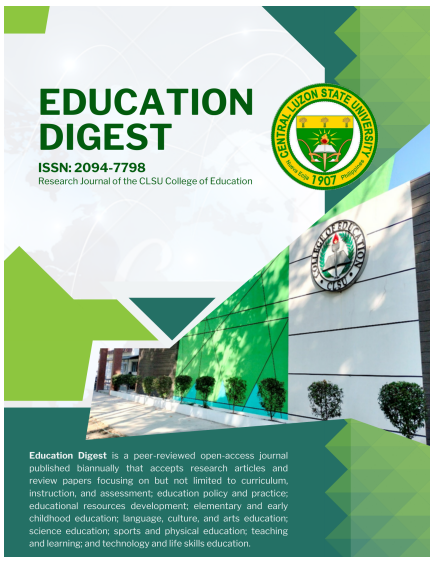

Enhancing Conceptual Understanding and Interest in Energy Concepts through Comics-Based Mnemonics

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Abstract: This study aimed to evaluate the effectiveness of Comics-Based Mnemonics (CBM) in enhancing students' conceptual understanding and interest in Physics topics such as energy transformation and the conservation of mechanical energy. A quasi-experimental research design was utilized, involving 40 Grade 9 students at a public national high school, selected through purposive sampling. The experimental group was taught using CBM, while the conventional group continued with the commonly used method of teaching. Data collection included a validated researcher-made 30-item pretest and posttest, as well as a Likert scale questionnaire to assess students' conceptual understanding and interest levels in Physics. Descriptive and inferential statistics, such as dependent and independent t-tests, were used to compare the performance of the groups. Results demonstrated that the use of CBM significantly enhanced students' conceptual understanding and increased their interest in Physics. Additionally, a correlational analysis between posttest scores and post-interest levels of the CBM group, using Spearman's rho, revealed a moderate, statistically significant positive relationship. This indicates that incorporating visually engaging, relatable, and creative instructional materials in the teaching–learning process can help students enhance their conceptual understanding when dealing with complex and abstract Physics concepts. Given the promising results, this study highlights the potential of CBM as a valuable pedagogical tool that can transform science education by making learning more accessible and engaging. To further establish its significance, future research should involve a larger and more diverse student population, extend the implementation period, and explore the applicability of CBM across various scientific disciplines. Doing so can strengthen the case for integrating CBM into mainstream science curricula and support educational innovations that promote deeper understanding and sustained interest in science among learners.

Keywords: *action research, classroom intervention, instructional materials, physics education*

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Introduction

Science education is essential for modern learning because it encompasses a wide range of disciplines and equips students with the knowledge, skills, and mindset necessary to engage with the natural world. It provides a basis for addressing global concerns while also developing the critical thinking, problem-solving, and inquiry skills needed for making informed decisions in everyday life. However, science education faces substantial challenges both globally and in the Philippines. Some leading science educators identified that the most challenging aspects of science education are the complexity of the subject matter and the ineffectiveness of instructional methods (Gusti & Komariah, 2023). Scientific concepts are often associated with complex and difficult-to-understand topics. Moreover, they frequently require background knowledge and skills in experimental procedures, mathematical reasoning, technical terminology, and multidisciplinary understanding (Esguerra & Natividad, 2025). Without foundational knowledge in science education, a thorough understanding of complex concepts becomes challenging.

In today's modern world, the challenges brought by the 21st century call for more effective and enhanced education, including teaching strategies that equip students to face, surpass, and overcome these challenges. In this century, students need to be more functionally literate and critical thinkers to develop their conceptual understanding. According to Konicek-Moran and Keeley (2015), conceptual understanding refers to one's ability to grasp the context of concepts fully. Thus, it enables learners not only to know the facts but also to understand them on a deeper level—such as by building connections and applying ideas—so that they can truly comprehend why and how something works (Sulman et al., 2023). However, the continued use of traditional teaching methods makes it difficult

to achieve this, as such methods often promote rote memorization. This negatively affects learners' growth by weakening their critical thinking skills instead of strengthening the experiential learning and essential competencies needed to face the challenges of the 21st century. The issues and challenges faced by science education in the Philippines were highlighted by the results of PISA 2022, where the country ranked third-lowest out of 81 participating countries, and its average score slightly declined compared to 2018 (Chi, 2023). These results highlight the urgent need for immediate changes in the educational system to enhance students' scientific literacy.

