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Effectiveness of a Contextualized Interactive Multimedia for Grade 8 Science Students

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Abstract

The Computer-Assisted Instruction is undertaken widely to catch interest and to improve student's performance. This Descriptive and True- Experimental research was anchored in determining the effects of the developed and validated Contextualized Interactive Multimedia (CIMM) to the 58 grade 8 students of Tanglag National High School in their Science subject.

To determine the level of interest of the population toward Science subject, the researcher utilized a 10-item survey-questionnaire called Test of Related Science Attitude (TORSA). Additionally, a researcher-made pretest and posttest questionnaires were administered to determine the academic performance of the respondents.

Findings showed that there is an increase in the academic performance and interest toward Science of the experimental group who was exposed to the CIMMs. Moreover, significant difference does not exist between the results of the posttests of both groups. However, a significant difference can be noted between the controlled and experimental groups' attitude toward Science subject after the implementation of the intervention.

Keywords: *Biology, Computer-Assisted Instruction, contextualization, Interactive multimedia.*

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Introduction

As the notable innovations in science and technology emerge, the gap between the understanding and the students' interests also widens. According to Alam (2011), the way the young people of today conceptualize science knowledge, skills, and attitudes is unrelated to day-to-day living problems and decision-making in their life. Another is students see Science as a boring subject which commonly resulted to disappointment. Moreover, one factor of this is when teachers fail to ask questions that should provoke higher-order thinking, but rather they ask questions that just recall basic knowledge (Oloruntegbe, Akinsete, Ayeni, & Alam, 2010). The negligence of teachers and students to scientific ways of rationality in favor of the learning of meanings and standard procedures is one of the culprits of this gap (O'Connor, 2003). These dispute to the general goal of education that any curriculum must tend to make knowledge significant to students (UNESCO, 2007).

To possibly solve these glitches, most of today's educational institutions promote the contextualized curriculum to address the deteriorating interests of students to their subjects while boosting their eagerness and curiosity to look for new ideas and skills (Ultanir, 2012). By increasing their interest in the subject through contextualization, their academic performance may also be affected. Contextualization is an instructional strategy which drives teaching and learning process to some concrete applications in specific context that is of interest to the student which is linked to their foundational skills and academic content (Mazzeo, Rab, & Alssid, 2003).

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The current situation of education is observed as teacher-oriented. Teachers make and use technology or multimedia in a teacher-centered environment. Questions such as how to integrate and when to use digital technology are at stake. While it is true that teachers are equipped with the skills to use digital technology, they still lack the ability to integrate it in the real classroom scenario, thus, a framework is needed. Because of this, learner's find themselves confined to traditional mode of teaching and the learner-centered strategy of multimedia learning remains a paradigm untouched (Teoh & Neo, 2014).

Therefore, teachers and future teachers must be knowledgeable, skillful, and competent in using digital technologies and in integrating these in the development of lesson; They need to become computer literates in order to enhance the quality of education in the Philippines especially in the field of Science. This supports the idea that teachers are deemed to be great factors in the success of learning and improving classroom outcomes.

Even if the teachers have the skills in manipulating the technology, it is not an assurance that they can integrate technology to the lessons very well. That is why most of the teachers still prefer the conventional way of teaching such as the use of chalk and board. This can be mirrored to the current perceptions of the Science teachers in the 2nd district of La Union regarding modern instructional materials. The study of Laguardia (2015) showed that Chemistry teachers find Computers, Laptops and Interactive CD's/DVD's less adequate instructional materials for the subject Chemistry.

