the LRMDs a standardized evaluation tool for SIM in the Department of Education (DepEd).

Research Locale

The study was conducted at the public high schools of Surigao City division particularly the Junior High Schools. These schools were located in the mainland and island barangays during S.Y. 2019-2020. The schools included were Day-asan National High School (DNHS), Taft National High School (TNHS), Caraga Regional Science High School (CRSHS), Rizal National High School (RNHS) and Ipil National High School (INHS), Capalayan National High School (CNHS), Surigao City National High School (SCNHS), Anomar National High School (ANHS), Mat-I National High School (MNHS), Mabini National High School, Nonoc National High School (NNHS), Zaragosa National High School (ZNHS), Talisay National High School (TNHS), Cantiasay National High School (CNHS), San Jose National High School (SJNHS), Libuac National High School (LNHS), Alegria National High School (ANHS), Lipata National High School (LNHS), and Raffols National High School (RNHS). The schools are public institutions under the mandate of the Department of Education (DepEd). Both offer Junior and Senior High Schools in the mainland areas of Surigao City, Surigao del Norte.

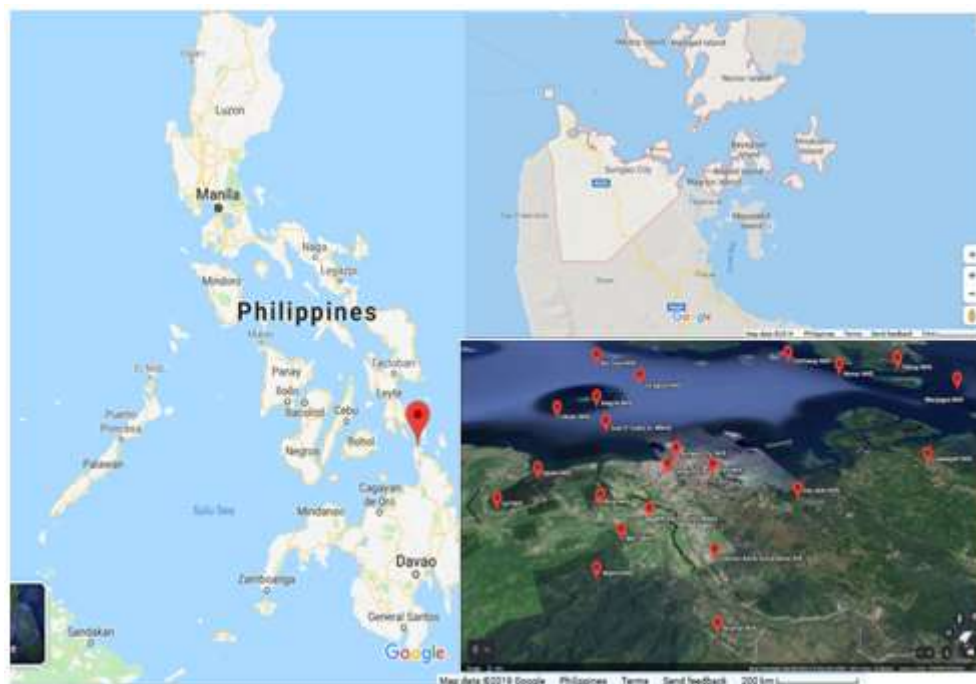


Figure 2: Location Map of District Schools

Participants of the Study

The respondents of this study were the nineteen (19) science teachers who have taught in Grade 9 Science subject of the public high schools and five (5) expert/master teacher/Education Program Supervisor (EPS) in Science. The participants were chosen based on the subject they have handled and expertise in the subject in schools of Surigao City division.

Research Instrument

This study utilized a standardized tool of LRMDs for SIM evaluation as prescribed by the DEPED. The statistical range which corresponds to the Likert scale that was used to evaluate the Strategic Intervention Material (SIM) were as follows:

Table 1: Scoring and Quantification of Data.

Scale	Range	Descriptive Rating	Qualitative Interpretation
4	3.25-4.00	Strongly Agree	Very Satisfactory (VS)
3	2.50-3.24	Agree	Satisfactory (S)
2	1.75-2.49	Disagree	Poor (P)
1	1.00-1.74	Strongly Disagree	Not Satisfactory (NS)

Validity. The validation of the Strategic Intervention Material (SIM) was done using a draft of the developed SIM presented to the adviser/professor, teacher and experts. Suggestions and recommendations were taken into account to incorporate in the material. The content was scrutinized and based on the grade level (grade 9) to which the SIM intended for.

Reliability. For reliability, the researcher used the standardized tool of LRMDs for SIM evaluation. Copies of the same research instrument was validated and evaluated, hence it is the tool being used in making any learning material, of such, the strategic invention material was included.

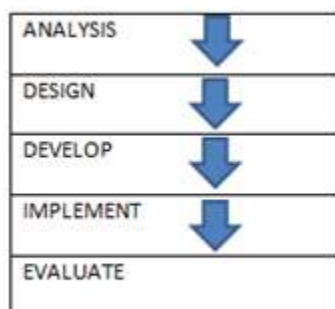
Research instrument was constructed in justification on the use of Non-parametric Statistics using Test of Normality. There were 4 factors: AAVE, BAVE, CAVE, & DAVE. When being grouped, DAVE is constant at 2.00 and has been omitted.