The reasons why many students perceive Physics as a complex subject do not revolve solely around its abstract nature and ineffective teaching strategies. There are also several other contributing factors, one of which is the lack of student interest (Sofna et al., 2023). This lack of interest leads to various interconnected problems, such as decreased motivation to attend class and put effort into learning, inattentive behavior, and poor academic performance (Natividad, 2022). According to a study conducted by Kwarikunda et al. (2020), motivation and interest play a crucial role in helping learners overcome the difficulties they face in challenging subjects, such as physics. Being interested in a subject enhances student learning, leading to a better understanding and retention of knowledge. Furthermore, interest can inspire students to put more effort into learning by engaging in self-study, which deepens their understanding and helps them grasp complex topics more effectively.

To address these issues, it is essential to employ innovative teaching methods that cater to diverse learning styles and enhance students' understanding and interest (Keller et al., 2017). One such approach is the use of mnemonics, which are techniques for improving memory retention by associating information with easily recalled patterns or signals. Although mnemonic strategies have been extensively studied and shown to aid students in better understanding physics concepts, there is a noticeable lack of research on Comics-Based Mnemonics (CBM) as a method for enhancing physics education. The effective integration of visual and verbal cues in comics enhances comprehension and memorization, aligning with the principles of the Dual Coding Theory. Research conducted by Lubin and Polloway (2016), Putnam (2015), and Melekoğlu and Çetin (2023) revealed that mnemonic methods are helpful in teaching science. However, the use of comics as a mnemonic device has received relatively little attention. The potential of comics to become an effective instructional tool in teaching Physics lies in their ability to capture students' attention and interest in class, combined with the use of verbal and visual cues that support learning.

The use of comics as a mnemonic tool supports learners by providing clear, meaningful, and memorable storylines that are conceptually accurate, relatable, and entertaining. In addition, it combines text and images to help students better understand the context of the lesson being discussed—a practical approach in science education (Raiyn, 2016). The idea of CBM is supported by Cognitive Load Theory (CLT) and Dual Coding Theory. According to CLT, students learn best when lessons are simplified into bite-sized information, allowing them to comprehend and retain complex content more easily (Sweller, 1988, as cited in Koenig-Workman, 2024). Similarly, Dual Coding Theory supports the idea that learners absorb information more effectively when visual content is paired with verbal explanations (Kurniawan et al., 2022), implying that integrating comics as mnemonics into instructional materials can enhance students' interest and conceptual understanding in Physics.

Aside from these theories, several studies also support the idea that comics are practical tools for enhancing students' interest and addressing difficulties in understanding abstract concepts. For instance, Akcanca (2020) revealed that comics simplify abstract concepts, thereby increasing students' interest in Physics. Similarly, Mamolo (2019) found that using digital interactive math comics improved the teaching–learning process in senior high school general mathematics by making complex ideas more understandable. In addition, Ozdemir (2017) emphasized how the visual and verbal elements of comics contributed to sustained learning in modern Physics. Affeldt et al. (2018) also demonstrated that verbal and visual cues in comics facilitated students' understanding of complex Chemistry concepts and enhanced their comprehension of scientific terms. These studies collectively underscore that comics—through a multimodal learning approach that integrates visual and verbal elements—are effective in helping learners grasp complex science concepts (Yulianti et al., 2016).

This study aimed to develop and implement CBM, a tool designed to serve as instructional material for enhancing the conceptual understanding and interest in physics among Grade 9 students, particularly in the topics of energy transformations and the conservation of mechanical energy. Furthermore, this study aimed to offer helpful insights that can contribute to addressing the challenges faced by science education in the Philippines and to provide possible solutions to these issues.