Meanwhile, the Science teachers of Tanglag National High School (TNHS) have attended different seminars and trainings that focus on the use of ICT in the teaching and learning process. However, it was observed that the utilization of ICT devices is just only

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limited to teachers' personal laptops, LCD projectors, LED TV and speakers, a practice which leads to a teacher-centered learning environment. Though the school has two computer laboratories with more than 80 computer desktops, students only use them in encoding assignments and creating PowerPoint presentations. Also, even though the Science teachers follow the contextualized module provided by the DepEd, the students do not find the materials interesting and engaging. With the low interest in the subjects or lessons, the students' academic performances may be affected. This is also reflected on the low scores on NAT of Tanglag National High School from S.Y. 2011-2012 to S.Y. 2014-2015 (MPS= 43.43; 44.73; 32.18; 30.61). It has also been observed that grade 8 learners of TNHS have a low Mean Percentage Score (MPS) of 36.11 percent and 40.55 percent in S.Y. 2016-2017 and S.Y. 2017-2018 respectively in Science during the 4th quarter examination when compared to the 80 percent goal of the school. The congestions of topics and failure to meet the class due to school activities and programs are some of the reasons observed why the trend on the academic performance of the students declined during the 4th quarter period.

With that, the output of this research will let Science educators have a glimpse of the importance of contextualized multimedia using computers and mobile phones in increasing students' participation and interests toward the subject, an intervention or innovation which may lead to the increase of their academic performance. Furthermore, by relating the content and the technology to the user, the teaching and learning process will not just be educational but also fun.

Framework of the Study

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This research is fastened to the different range of interrelated theories of contextualization which shows indications of authentic learning. One of which is the theory of Piaget and Dewey, the constructivist learning, in which the learning processes emphasize an experiential-learning and learner-center educational system. According to Rana (2016), constructivism is driven by both action/reflection and experience/abstraction which are viewed as a dynamic learning. The individual's experiences and knowledge were driven by their sensation and cognition (Ultanir, 2012). Learners acquire knowledge through constructing meaning and relating it to their environment, while problems are usually being solved through citing their past experiences. In the study of Newman (1996) as cited by Rathburn (2015), students are constructing their own learning, having a deep understanding of an issue from a disciplinary perspective, and valuing learning are evidences of authentic learning.

This current study is also anchored to Theory of Experiential Learning. Experiential Learning is characterized as learning through self-reflection, observation, and interaction of the students to their environment. By encouraging students to involve themselves in a teaching-learning process that can provide them an opportunity to reflect on the emotional and rational dynamics of managing and organizing is an experiential learning approach (Penger, Znidarsic, & Dimovski, 2011). According to Laguardia (2015), experiential learning involves learners to a more personal level of classroom interaction by considering what they need and want to learn. He also added that fun learning environment, with sufficient laughter and respect for their abilities, promotes an experiential learning environment.

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Moreover, sustaining interest and enjoyment has an important consequence in contextualization. A student who enjoys or is motivated towards the subject has a higher self-efficacy as resulted by the study of Ucar and Sung (2017), wherein student's perceptions such as motivating task were found as conjecturers of their efficacy. Self-Efficacy is when a person's perceived belief about his/her own capabilities in producing a certain level of performance (Bandura 1994). Additionally, he believed that a strong sense of self-efficacy can enhance human accomplishments and personal well-being and people who are confident in their capabilities approach difficult tasks as challenges to be mastered rather than threats to be avoided.

Another theory underlying contextualization is Problem-centered Learning or (PCL). This type of learning allows students to inquire, apply knowledge and skills, and integrate practice and theory in developing a solution to a given problem (Savery, 2006). In this learning theory, teachers were viewed as a facilitator while the students are the ones to solve the problem self-directly. Moreover, PCL was also dubbed as conventional method in applying constructivist approach since it empowers students to acquire new knowledge using the prior ones with the collaborations of their peers.

Gagne's instructional events served as the guide in selecting and creating appropriate media in the development of the learning process. Additionally, Gagne's framework has been claimed flexible in the part of the teacher. The incorporation of Gagne's framework to the media leads instructional technologist to develop computer-based projects that will boost retention and motivation of learners. The study of Tsai (2008)

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which has successfully enhanced the learning retention of the learners, wherein he used Gagne's model in teaching to guide them in their lesson.