Data Gathering Procedure

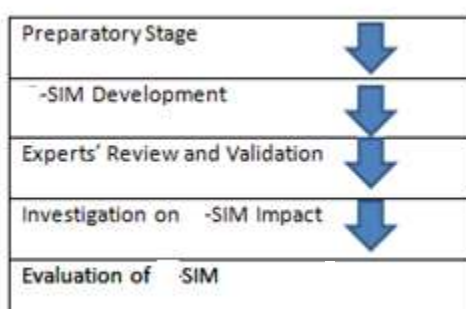
The researcher sent a letter to the respective administrators such as those for the principals and the Schools Division Superintendent of Surigao City division to secure permission for the conduct of the study. Upon approval of the request, identification of least learned competencies in Biology was administered to teacher respondents who have taught Biology. The development of SIM was based on the identified least learned. There were series of different activities to reinforce and scaffold students' learning. These were designed and anchored on the pedagogical theories in education such as Social Learning Theory, Social Development Theory, and Theory of Constructivism. The respondents validate and evaluate the material. The data that were collated, tallied, analyzed and interpreted using appropriate statistical treatment. A descriptive, nonparametric and inferential analysis was used to treat data. Strategic Intervention Material (SIM) was evaluated using the standardized evaluation tool from LRMDs both for teachers and expert/area coordinator in science especially in biology.

Generally, the study was consisted two stages: firstly, for the identification of the least learned competencies in biology of grade 9 students and secondly, development of the Strategic Intervention Materials (SIM) was done and evaluated by both teachers handling biology and experts/ area coordinators. This study was anchored on ADDIE model as a guide for instructional design method and was modified by Saciao (2016) in Figure 3 below. The researcher made use of a modified model ADE since the study was only until validation /evaluation of the developed SIM.

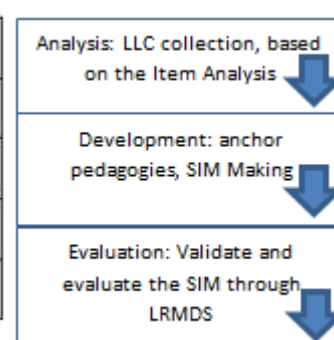
Original ADDIE Model



Saciao(2016)



Modified ADE



Preparatory Stage

The basis for intervention of the topic was the least learned competencies obtained from the students during the administration of the examination in the previous year 2018- 2019 and 2019- 2020. Consequently, the identification of least learned competencies (LLC) was based from the item analysis. The Curriculum Guide (CG) of the DepEd (Department of Education) served as a guide to identify such competencies. During the second quarter period, the following are the identified Content Standard: 1) Respiratory and Circulatory System, 2) Heredity: Inheritance of Variation 3) Biodiversity and Evolution and 4) Ecosystem.

SIM Development

The SIM was used as an intervention to address the needs of students to scaffold their difficulties in learning after identifying the least learned skills and competencies. This was also

design to address the pedagogical theories in education on how students' learn. The researchers ensured that the content and competencies were aligned with the Curriculum Guide (CG) from the Department of Education (DepEd) and that the activities were at their levels of understanding. Learning competencies were reflected in the SIM so that the teacher and students would be guided. Comments and Suggestions from the Experts were highly regarded, appreciated and incorporated to contribute for the improvement of SIM development.

Experts' Review and Validation

Education Program Supervisor (EPS) and Master Teacher, as well as the teacher handling the subjects were Science experts from the division of Surigao City in the Department of Education (DepEd) who validated the SIM development. The guide and indicator of a 4-likert scale in the LRMDs were used to validate the SIM.

2. Literature Review

Strategic Intervention Material (SIM) in Improving Least learned Competencies

Strategic Intervention Material (SIM) has found to reduce least mastered skills after implementation as stressed by Escoreal (2012) Grade 4 science, with a conclusion that SIM provides baseline information and it is necessary to implement to avoid marginalization of pupils. This study reiterated that an indication that there is a significant reduction ($p < 0.05$) in the pupil's mean number of least mastered skills. Its findings were supported by Soberano (2010) and mentioned that Strategic Intervention Materials (SIM) were effective in mastering the competency based skills in chemistry based on the mean gain scores in the posttests of the experimental and control groups. The finding was a positive transfer of learning in both the groups. However, the higher mean observed from the experimental group after the presentation of the intervention materials.

Consequently, Salviejo et al. (2014) revealed that Strategic Intervention Material – Based Instruction, Learning Approach and Students' Performance in Chemistry (SIM-BI) was effective in terms of improving students' performance and learning approach. The surface learners performed equally well as the deep learners when SIM-BI was used. The positive result of the survey suggested that the SIM was appreciated and appealed to both types of learners. Moreover, Gultiano (2012) studied the effect of strategic intervention material on the students' academic achievement in Chemistry. The study employed the experimental design and found out that the experimental group, where SIM was integrated, performed significantly better in the post test,

Dilemma Without SIM and Other Strategic Intervention Material

It is a common observation that learning Science, creates a negative feedback to most students in the secondary level which students would likely fail completing the necessary requirements and get low performances in both academic and conceptual reasoning skills. To many students, Science learning is never fun and the process is boring and burdensome; thus, student achievement in this field is relatively low. According to Legaspi (2014), the Department of Education agreed that there have been delays in the delivery of learning materials such as activity sheets and modules for the pupils. The lack of learning materials is a perennial issue even before the change of the curriculum. Dios (2014) reported that the Basic Education Information System (BEIS) revealed that a few schools in Caraga have 1: 3 ratio of learner to textbook. This situation may cause an academic disadvantage to children who were not afforded with the learning materials.