Research Questions

The general purpose of this action research was to evaluate the effectiveness of CBM as an intervention in enhancing both the conceptual understanding and interest levels of Grade 9 students at a public national high school.

Specifically, this study aimed to answer the following research questions:

(1) What are the pretest and posttest scores of the conventional and CBM groups in terms of conceptual understanding of physics lessons?
(2) Is there a significant difference between pretest and posttest scores of the conventional and CBM group?
(3) Is there a significant difference in posttest scores of the conventional group and the CBM group in terms of conceptual understanding in Physics?
(4) What are the pre-intervention and post-intervention interest levels of the CBM group exposed to CBM in learning physics concepts?
(5) Is there a significant difference in the pre-intervention and post-intervention interest levels of the CBM group exposed to CBM in learning Physics concepts?
(6) Is there a significant relationship between posttest scores and the post-interest levels of the students in the CBM group?

Methodology

Research Design and Sample

A quasi-experimental research design was employed to investigate the effect of CBM on students' conceptual understanding and interest levels in two least-learned Grade 9 science skills, specifically those related to energy transformation and conservation of mechanical energy. This research design enabled the researchers to determine the effectiveness of CBM as an intervention by comparing the performance of students exposed to CBM with those who received conventional teaching methods. In addition, a non-equivalent control group design, which involves selecting groups that were not randomly assigned, was utilized to compare the effectiveness of CBM.

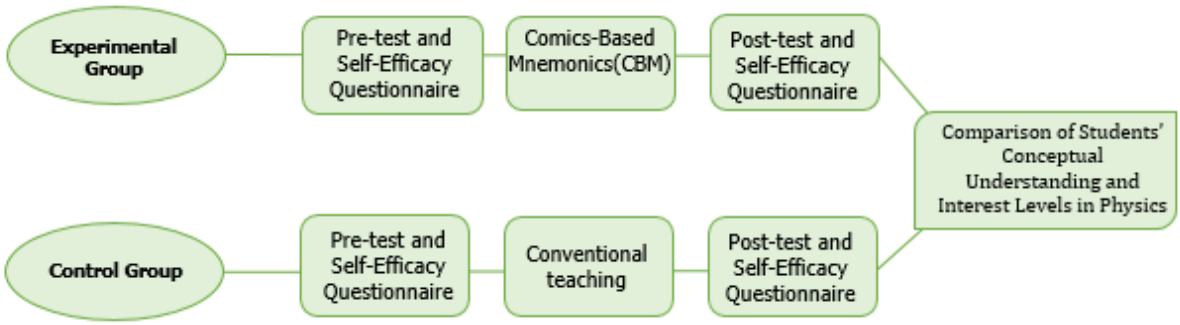

Figure 2. Utilization of a quasi-experimental design to assess the effect of CBM on students' conceptual understanding of Physics.

The respondents for this study were 40 Grade 9 students. Twenty students served as the CBM group, while the other 20 students served as the conventional group. Both groups were identified based on specific criteria for participation, using a purposive sampling technique. These criteria included the following: (1) enrolled in Grade 9, (2) taking the Science 9 subject, and (3) belonging to regular sections and not to any special program, such as the Science, Technology, and Engineering (STE) program. The purposive sampling technique was appropriate for this study, as it allowed the researchers to select participants who possessed qualities aligned with the study's objectives.

Data Collection and Instruments

In the first week, all necessary permissions were obtained from the division office and the school administration, and informed consent was obtained from both students and their parents. This study involved two groups: the conventional group and the CBM group.

During the second week, both groups were given a researcher-made 30-item pretest designed to assess their prior understanding of Grade 9 Physics topics from Unit 4, Module 2: Work, Power, and Energy, specifically on energy transformation and conservation of mechanical energy. For the CBM group, a researcher-made Likert scale survey questionnaire was given to determine the students' pre-intervention interest levels in Physics. After pretest administration, the following days, up to week 3, were allotted for the intervention period, during which the CBM group was taught using CBM as instructional material, while the conventional group continued with the usual method of teaching. After the intervention period, both groups took a 30-minute posttest to evaluate the effect of the intervention on the conceptual understanding of Physics lessons in the CBM group compared to the conventional

group, which continued with the usual method of teaching. Following the posttest, the CBM group also completed a post-intervention interest-level questionnaire to assess any changes in their interest in Physics after being exposed to the CBM intervention.