Non-linear Learning Models provide each learner personalized learning experiences that can accommodate different abilities and learning styles (Robberecht, n.d.). In creating a nonlinear environment, the teacher should consider different situations that may occur during the teaching-learning process. Learners should be able to select any entry point in the subject and will be directed to any point and will not sacrifice their understanding and learning (Robberecht, n.d.). The students/ users choose their own path of learning, how will they learn the lesson, and at what pace will they understand it.

Objectives

This study focused on the effects of the developed and validated offline Contextualized Interactive Multimedia (CIMM) application in Biology class to the attitudes towards Science subject and the academic performance of the Grade 8 learners of Tanglag National High School. Specifically, it identified the (a) attitude of the controlled group and experimental group toward Science before the implementation of the intervention; (b) level of academic performance of the two groups before the implementation of the intervention; (c) attitude of the two groups toward Science after the implementation of the intervention; (d) level of academic performance of the two groups after the implementation of the intervention; (e) significant difference on the level of academic performance and attitude toward Science before and after the implementation of the intervention; and (f) significant difference between the controlled group and

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experimental group in terms of level of academic performance and attitude toward Science after the implementation of the intervention.

Methodology

The CIMM's that were utilized in this study were developed using a special software called Articulate Storyline 3. Furthermore, the content of the CIMMs were developed using the Grade 8 Science curriculum of DepEd as a basis and through the help of three master teachers in Science. Furthermore, 10 Junior High School teachers in Science were exposed to the CIMMs to validate and passed based on the following criteria: (1) Learner-Centered Environment; (2) Use of Multimedia; (3) Understanding Content; (4) Motivation; (5) Content and Organization; and (6) Availability.

This current study utilized 58 students of TNHS and were grouped into two, the controlled and experimental group. A pre-formative questionnaire in Test of Related Science Attitude (TORSA) were given to the student-respondents to measure their interest toward Science. In addition, research-made pretests regarding the current topic was also administered before each lesson started in both groups. Moreover, research-made posttests and post-formative evaluation in TORSA were administered after each lesson. The period of the exposure of the experimental group to the CIMM was equal to the allotted timeframe by the DepEd Module on each topic.

Results and Discussion

Level of Attitude of the Controlled and Experimental Groups toward Science before the Implementation of the Intervention

Table 1 highlights the mean and overall mean scores of the controlled and experimental group on their attitude toward Science subject before the intervention. It

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reveals that both groups show a low average weighted mean results in the pre-evaluation test on TORSA. The controlled group obtained an overall mean of 3.21 while the experimental group obtained 3.25. This indicates that both groups have an average interest toward the Science lessons.

This result is in consonance with the study conducted by Nwafor and Oka (2018) wherein low Science interest among the secondary school students in Nigeria was reported.

Table 1. Mean and Overall Mean of Controlled and Experimental Group about the Attitude toward Science Class before the CIMM

Indicators	Controlled		Experimental	
	M	DR	M	DR
1. Science lessons are fun.	3.34	SO	3.21	SO
2. I like Science lessons.	3.31	SO	3.72	O
3. School should add more Science lesson each week.	2.93	SO	3.17	SO
4. Science lesson do not bore me.	3.10	SO	3.38	SO
5. Science is one of the most interesting school subjects.	3.24	SO	3.59	O
6. Science lesson is not a waste of time.	3.21	SO	3.66	O
7. I really enjoy going to Science lessons.	3.52	O	3.34	SO
8. The material covered in Science lesson is interesting.	3.07	SO	3.79	O
9. I look forward to Science lessons.	3.24	SO	2.62	SO
10. I would enjoy school more if there were Science lessons.	3.14	SO	2.00	SE
Overall Mean	3.21	SI	3.25	SI

Legend:

	Descriptive Rating for Mean	*Descriptive Rating for Overall Mean*
4.21 – 5.00	*Always (A)*	*Very interested (VI)*
3.41 – 4.20	*Often (O)*	*Interested (I)*
2.61 – 3.40	*Sometimes (SO)*	*Sometimes Interested (SI)*
1.81 – 2.60	*Seldom (SE)*	*Uninterested (U)*
1.00 – 1.80	*Almost Never (AN)*	*Very uninterested (VU)*

Results shows that Nigerian respondents tend to have low interest not only in the subject but also in all interrelated activities and careers in Science (Nwafor & Oka, 2018).