The Trends in International Mathematics and Science Study (TIMSS 2003) which was conducted nine years ago revealed unsatisfactory results. The Philippines ranked 42nd in Science out of 45 participating countries that were tested (Manila Times, 2004). TIMSS result specifically in Chemistry has an international average of 45% correct answers and Philippine average of 30 %. This proved that vast majority of Filipino students have performed below par in the Chemistry achievement test and below the levels of most students from other countries based on the international tests. The two international sources of information and analysis on science education, i.e. Programme for International Student Assessment (PISA) and Trends in Mathematics and Science Study (TIMSS), aim to assess the extent of student's achievement in science and other fields. TIMSS, specifically, is an international study on student's ability to solve scientific as well as mathematical problems participated by many countries around the world. In this assessment, the Philippines was among the bottom five of poor performers in Math and Science. Dela Cruz (2012) reported that the Philippines placed 36th in science out of the 38 countries who participated in the said assessment. Similarly, results in the 2003 TIMSS showed that the country ranked 23rd of the 25 countries in grade four science and 42nd out of the 45 participating countries in second year science. Moreover, Dios (2013), reported a similar trend in the student's achievement in the annually conducted National Achievement Test (NAT) for the fourth years. The assessment showed similar unsatisfactory achievement in the overall performance of the students across the country. In the 2005 NAT, performance of the students in science got the lowest mean percentage score (MPS) with 39.49 among the five (5) subjects assessed. Performances in the 2006 and 2012 TIMSS yielded the same dismaying performance with MPS of 37.98 and 40.53, respectively.

Furthermore, the mediocre difference in the academic performance of students was also evident in the results posted in the National Achievement Test given by the Department of Education (DepED) to elementary and high school students. In the year 2007, Chemistry posted an average of 51.8 %, 57.8 % in 2008 (Espinosa, 2012). The results were far and below the criterion target set by the Philippine government which is 75% (Lapuz, 2009) cited. This problem in the education system is now being addressed by the government through adopting the K-12 program. This program being implemented by the government extends the basic education curriculum from 10 to 12 years. DepEd reasoned that it is high time to implement this system in the basic education attributing the low achievement scores of students nationally and internationally.

Instructional Material to Support Learning

In Portugal, it has been observed that there is a deficient learning in science both at middle and secondary level (Fonseca, 2006). Wood (2002) which emphasized that teachers in California High School struggled in teaching science particularly Biology in a way the students can truly understand the concepts.

In the present situation of the Philippine Educational System, wherein there are shortage in the classrooms throughout the country and scarce funds, not enough to cater instructional materials needed in every science classroom. The primary goal of teaching is to provide appropriate and effective instruction to students. Thus, a Science teacher is responsible to devise and provide the necessary materials for use in science classes (Dy, 2011). Teaching Science is more productive when there are available, sufficient, and strategically designed instructional materials suited for the type of students. Instructional approaches may succeed or fail, they are dependent to the learning needs of the students. Teachers must consider the students' emotional needs and their approaches to learning. Developing instructional materials play an integral role

in the teaching – learning process. Use of instructional materials has a strong relationship with academic performance at the secondary students as mentioned by Dahar (2011).

Consequently, teacher's initiative in crafting and utilizing instructional materials (Dy, 2011) bridges these gaps towards the achievement of the educational goals: learning the concepts and mastering the skills. Productivity of teaching Science will be enhanced when there are available, sufficient and strategically designed (Salvieto et al., 2014) instructional and intervention materials appropriate for the multitude of students, considering their learning styles, personality types and stress-coping mechanisms (Dacumos, 2015).

Hence, it is imperative that science teachers have a holistic understanding of their learners to craft personalized instructional materials, thus addressing students' individual needs to achieve better comprehension in science. The role of developing (Dacumos, 2015) personality styles, stress-coping mechanisms and academic performance of grade nine students in science. Manuscript submitted for publication the fact that there is no ideal strategy that generates success in all learning situations; hence, teachers need to be trained to develop an understanding and skills in using appropriate strategies that satisfy student learning (Simsek & Balaban, 2010).

DepEd Order on SIM as a Material and Its Nature

Workshop on Strategic Intervention Materials (SIMs) for Successful Learning¹ provided science secondary teachers the training in the preparation of SIMs to intensify and develop materials to remediate the poor performance in Science. The Department of Education included the SIM making as one of the contests during science fairs in school, division, regional, and national level competitions. DepEd Memo No. 117, series of 2005 entitled —Training Workshop on Strategic Intervention Materials (SIMs) for Successful Learning¹ provided science secondary teachers the training in the preparation of SIMs. This intervention has to be made by the teachers in order to address the gaps in learning of students.

The first part of the SIM is the title card which includes the subject matter. The second part is the guide card. This section gives a preview of what students will learn. It presents the focus skills mentioned in the learning competencies and must state at least two sub-tasks (activities). This part must also cite prerequisite skills built on prior learning and concrete outcome or product that students are expected to demonstrate or produce.