The researcher developed a 30-item pretest and a Likert scale survey questionnaire, which served as the research instruments used in this study. Both tests were designed to evaluate the Grade 9 students' conceptual understanding of Physics topics, such as energy transformation and the conservation of mechanical energy. To ensure that the items were aligned with the targeted learning skills, the researcher developed a Table of Specifications (TOS) to guide the construction of the questions. Meanwhile, to assess the pre-intervention and post-intervention interest levels of the CBM group, a Likert scale survey questionnaire was used to measure changes in the group's interest after being exposed to the intervention. To enhance the appropriateness and accuracy of these instruments, expert-validators reviewed them, ensuring that all data collected was accurate, valid, and reliable.

Data Analysis

The collected data were analyzed using both descriptive and inferential statistics. To describe and present the results, the mean and standard deviation of pretest and posttest scores of the conventional group and the CBM group were used in descriptive statistics. On the other hand, inferential statistics, such as dependent and independent t-tests, were used to compare the performance of the conventional and CBM groups, evaluating the effectiveness of Comics-Based Mnemonics in enhancing students' conceptual understanding of Physics topics, including energy transformation and the conservation of mechanical energy. The dependent t-test, specifically the paired t-test, was applied to compare pretest and posttest scores of each group. It was also used in the comparative analysis of the pre-intervention and post-intervention interest levels of the CBM group to determine the effect of the CBM intervention on students' interest in Physics.

On the other hand, to determine the significant differences in posttest scores between the conventional and CBM groups, the independent samples t-test was used. These statistical tests helped the researchers assess and evaluate the results to determine whether CBM had a significant effect on students' conceptual understanding and interest in Physics, specifically on topics such as energy transformation and conservation of mechanical energy, compared to conventional methods of teaching. Furthermore, Spearman's rho correlation analysis was conducted to determine the relationship between students' interest levels and conceptual understanding in Physics.

To analyze the study's data, the researchers utilized the Jamovi application, a statistical tool, to evaluate the results of the collected data. The Wilcoxon signed-rank test was used for the comparative analysis of prtest and posttest scores of the conventional and CBM groups. This test is ideal for analyzing paired non-parametric data. Additionally, Student's t-test was applied to assess the significant difference in posttest scores between the conventional group and the CBM group. It was appropriate to use since the data were normally distributed.

Ethical Consideration

To conduct this study, all necessary permissions were obtained from the Division Office and school administrations, and informed consent was obtained from both parents and students, along with clear information about the research purpose and procedures for gathering the necessary data. The researchers ensured that all data and information obtained were used solely for the purpose of the study, taking utmost care to maintain the confidentiality and anonymity of all participants. Transparency was also maintained throughout the research process, with the findings shared responsibly to contribute to knowledge without misrepresentation. In addition, all sources used in this study were cited correctly, and the researchers ensured that ethical standards guided every phase of the research process to uphold the rights and dignity of all participants.

Results and Discussion

Pretest and Posttest Scores of the Conventional and CBM Groups

Table 1 presents bopretestest and posttest scores of the conventional and CBM groups regarding their conceptual understanding of the two least-learned Physics topics under Module 2: Work, Power, and Energy, specifically the subtopics of energy transformations and conservation of mechanical energy. The conventional group, which received the commonly used teaching strategies while learning the two Physics topics, had a mean pretest score of 16.15 with a standard deviation (SD) of 3.53. In the posttest, their scores showed improvement, with the mean score increasing to 19.15 and the standard deviation to 3.81. Meanwhile, the CBM group, which was taught using CBM, had a mean pretest score of 17.00 (SD = 4.15) and a mean posttest score of 23.15 (SD = 3.93), indicating that the

CBM group, which received the intervention, showed greater improvement in the pretest and posttest scores compared to the conventional group. This suggests that the CBM group performed better in understanding Physics concepts than the traditional group. This further indicates that CBM helps students understand complex and abstract Physics concepts such as energy transformation and conservation of mechanical energy. Regarding the lessons, both the conventional and CBM groups scored better in the topic of conservation of mechanical energy than in the topic of energy transformations.