The implication of these findings to the educational institutions, especially to Science educators, may lead to the understanding of the current attitude of students toward

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Science which can be the basis for devising a new pedagogy that may improve and increase students' interests.

Level of Academic Performance of Controlled and Experimental Groups before the Implementation of the Intervention

Table 2 highlights the mean scores on the pretests of the controlled and experimental group.

Table 2. Mean Scores on Pretests of the Controlled and Experimental Groups

Topic/ Quiz	Controlled	Experimental

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	Mean	DR	Mean	DR
1. Digestive System	3.76	B	3.66	B
2. Cell Division	3.97	B	4.07	B
3. Mendelian Genetics	3.93	B	4.00	B

Legend:

9.00 – 10.00	*Advanced (A)*
8.00 – 8.99	*Proficient (P)*
7.00 – 7.99	*Approaching Proficiency (AP)*
6.00– 6.99	*Developing (D)*
0.00 – 5.99	*Beginning (B)*

As disclosed in the table below, both groups obtained a low performance on the three topics during the pretest. This means that students are at the beginning level of proficiency before the class interactions. One of the causes of such low performance is the content of the test itself. There maybe lots of concepts in the three topics that are not yet learned by the students.

This proposition supports the claims of Calmorin (2004) and E. Carag and C. Carag (2004) as cited in the study of Cabardo (2014), regarding the main purpose of the pretests to the teaching and learning process. Accordingly, low score in pretests are expected because it is used to identify competencies or topics do the learners know and topics they need to know.

The poor academic performance of the students in the three topics may be attributed to their low interests toward the subject. Since interest plays a big role in students' motivation, their self-efficacy in having advance learning may also be affected. These findings have an implication for Science educators to integrate the topics across other learning area for the student to get familiarized with their Science concepts.

Level of Attitude of the Two Groups toward Science after the Implementation of the Intervention

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Table 3 highlights the mean and average weighted mean of the controlled and experimental group on their attitude toward Science lessons after the intervention.

It shows an increase of the mean scores of both groups using TORSA. The controlled group garnered and the experimental group garnered an average weighted mean of 4.07 and 4.36, respectively. The experimental group achieved higher mean scores and it can be noted that the group shows greater interest toward Science class than the controlled group.

Table 3. Mean and Overall Mean of Controlled and Experimental Groups about the Attitude toward Science Class after the CIMM

Indicators	Controlled		Experimental	
	Mean	S.D.	Mean	S.D.
1. Science lessons are fun.	4.24	A	4.62	A
2. I like Science lessons.	4.07	O	4.31	A
3. School should add more Science lesson each week.	4.00	O	3.97	A
4. Science lesson do not bore me.	3.69	O	4.21	A
5. Science is one of the most interesting school subjects.	3.93	O	4.03	O
6. Science lesson is not a waste of time.	3.76	O	4.69	A
7. I really enjoy going to Science lessons.	4.03	O	4.45	A
8. The material covered in Science lesson is interesting.	4.07	O	4.38	A
9. I look forward to Science lessons.	4.41	A	4.17	O
10. I would enjoy school more if there were Science lessons.	4.45	A	4.72	A
Overall Mean	4.07	I	4.36	VI

Legend:

	Descriptive Rating for Mean	*Descriptive Rating for Overall Mean*
4.21 – 5.00	*Always (A)*	*Very interested (VI)*
3.41 – 4.20	*Often (O)*	*Interested (I)*
2.61 – 3.40	*Sometimes (SO)*	*Sometimes Interested (SI)*
1.81 – 2.60	*Seldom (SE)*	*Uninterested (U)*
1.00 – 1.80	*Almost Never (AN)*	*Very uninterested (VU)*

Level of Academic Performance of the Two Groups after the Implementation of the Intervention

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Table 4 shows the mean scores on posttest of the controlled and experimental group.