The third part of the SIM is the activity card which consists of activities that will develop understanding of the students related to the given objective. It contains guide questions, objectives, students' exercises, activities, and drills with clear directions to develop necessary skills in the three domains and concrete concepts. It allows also the students to organize based on the sequence of the focus skills and discover on their own. The fourth part is the assessment card which consisted of activities to test on student's learning from the previous activities. The fifth part of the SIM is the enrichment card. This section provides practical activities which involves practical applications. The last part of the SIM is the reference card which includes the title of the books, websites, or any other electronic or printed materials, a reference for additional information concerning the topic covered.

Synthesis. The present study has been influenced by the literature and studies cited which provides rich source of information and insights.

The insights of Escorial, Soberano and Salvieto that Strategic Intervention Materials (SIM) were effective in mastering the competency based skills, that is, to reduce the least mastered skills. This is effective in terms of improving students' performance.

The viewpoints of Gultiano, that the effect of strategic intervention material being employed using experimental design and found out that the experimental group performed significantly better in the post test.

The idea of Dios and Legaspi that few schools have a ratio of 1: 3 of learner to textbook. This situation may cause an academic disadvantage to children if not delays in the delivery of learning materials such as activity sheets and modules for the pupils.

Furthermore, the ideas of Espinosa and Lapus that the government finds way to help the sad results in two international studies, far below the criterion. This problem in the education system is now being addressed by the through adopting the K-12 program aside from crafting instructional techniques and design to this new curriculum which intervention material is one of these endeavors.

3. Discussion and Conclusion

Least Learned Competencies of Grade 9 Students in Biology

Problem 1: What are the least learned competencies of grade 9 students in Biology?

Table 2 shows the distribution of teachers who identified the six competencies in Grade 9 Biology as either least learned or not. Of the 19 teachers responded, none of them identified the first competency S9LT-Ia-b-26 as least learned. The competency is described as explaining how the respiratory and circulatory systems work together to transport nutrients, gases and other molecules to and from the different parts of the body. There are three or 15.79% of the teachers who considered the second competency S9LT-Ic-27 as least learned. This competency is characterized by inferring how one's lifestyle can affect the functioning of respiratory and circulatory systems. The third competency S9LT-Ia-28 and fifth competency S9LT-Ie-f-30 were identified by 6 or 31.58 teachers respectively as least learned. The former aims that students be able to describe the location of genes in chromosomes while the latter is characterized by relating species extinction to the failure of populations of organisms to adapt to abrupt changes in the environment. Furthermore, the fourth and sixth competencies are identified by 16 or 84.21% and 13 or 68.42 teachers and respectively as least learned. The competency S9LT-Id-29 is described by the ability to explain the different patterns of non-Mendelian inheritance while competency S9LT-Ig-j-31 is described by differentiating basic features and importance of photosynthesis and respiration.

Table 2: Least Learned Competencies in Biology

	Competency	f(n=19)	Percent
1	(S9LT-Ia-b-26)	0	0.00
2	(S9LT-Ic-27)	3	15.79
3	(S9LT-Ia-28)	6	31.58
4	(S9LT-Id-29)	16	84.21
5	(S9LT-Ie-f-30)	6	31.58
6	(S9LT-Ig-j-31)	13	68.42

Quality of SIM for Biology in Grade 9

Problem 2: What is the quality of SIM as evaluated by teachers and experts in terms of content, format, presentation and organization, and accuracy and up-to-datedness?

The results on evaluation of teachers and experts on the quality of the SIM are shown in the next Tables. Table 3 presents the evaluation on the quality of contents of the SIM. Shown in

the Table is an average value of 3.67 with a standard deviation of 0.25 as rated by the teachers. Similarly, the experts rated the quality of contents with an average value of 3.64 and a standard deviation of 0.32. These ratings described the contents of the SIM as very satisfactory. Both the teachers and the experts agree that the material can very well help in developing Science competencies to the students.

The quality of contents of the SIM is unanimously evaluated by teachers as very satisfactory specifically on the suitability of the content to student' level of development, contribution of the material to the achievement of specific objectives of the subject area and grade/year level for which is intended, absence of biases and prejudices in the material, and its potential to arouse interest of targeted reader. Such results are based on the obtained mean values of 4.00 with SD=0 in items 1, 2, 4 and 6 respectively. On the other hand, the experts unanimously rated the contents as suitable to the students' level of development and that material contributes to the achievement of specific objectives of the subject area and grade/year level for which is intended. These are based on the obtained mean value of 4.00 with SD=0 for both items 1 and 2.

However, item 5 "material enhances the development of desirable values and traits" got the lowest mean rating from teachers of 3.36 with SD=0.14. Similarly, this item obtained a mean rating from experts of 3.45 with SD=0.36. These described the potential of the SIM to develop desirable values and traits as just satisfactory. The teachers are unanimous in their evaluation that the material is not satisfactory in enhancing the development of love of country. Likewise, the experts evaluated this quality of the material as poor. These are based on the obtained mean value of 1.00 with SD=0 for teachers and a mean value of 2.20 with SD=0.84 for experts. Results also indicate that the material is poor in enhancing the development of pride in being a Filipino based on the obtained mean value of 2.29 with SD=1.31. Except from these values, the material is very satisfactory in developing other values and traits especially productive work with a rating of 3.82 and SD=0.45, scientific attitude and reasoning, desire to learn new things, and critical and creative thinking with mean values of 3.80 and SD's=0.30 respectively. However, the experts evaluated that the material is satisfactory in enhancing the development of pride in being a Filipino as well as the ability to know right from wrong based on the obtained mean of 2.80 with SD=0.84 and mean of 3.40 with SD=0.89 for items 5.1 and 5.9 respectively. The material is very satisfactory in enhancing the development of the rest of the values or traits specially scientific attitude and reasoning, unity, desire to learn new things, respect, and critical and creative thinking with mean values of 3.80 and SD's=0.45 respectively. This implies that the SIM met its objective in making a quality material since both experts and teachers rated it with a grand mean of Very Satisfactory (VS).