Table 1. Descriptive analysis pretest and posttest scores of the conventional and CBM groups.

Topic	n	CONVENTIONAL GROUP				CBM GROUP			
		Pretest		PPosttest		Pretest		PPosttest	
		Mean	SD	Mean	SD	Mean	SD	Mean	SD
Energy Transformations	20	6.55	1.57	8.15	1.66	6.80	1.74	9.65	1.79
Conservation of Mechanical Energy	20	9.60	1.96	11.00	2.15	10.20	2.41	13.50	2.14

Comparative Analysis of Pretest and Posttest Scores of the Conventional and CBM Groups

Table 2 presents the Wilcoxon Signed-Rank Test results for the comparative analysis of pretest and posttest scores of the conventional and CBM groups. For the traditional group, students' conceptual understanding of Physics significantly increased (from M = 16.9 to M = 19.7) even with the use of the conventional teaching method alone, without any intervention ($W = 0.822$, $p < .05$). Similarly, the conceptual understanding of students in the CBM group also significantly improved after using CBM as instructional material, increasing from the pretest mean of 17.3 to the pposttestmean of 24.3, which is considerably higher compared to their performance before the intervention ($W = 0.869$, $p < .05$). This implies that students who experienced both the conventional teaching method and the CBM intervention showed significant improvement in their conceptual understanding of Physics. However, the results showed that when comparing the performance of both groups before and after the intervention, the group that underwent CBM-integrated instruction exhibited a greater level of improvement compared to the conventional group that did not receive the intervention. This suggests that students learn better when using creative instructional materials compared to the traditional method alone. The study by Degorio and Langub (2025) supports this, indicating that the use of comic strips is effective in enhancing student learning and can be utilized as an innovative tool in physics education.

Table 2. Wilcoxon Signed-Rank Test results for the pre-test and posttest scores of Grade 9 students in conventional and CBM groups.

Group	Assessment	Mean	SD	*Statistic*	*p*
Conventional	Pretest	16.90	2.91	4.00	<.001
	PPosttest	19.70	3.10		
CBM	Pretest	17.30	2.98	0.00	<.001
	PPosttest	24.30	3.18		

Comparison of Posttest Scores Between the Conventional and CBM Groups

Table 3 shows a significant difference between the posttest scores of the conventional (M = 19.7) and CBM (M = 24.3) groups, with a p-value of .001. Since the data were normally distributed, the Student's t-test was utilized. The results revealed that the CBM group performed better than the conventional group. These findings further indicate that students exposed to the CBM intervention had a better conceptual understanding of complex Physics topics

compared to students who did not undergo any instructional intervention. Therefore, students who were taught using CBM significantly enhanced their abilities to understand various topics, such as energy transformations, where the concepts were presented using relatable scenes—like amusement rides, archery, and waterfalls—as well as in the topic of conservation of mechanical energy. Several factors, such as the combination of verbal and visual cues found in the CBM, might have contributed to this, enabling the students to relate to and visualize the concepts in real-life scenarios, which helped make the abstract concepts easier to understand. In addition, the use of context clues supports students' vocabulary learning, enhancing memory retention of essential keywords and helping them better understand crucial scientific terminologies related to the lesson (Innaci & Sam, 2017).

Moreover, the results suggest that the use of CBM can help students better enhance their conceptual understanding of complex Physics concepts. This also demonstrates that CBM, as an instructional intervention, is a practical approach. This finding aligns with the study of Damayanti and Kuswanto (2021), which reported that the developed comic significantly enhanced students' critical thinking abilities and understanding in Physics education.