The results revealed that after the class interaction, both group achieved an increase in the mean scores in all the topics which placed them in the approaching proficiency level. This means that the students have acquired fundamental knowledge of the content and core understanding with little guidance and assistance from their teacher or peers.

This suggests that the use of CIMMs and other interactive multimedia is effective in increasing academic performance among students. This resonates the study conducted by Chen (2012) to 20 junior high school students in Taiwan. In his study, the experimental group achieved high posttest results after their exposure to the Multimedia and E-learning Platforms.

Table 4. Mean Scores on Posttest of the Controlled and Experimental Groups

Topic/ Quiz	Controlled		Experimental	
	Mean	DR	Mean	DR
1. Digestive System	7.34	AP	7.72	AP
2. Cell Division	7.45	AP	7.55	AP
3. Mendelian Genetics	7.66	AP	7.93	AP

Legend:

	Descriptive Rating for Mean
9.00 – 10.00	*Advanced (A)*
8.00 – 8.99	*Proficient (P)*
7.00 – 7.99	*Approaching Proficiency (AP)*
6.00– 6.99	*Developing (D)*
0.00 – 5.99	*Beginning (B)*

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Significant Difference on the Level of Academic Performance and Attitude toward Science

The test of difference between the results of Pretest and Posttest of the Controlled group is shown in Table 5.

Based on the one-tailed paired sample t-test, it was found that there is a significant difference between the results of pretest and post-test on the three topics: Digestive System, *t(28)=-10.711*, p≤ 0.05; Cell Division, *t(28)=-11.603, p≤ 0.05*; and Mendelian Genetics, *t(28)=-9.410, p≤ 0.05*. Likewise, the table below reveals a higher mean of posttest than the pretest of the controlled group.

Table 5. Test of Difference between Pretest and Posttest of the Controlled Group

Topic/ Quiz	Pretest		Posttest		T	df	p-value
	Mean	S.D.	Mean	S.D.			
1. Digestive System	3.76	1.722	7.34	1.143	-10.711	28	.000
2. Cell Division	3.97	1.543	7.45	1.378	-11.603	28	.000
3. Mendelian Genetics	3.93	1.476	7.66	1.421	-9.410	28	.000

Furthermore, Table 6 shows the test of difference between pretest and posttest results of the experimental group.

The posttest shows significantly higher mean scores than the pretest of the experimental group which was exposed to the CIMMs during the classroom interaction: Digestive System, *t(28)=-8.730, p≤ 0.05*; Cell Division, *t(28)=-9.040, p≤ 0.05*; and Mendelian Genetics, t*(28)=-9.906, p≤ 0.05*. The same results were also observed in the study done by Vaishnav et al. (2013), wherein, interactive multimedia instruction was found to be effective to the 60 learners of Biology classes in New Dehli, India.

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Table 6. Test of Difference between Pretest and Posttest of the Experimental Group

Topic/ Quiz	Pretest		Posttest		t	df	p-value
	Mean	S.D.	Mean	S.D.			
1. Digestive System	3.66	1.289	7.72	1.279	-8.730	28	.000
2. Cell Division	4.07	1.751	7.55	1.454	-9.040	28	.000
3. Mendelian Genetics	4.00	1.773	7.93	1.387	-9.906	28	.000

In addition, Table 7 presents the test of difference on the results of attitude toward Science of the two groups before and after the intervention.

Based on the table below, both groups showed significant increase of interest toward the Science topics after the classroom interaction. The controlled group, which used the Deped Science 8 module, gained an average weighted mean score of 4.06 from 3.21 *(t(9)=-4.906, p≤ 0.05)*. Also, the group which was exposed in the CIMMs also showed a significant difference between the results of their attitude toward Science subject before and after the intervention *(t(9)=-5.221, p≤ 0.05)*. This means that both groups show greater interest in Science subject after the classroom interaction.