Table 3: Evaluation on SIM Quality in terms of Content

Item	Teacher			Expert		
	Mean	SD	D	Mean	SD	D
1. Content is suitable to the students' level of development	4.00	0.00	VS	4.00	0.00	VS
2. Material contributes to the achievement of specific objectives of the subject area and grade/year level for which is intended	4.00	0.00	VS	4.00	0.00	VS
3. material provides for the development of higher cognitive skills such as critical thinking, creativity, learning by doing, inquiry, problem solving, etc.	3.84	0.37	VS	3.80	0.45	VS
4. Material is free of ideological, cultural, religious, racial, and gender biases and prejudices.	4.00	0.00	VS	3.80	0.45	VS
5. material enhances the development of desirable values and traits such						

5.1 pride in being a Filipino	2.29	1.31	P	2.80	0.84	S
5.2 Scientific attitude and reasoning	3.80	0.30	VS	3.80	0.45	VS
5.3 Desire for excellence	3.64	0.50	VS	3.40	0.89	S
5.4 Love of Country	1.00	0.00	NS	2.20	0.84	P
5.5 Helpfulness/Teamwork/Cooperation	3.64	0.50	VS	3.40	0.55	S
5.6 Unity	3.51	0.62	VS	3.80	0.45	VS
5.7 Desire to learn new things	3.80	0.30	VS	3.80	0.45	VS
5.8 Honesty and trustworthiness	3.70	0.48	VS	3.60	0.89	VS
5.9 Ability to know right from wrong	3.72	0.35	VS	3.40	0.89	S
5.10 Respect	3.67	0.38	VS	3.80	0.45	VS
5.11 Critical and Creative thinking	3.80	0.30	VS	3.80	0.45	VS
5.12 Productive work	3.82	0.45	VS	3.60	0.55	VS
Sub-Average	3.36	0.14	S	3.45	0.36	S
6. material has the potential to arouse interest of target reader	4.00	0.00	VS	3.80	0.45	VS
7. Adequate warning/cautionary notes are provided in topics and activities where safety and health are of concern	3.74	0.45	VS	2.60	1.52	S
Average	3.67	0.25	VS	3.64	0.32	VS

Legend: D - Description NS - Not Satisfactory P - Poor S - Satisfactory VS - Very Satisfactory

Table 4 shows the evaluation on the quality of format of the SIM. Shown in the Table is an average value of 3.67 with a standard deviation of 0.25 as rated by the teachers. Similarly, the experts rated the quality of contents with an average value of 3.64 and a standard deviation of 0.32. These ratings described the contents of the SIM as very satisfactory. Both the teachers and the experts agree that the material can very well help in developing Science competencies of the students.

In terms of quality of prints, teachers rated the material as very satisfactory with a sub-average value of 3.61 and SD=0.35. Specifically, the appropriateness of the size of letters to the intended user and the ease of reading the font are very satisfactory based on the obtained mean values of 3.84 and SD's=0.37 in items 1.1 and 1.3 respectively. However items 1.2 and 1.4 are rated slightly lower with means of 3.42 (SD=0.51) and 3.32 (SD=0.48) respectively. Such ratings imply that spaces between letters, ability of words to facilitate reading, absence of broke lines, evenness of density, correctness of alignment, proper placing of screen registration are satisfactory. Moreover, the experts also consider the quality of prints as very satisfactory based on the obtained sub-average value of 3.80 with SD=0.45. All specific items concerning print quality are all rated as very satisfactory with uniform mean value of 3.80 and SD=0.45.

For the quality of illustrations, the teachers rated the material as very satisfactory based on the obtained sub-average of 3.65 with SD=0.26. Being realistic and having appropriate colors are the strongest characteristic of the illustrations as the teachers rated item 2.4 with a mean value of 3.89 (SD=0.32). This was followed by the mean value of 3.84 (SD=0.37) for both clarity/supplement the text and attractive and appealing in items 2.2 and 2.5. A mean value of 3.58 (SD=0.51) is obtained for proper labels and captions in item 2.3. All these qualities of illustrations are described as very satisfactory. However, the simplicity, ease of recognition, and cultural relevance of the illustrations are rated slightly lower at mean values of 3.42 (SD=0.51) and 3.32 (SD=0.48) for items 2.1 and 2.6 respectively. These are qualities described as satisfactory. On the other hand, the experts rated all specific qualities of illustrations as very satisfactory at mean of 3.80 and SD=0.45 except its cultural relevance which is described as just satisfactory with mean=3.40 and SD=1.34. Generally, the experts evaluated the illustrations as very satisfactory at a sub-average of 3.73 and SD=0.60.