Table 3. Independent T-test analysis for posttest scores of Grade 9 students in the conventional and CBM groups.

Group	Mean	SD	*Statistic*	*p*
Conventional	19.70	3.10	-4.63	<.001
CBM	24.30	3.18		

Pre-Intervention and Post-Intervention Interest Levels of the CBM Group

Table 4 shows the pre-intervention and post-intervention interest levels of the CBM group. The CBM group (overall median = 3) had less interest in their pre-intervention interest level test but showed increased interest in their post-intervention interest level test (overall median = 4). This implies that the CBM group felt less interested in studying Physics before the implementation of CBM as an intervention, with an overall median of 3 (somewhat interested). Indicators 6, 7, 8, 9, 11, and 12 received the same and highest median score of 4. At the same time, item number 10, which states, "I believe that innovative instructional strategies make challenging Physics concepts easier to understand," had the lowest standard deviation (SD = 0.41), indicating better clarity and reliability. Meanwhile, statement number 10, "I feel that traditional teaching methods in Physics can be boring or unengaging," had the lowest median score of 2, with a standard deviation of 0.41.

On the other hand, the interest levels in Physics among Grade 9 students increased significantly after the implementation of CBM, with an overall mean of 4 (indicating interest). The median value of each indicator increased significantly, with the highest median score of 5 observed in indicators 5, 6, 7, 8, 9, and 12. However, indicator number 9, which states, "I am more likely to pay attention in class when the teaching method is creative," had the lowest standard deviation (SD = 0.44).

Table 4. Pre-interest and Post-interest Level of Grade 9 Students toward Physics.

	PRE-INTEREST LEVEL			POST-INTEREST LEVEL		
INDICATORS	**MEDIAN**	***SD***	**DESCRIPTION**	**MEDIAN**	***SD***	**DESCRIPTION**
1. I find physics topics engaging and enjoyable.	2	0.79	Uninterested	4	0.49	Interested
2. I look forward to studying physics in class.	2	0.69	Uninterested	4	0.50	Interested
3. I am curious to learn how physics applies to real-life situations.	3	0.72	Somewhat Interested	4	0.66	Interested
4. I feel motivated to study physics outside of school.	2.5	0.68	Uninterested	4	0.72	Interested

5. I enjoy learning physics through creative and visual materials.	3.5	0.60	Interested	5	0.50	Extremely Interested
6. Comics or illustrations make learning physics more enjoyable for me.	4	0.49	Interested	5	0.47	Extremely Interested
7. I prefer lessons that involve storytelling or relatable examples.	4	0.60	Interested	5	0.49	Extremely Interested
8. I am more interested in physics when lessons are presented in a fun and innovative way.	4	0.49	Interested	5	0.50	Extremely Interested
9. I am more likely to pay attention in class when the teaching method is creative.	4	0.50	Interested	5	0.44	Extremely Interested
10. I feel that traditional teaching methods in physics can be boring or unengaging.	2	0.41	Uninterested	2	0.50	Uninterested
11. I feel that creative teaching methods encourage me to participate in class discussions actively.	4	0.49	Interested	4.5	0.51	Extremely Interested
12. I believe that innovative instructional strategies make challenging physics concepts easier to understand.	4	0.41	Interested	5	0.50	Extremely Interested
OVERALL MEDIAN/SD	**3**	**0.13**	**Somewhat Interested**	**4**	**0.08**	**Interested**

Comparative Analysis of Pre-Intervention and Post-Intervention Interest Levels of the CBM Group

A significant difference was found between the pre-intervention (M = 3.33, SD = 4.00) and post-intervention (M = 4.42, SD = 5.00) interest levels of the CBM group after using CBM, with a p-value of < .05 (Table 5). This suggests that CBM is effective not only in enhancing students' conceptual understanding but also in increasing their interest in studying Physics. Furthermore, after using CBM as an instructional material in the teaching and learning process, students felt more interested in studying Physics because the lessons were presented in a fun and innovative way. In addition, the use of CBM made students more curious about how Physics applies to real-life situations, such as understanding the concept of energy transformation and the conservation of mechanical energy through relatable examples. The study by Nishonova (2024) supports this finding, reporting that the use of comics enhanced interest levels and understanding among primary school students, while also helping learners develop a deeper appreciation and interest in learning complex concepts.