Table 7. Test of Difference on the Results of Attitude toward Science before and after the Intervention of the Two Groups

Group	AWM Pre-evaluation	AWM Post-Evaluation	t	df	p-value
1. Controlled Group	3.21	4.06	-4.906	9	.001
2. Experimental Group	3.25	4.36	-5.221	9	.001

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These findings have an implication to educators and institutions to realize the importance of technology integration in increasing interest toward the subject. Technology integration does not only increase students' academic performances and interests toward Science, but also promotes the development of technological skills and collaboration with peers.

Significant Difference between the Controlled and Experimental Groups in Terms of Level of Academic Performance and Attitude toward Science

Table 8 displays the test of difference between the results of posttests of the controlled and experimental group.

As shown in the table below, the p-value results of the posttests along the three topics are higher than 5 percent level of significance: Digestive, $t(28)= -1.110, p > 0.05$; Cell Division, $t(28)= -.300, p > 0.05$; and Mendelian Genetics, $t(28)= -.812, p > 0.05$. This implies that there is no significant difference between the academic performance of students who were exposed to the developed CIMMs during classroom interaction and to those who used the DepEd learning module. However, there is a significant difference recorded in terms of student's interest. It can be noted that this may lead to future success which is believed to pave way for better academic performance.

Table 8. Test of Difference between the Results of Posttest of the Controlled and Experimental Groups

Topic/ Quiz	Controlled Mean	Experimental Mean	t	df	p-value
1. Digestive System	7.34	7.72	-1.110	28	.276
2. Cell Division	7.45	7.55	-.300	28	.767
3. Mendelian Genetics	7.66	7.93	-.812	28	.424

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Meanwhile, Table 9 displays the test of difference between the controlled and experimental group on their attitude toward Science after the intervention.

It can be noted from the table below that there is a significant difference in the mean scores of attitude toward Science between the controlled and experimental group, $t(9)= 2.884,\ p \leq 0.05$. This suggests that students exposed to contextualized interactive multimedia tend to increase not only their interest but also their enjoyment toward Science subject.

This result resonates the study of Leow (2014) indicating that the media-rich approach of teaching improves student's retentions, strengthens their motivation, and encourages them to make full use of the learning program prepared for them. Moreover, the study of Tomte and Hatlevik (2011) shows that students in primary school who have multimedia-based instructions want this kind of instruction to be regularly integrated to their subjects. They found out that the students' level of motivation towards the subject increases significantly.

Table 9. Test of difference between the Controlled and Experimental Groups in Terms of Level of Attitude toward Science after the Intervention

	Controlled	Experimental	t	df	p-value
AWM Post-evaluation	4.07	4.36	2.884	9	.018

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

1. Before the implementation of the intervention, the two groups showed low interest toward the Science subject.

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2. Both groups attained a beginning level of proficiency before the classroom intervention and that the students still lack some knowledge regarding the content of the lessons.
3. The controlled group showed an average interest toward Science while the experimental group became very interested to Science subject after the students were exposed to the CIMMs.
4. Both groups already attained an approaching proficiency level and developed knowledge and core understanding toward the lessons with lesser guidance from teachers and peers to achieve proficiency.
5. The developed CIMMs can be effective in improving students' academic performance and attitude toward Science subject.
6. The academic performance of the experimental group which was exposed to CIMM can be comparable to the performance of the controlled group. The experimental group significantly attained higher interest than that of the controlled group.

Recommendations

The following recommendations are derived based on the conclusions drawn from the study:

1. Science teachers are encouraged to use CIMM in teaching the subject to improve the attitude and motivation of the students toward Science.

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2. The teacher may utilize or develop similar materials to enhance the level of proficiency level of students in learning lessons in Science.
3. If interactive multimedia is limited, the teacher could enhance and improve the materials and modules given by the Department of Education. Though the grade 8 learning module is already contextualized, the teacher could devise a strategy that would suit students' interests.
4. Teachers may consider attending seminars and trainings on using interactive multimedia in the teaching and learning process.
5. Teachers could develop contextualized modern materials that students can relate to.
6. A similar study may be conducted to further analyze other benefits of the CIMM in the teaching-learning process and the integration of contextualized interactive multimedia in the classroom.

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