With respect to design and layout, the teachers rated the material as very satisfactory based on the sub-average value of 3.84 (SD=0.37). All four specific items on quality of design and layout were rated by them as very satisfactory with uniform mean and SD values equal to the sub-

average. However, the experts evaluated differently. Simplicity, adequacy of illustrations in relation to text, and harmonious blending of elements are just satisfactory at uniform mean values of 3.4 (SD=0.55) for items 3.2, 3.3, and 3.4 respectively. Nevertheless, the experts saw the attractiveness and how pleasing the design and layout to look at very satisfactory based on a mean value of 3.80 (SD=0.45) for item 3.1. Generally, the experts perceived the quality of design and layout as very satisfactory based on the sub-average value of 3.50 (SD=0.47).

As to its paper and binding, both teachers and experts evaluated the material as very satisfactory based on the obtained sub-averages of 3.66 (SD=0.24) and 4.00 (SD=0) respectively. Specifically, the teachers rated the durability of binding to withstand frequent use as very satisfactory at a mean value of 3.84 (SD=0.37) but the quality of the paper used to contribute ease in reading is rated satisfactory at a mean value of 3.47 (SD=0.51). On the other hand, the experts are unanimous in giving a perfect rating score of 4.00 for quality of paper and durability of binding. In terms of size and weight of resource, both respondents rated the material as very satisfactory at sub-averages of 3.72 (SD=0.28) and 3.73 (SD=0.28) from teachers and experts respectively. The teachers believed that the material is very satisfactory quality in terms of ease in handling and relatively lightness; these are based on the equal mean values of 3.84 and SD's=0.37 for both items 5.1 and 5.2. Likewise, the experts also consider these qualities as very satisfactory at uniform mean values of 3.60 and SD's=0.55.

Table 4: Evaluation on SIM Quality in terms of Format

Item	Teacher			Expert		
	Mean	SD	D	Mean	SD	D
1. Prints						
1.1 size of letters is appropriate to the intended user	3.84	0.37	VS	3.80	0.45	VS
1.2 Spaces between letters and words facilitate reading	3.42	0.51	S	3.80	0.45	VS
1.3 Font is easy to read	3.84	0.37	VS	3.80	0.45	VS
1.4 Printing is of good quality, no broken letters, even density, correct alignment, properly placed screen registration	3.32	0.48	S	3.80	0.45	VS
Sub-Average	3.61	0.35	VS	3.80	0.45	VS
2. illustrations						
2.1 Simple and easy recognizable	3.42	0.51	S	3.80	0.45	VS
2.2 Clarity and supplement the text	3.84	0.37	VS	3.80	0.45	VS
2.3 properly labelled or captioned(if applicable)	3.58	0.51	VS	3.80	0.45	VS
2.4 Realistic/appropriate colors	3.89	0.32	VS	3.80	0.45	VS
2.5 Attractive and Appealing	3.84	0.37	VS	3.80	0.45	VS
2.6 culturally relevant	3.32	0.48	S	3.40	1.34	S
Sub-Average	3.65	0.26	VS	3.73	0.60	VS
3. Design and Layout						
3.1 Attractive and pleasing to look at	3.84	0.37	VS	3.80	0.45	VS
3.2 Simple(i.e., does not distract the attention of the reader	3.84	0.37	VS	3.40	0.55	S
3.3 Adequate illustration in relation to text	3.84	0.37	VS	3.40	0.55	S
3.4 harmonious blending of elements 9e.g., illustrations and text)	3.84	0.37	VS	3.40	0.55	S
Sub-Average	3.84	0.37	VS	3.50	0.47	VS
4. Paper and Binding						
4.1 paper used contributes to easy reading	3.47	0.51	S	4.00	0.00	VS
4.2 Durable binding to withstand frequent use	3.84	0.37	VS	4.00	0.00	VS
Sub-Average	3.66	0.24	VS	4.00	0.00	VS
5. Size and Weight of Resource						
5.1 Easy to handle	3.84	0.37	VS	3.60	0.55	VS
5.2 Relatively light	3.84	0.37	VS	3.60	0.55	VS
Sub-Average	3.84	0.37	VS	3.60	0.55	VS
Average	3.72	0.28	VS	3.73	0.28	VS

Legend: D - Description S - Satisfactory VS - Very Satisfactory

Table 5 shows the evaluation results on SIM quality in terms of presentation and organization. Shown are average values of 3.84 (SD=0.37) from teachers and 3.80 (SD=0.45) from experts. These results imply that the presentation and organization of the material are very satisfactory as evaluated by both teachers and experts. Moreover, the teachers rated five specific items uniformly at mean values of 3.84 and SD's=0.37 respectively. The same is observed from the ratings of experts in all these items at uniform mean values of 3.80 and SD's=0.45 respectively. These further suggests that the material has engaging, interesting, and understandable presentation; has logical and smooth flow of ideas; has vocabulary level that is adapted to target reader's likely experience and level of understanding; has length of sentences that is suited to the comprehension level of the target reader; has sentences and paragraphs structures which are varied and interesting to the target reader.