Table 5. Student's test results for the pre-intervention and post-intervention interest levels of the CBM group.

Interest Level	Mean	Median	Statistic	*p*
Pre-Interest	3.33	4.00	-7.29	<.001
Post-Interest	4.42	5.00		

Relationship Between Posttest Scores and Post-interest Levels of the CBM group

Table 6 presents the results of the correlational analysis between the posttest scores and post-intervention interest levels of the CBM group, revealing a moderate positive correlation (Spearman's ρ = 0.508, p = 0.022). This suggests that higher levels of conceptual understanding in Physics are associated with greater student interest. The correlation is statistically significant at the 0.05 level, as the p-value falls below the threshold (p = .022), confirming a meaningful relationship between the two variables. This finding suggests that as students' understanding of Physics improved following the intervention, their interest in the subject also increased. It highlights a mutually reinforcing relationship between cognitive achievement and affective engagement. The result is consistent with the findings of Harackiewicz et al. (2016), who emphasized that interest in a subject significantly contributes to students' academic success by influencing their motivation, persistence, and overall educational trajectory.

Table 6. Correlation analysis of the posttest scores and post-interest levels of the CBM group.

	Spearman's rho	**df**	**p-value**
PPosttestscores Post-interest	0.508	18	0.022

Conclusion and Recommendations

This study demonstrated that CBM is not only effective as an instructional material in improving the conceptual understanding of Physics lessons among Grade 9 students, but it also contributes to increased student interest in the subject. In comparison to conventional methods, CBM proved more effective in facilitating the learning of complex concepts, including the conservation of mechanical energy and energy transformation. Thus, this outcome indicates that incorporating visually engaging, relatable, and creative instructional materials into the teaching–learning process can help students enhance their conceptual understanding of complex and abstract Physics concepts.

Theoretically, the findings support the idea that multimodal learning tools enhance cognitive processing and memory retention. In practical classroom settings, Comics-Based Mnemonics foster active participation and interest, especially among learners who find conventional teaching methods less engaging. Notably, the correlational analysis between posttest scores and post-intervention interest levels of the CBM group, using Spearman's rho correlation, revealed a moderate, statistically significant positive relationship. Reflecting on this, the researchers realized how creativity and connecting lessons to real-life situations can make teaching and learning more engaging—especially in science, which many students often find challenging and uninteresting.

The researchers recommend using CBM as instructional materials in teaching abstract Physics concepts, as they have proven effective in enhancing students' conceptual understanding and interest levels toward Physics. However, the study had certain limitations, including a short implementation period, a small sample size, and a focus only on selected Physics topics. In addition, utilizing comics as a teaching tool remains not only unfamiliar but also underutilized in science education. Thus, it is recommended that future researchers expand the study with a larger and more diverse group of respondents, a longer implementation duration, and explore the use of CBM in other areas of science to assess its effectiveness further and expand its potential as instructional materials in educational settings.

Conflict of Interest

The authors declare that they have no conflict of interest.

Authorship Details

Gabriel (40%): Concept and design, data acquisition and analysis, writing the manuscript. Castulo (40%): Concept and design, data acquisition and analysis, writing the manuscript. Natividad (20%): Supervision, reviewing, and editing the manuscript.

Use of AI Declaration

ChatGPT was used in creating the visuals for the Comics-Based Mnemonics as it provided the easiest and fastest way to produce comic illustrations. By maximizing the potential of AI tools, the researchers were able to generate accurate, hassle-free visuals while also reducing the financial burden of hiring external visual artists. The researcher-

made storyline of the comics served as input in developing the visuals to ensure alignment with the desired visuals. Additionally, ChatGPT was used to assist in correcting grammatical errors.

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