Table 5: Evaluation on SIM Quality in terms of Presentation and Organization

Item	Teacher			Expert		
	Mean	SD	D	Mean	SD	D
1. Presentation is engaging, interesting, and understandable	3.84	0.37	VS	3.80	0.45	VS
2. There is logical and smooth flow of ideas	3.84	0.37	VS	3.80	0.45	VS
3. Vocabulary level is adapted to target reader's likely experience and level of understanding	3.84	0.37	VS	3.80	0.45	VS
4. length of sentences is suited to the comprehension level of the target reader	3.84	0.37	VS	3.80	0.45	VS
5. Sentences and paragraphs structures are varied and interesting to the target reader	3.84	0.37	VS	3.80	0.45	VS
Average	3.84	0.37	VS	3.80	0.45	VS

Legend: D - Description VS - Very Satisfactory

Table 6 presents the evaluation of teachers and experts on SIM quality in terms of accuracy and up-to-datedness. The Table shows average of 3.87 (SD=0.1) from teachers and 4.00 (SD=0) from experts. These ratings implies that the accuracy and up-to-datedness of the material are very satisfactory. The teachers unanimously rated error-free grammars at a mean value of 4.00 while the rest of the accuracy items with respect to conceptual, factual, computational, typographical and minor errors, and obsolete information are rated at uniform mean values of 3.84 and SD's=0.37. On the other hand, the experts unanimously rated all accuracy and up-to-datedness items with uniform mean values of 4.00. These entail that the material is very satisfactory when it comes to freedom from errors and update on information used.

Table 6: Evaluation on SIM Quality in terms of Accuracy and Up-to-datedness

Item	Teacher			Expert		
	Mean	SD	D	Mean	SD	D
1. Conceptual errors	3.84	0.37	VS	4.00	0.00	VS
2. Factual errors	3.84	0.37	VS	4.00	0.00	VS
3. Grammatical errors	4.00	0.00	VS	4.00	0.00	VS
4. Computational errors	3.84	0.37	VS	4.00	0.00	VS
5. Obsolete information	3.84	0.37	VS	4.00	0.00	VS
6. Typographical and other minor errors (e.g., inappropriate or unclear illustrations, missing labels, wrong captions, etc.)	3.84	0.37	VS	4.00	0.00	VS
Average	3.87	0.31	VS	4.00	0.00	VS

Legend: D - Description VS - Very Satisfactory

Comparison of Assessment of Teachers and Experts on Quality of SIM for Biology in Grade 9

Problem 3: Is there significant difference between evaluation of teachers and experts on SIM's quality?

Results on the comparison of evaluations of teachers and experts on the quality of SIM along four factors are shown in the next Table.

When the ratings provided by teachers and experts on the quality of SIM are compared, $U=44.0$ with $p=0.84$ on content, $U=41.0$ with $p=0.68$ on format, $U=45.5$ with $p=0.89$ on presentation and organization, and $U=40.0$ with $p=0.63$ on accuracy and up-to-datedness are obtained. The obtained p -values are greater than 0.05 level of significance. Thus, all null hypotheses are not rejected. There is no evidence to show that the ratings provided by the teachers and experts on the quality of SIM are significantly different from each other. It is safe to claim then that the ratings of experts validated the ratings of teachers on the quality of the material. Both teachers and experts agree that the developed material is very satisfactory in terms of its four factors.

Accordingly, it is imperative for a teacher to provide ways and means like crafting a developed intervention material (Cubillas, 2018) to easy understand the lesson by the students due to scarcity of books and other teaching aid based on Basic Education Information System(BEIS) as stated by Dios (2014). Along with the teachers are experts and other researchers who are considered as a decision maker to focus on quality intervention to improve learning process (Pritchett, 2013).

Table 6: Difference on Evaluations of Teachers and Experts on SIM Quality

Factor	U	p	Decision
Content	44.0	0.84	Not Rejected
Format	41.0	0.68	Not Rejected
Presentation and Organization	45.5	0.89	Not Rejected
Accuracy & Up-to-datedness	40.0	0.63	Not Rejected

Comparison of Quality of SIM for Biology in Grade 9 among Factors

Problem 4: Do the quality of the aspects of SIM in terms of content, format, presentation and organization, and accuracy and up-to-datedness significantly differ with each other?

Results on the comparison of quality of developed SIM among the four factors are shown in the table 7 and 8 respectively. When the combined ratings of all respondents on four factors are compared, a Friedman Chi-square-value of 25.51 is obtained with $p<0.001$. This implies that there is a significant difference on the ratings of the respondents among the four factors: content, format, presentation and organization, and accuracy and up-to-datedness. Specific comparisons are shown in Table 7.

Pairwise comparisons of ratings of factors show that $Z=-0.55$ with $p=0.585$, $Z=-2.88$ with $p=0.004$, $Z=-3.28$ with $p=0.001$ are obtained when rating on quality of content is compared to ratings on quality of format, presentation and organization, and accuracy and up-to-datedness respectively. Moreover, $Z=-2.52$ with $p=0.012$, and $Z=3.27$ with $p=0.001$ are also obtained when rating on quality of format are compared with rating on quality of presentation and organization and rating on accuracy and up-to-datedness respectively. Likewise, $Z=-1.89$ with $p=0.059$ is obtained when rating on quality of presentation and organization is compared with rating on quality of accuracy and up-to-datedness. The null hypotheses on the comparison

between content and presentation and organization, between content and accuracy and up-to-datedness, and between format and accuracy and up-to-datedness are rejected as they are less than the Bonferroni Correction Alpha of 0.0083. These results imply that there is a significant difference on the ratings of quality between these paired factors which means

Moreover, based on the result, content did not significantly differ on format since series of revision of the material were done as per recommendations from both evaluators since format were evaluated in terms of readability and visibility in general. Learning the content significantly differ on the accuracy and up-to-datedness as well as on the presentation and organization, this is because content must ignite the interest of students in terms of its presentation especially if the lesson is not outdated but in accordance to the timeframe of the recent topics and concerns. As it was gleaned by Ramsden, (1992) in designing an intervention material, one must be aware of deep and surface approaches to learning and strategies must be appropriate to maintain the integrity of the learning outcome. Meanwhile, format is related to accuracy and up-to-datedness that there is significant difference between them because the readability factor (format) is in consonance with typographical error (accuracy) pertaining to recent facts/informations(up-to-datedness) while there is no significant difference with presentation and organization because format does not pertain to how logically arrange the paragraph/ideas in a way to capture the interest of the students but presentation and organization do. Lastly, presentation and organization can capture the interest of students if the material is updated and in tune with the recent trends/issues/lessons.

Table 7: Post hoc Test for Difference on SIM Quality among Factors

Factor		Z	p	Decision
Format	Content	-0.55	0.585	Not Rejected
Presentation and Organization	Content	-2.88	0.004	Rejected
Accuracy & Up-to-datedness	Content	-3.28	0.001	Rejected
Presentation and Organization	Format	-2.52	0.012	Not rejected
Accuracy & Up-to-datedness	Format	-3.27	0.001	Rejected
Accuracy & Up-to-datedness	Presentation and Organization	-1.89	0.059	Not Rejected

Friedman Chi-square = 25.51, $p < 0.001$

Bonferroni Correction for alpha = 0.0083

Based on percentile values shown in Table 8, rating on quality of presentation and organization which has 25th to 75th percentile range of 4.00-4.00 is better than the rating on quality of content which has lower percentile range of 3.43-3.93. Similarly, rating on accuracy and up-to-datedness which has a percentile range of 4.00-4.00 is better compared to the rating on quality of content which has lower percentile range. For the third pair, the rating on quality of accuracy and up-to-datedness is better than the rating on the quality of format which has a lower percentile range of 3.66-4.00. Although the quality of the SIM on the four factors are very satisfactory, these results suggest that the qualities of the SIM in terms of presentation and organization and accuracy and up-to-datedness are statistically better than the qualities of its content and format.

Table 8: Quartiles on SIM Quality by Factor

Factor	Percentiles		
	25th	50th (Median)	75th
Content	3.43	3.60	3.93
Format	3.66	3.70	4.00
Presentation and Organization	4.00	4.00	4.00
Accuracy & Up-to-datedness	4.00	4.00	4.00

This study aimed to develop Strategic Intervention Materials in Biology for Grade 9 students. Specifically, it ascertained the least learned competencies in Grade 9 Biology. It also assessed the quality of the developed materials in terms of content, format, presentation and organization, and accuracy and up-to-datedness. The evaluation of the teachers and experts on the quality of the materials were compared. The quality of the materials with respect to the four aspects were also compared.

Moreover, this study used a developmental, descriptive and inferential research designs. Data were gathered using a Likert-type instrument from 19 science teachers and 5 experts. Data were analysed using frequency count and percent for the least learned competencies, mean and standard deviation for the quality of SIM's, Mann-Whitney U test for the difference between the evaluations of teachers and experts, and Friedman Test and Wilcoxon Post Hoc Test with Bonferroni Correction Alpha for the difference on the quality of SIM among the four aspects.

The findings of the study were as follows:

- 1) There are six (6) identified least learned competencies in Grade 9 Biology class which served as basis for SIM development namely: (1) explain how the respiratory and circulatory systems work together to transport nutrients, gases and other molecules to and from the different parts of the body, (2) infer how one's lifestyle can affect the functioning of respiratory and circulatory systems, (3) describe the location of genes in in chromosomes, (4) explain the different patterns of non-Mendelian inheritance, (5) relate species extinction to the failure of populations of organisms to adapt to abrupt changes in the environment, and (6) differentiate the basic features and importance of photosynthesis and respiration.
- 2) The quality of the developed SIM is very satisfactory in terms of content, format, presentation and organization, and accuracy and up-to-datedness.
- 3) There is no significant difference on the evaluations of teachers and experts on the quality of the developed SIM.
- 4) The quality of the aspects of SIM in terms of content, format, presentation and organization, and accuracy and up-to-datedness significantly differ with each other.

Conclusions

Based on the findings of the study, the following conclusions were drawn:

The competencies such as “Patterns on non-Mendelian inheritance” and “Photosynthesis and respiration” are among the least learned competencies identified by majority of the Grade 9 Science teachers.

The developed SIM has a quality and can be a very good intervention material in terms of its parts as to content, format, presentation and organization, and accuracy and up-to-datedness per evaluation of Teachers and Experts. As a whole the SIM is a quality intervention material that has a distinct quality parts or factors.

Recommendations

In view of the findings and conclusions of the study, the following recommendations are drawn:

- 1) The developed SIM's may be utilized in teaching Biology to Grade 9 students.
- 2) Replicate the study in other strand in Science subject such as in Chemistry and Physics.
- 3) Investigate on the impact of the developed material to Grade 9 students,
- 4) Replicate this study with an integration of Bloom's taxonomy to each part of the SIM in order to diagnose whether or not the Examination is parallel to the developed SIM.

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