

**ENHANCING STUDENTS' CONCEPTUAL RETENTION IN SCIENCE
THROUGH THE INTEGRATION OF DUAL CODING AND
ELABORATIVE INTERROGATION PROMPTS**

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In Partial Fulfillment
of the Requirements for the Degree
Bachelor of Secondary Education
Major in Science

by

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APPROVAL SHEET

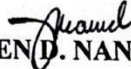
This thesis entitled, "ENHANCING STUDENTS' CONCEPTUAL RETENTION IN SCIENCE THROUGH THE INTEGRATION OF DUAL CODING AND ELABORATIVE INTERROGATION PROMPTS," prepared and submitted by MAICA JOY M. ELECCION, in partial fulfillment of the requirements for the degree of **Bachelor in Secondary Education major in Science**, has been examined and is recommended for acceptance for Oral Examination.


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DEDICATION

This research is sincerely dedicated to Almighty God,
whose unwavering love, divine guidance, and abundant blessings
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ABSTRACT

As science education continues to seek effective approaches to improve students' learning, instructional strategies such as Dual Coding and Elaborative Interrogation Prompts (EIP) have become valuable in enhancing conceptual retention and understanding. This action research determined the effectiveness of integrating Dual Coding and Elaborative Interrogation Prompts (EIP) in improving Grade 8 students' conceptual retention in Science. The study was conducted in one of the public secondary schools in Ozamiz City during the School Year 2025–2026. A one-group pretest-posttest research design was employed using a 50-item researcher-made test to measure students' conceptual retention before and after the implementation of the intervention. Data were analyzed using frequency, percentage, mean, standard deviation, and paired t-test through Jamovi software. Findings revealed that before the implementation of Dual Coding and Elaborative Interrogation Prompts (EIP), students demonstrated low conceptual retention in Science, with most of them falling under the Did Not Meet Expectations category. After the intervention, students' performance improved significantly, reaching a Satisfactory level. Statistical analysis showed a highly significant difference between the pretest and posttest results ($t = 8.50$, $p < .001$), indicating that the intervention effectively enhanced students' conceptual retention and understanding of scientific concepts. The study concludes that integrating Dual Coding and Elaborative Interrogation Prompts (EIP) strengthens students' comprehension, retention, and academic performance in Science. Therefore, the use of these learner-centered and evidence-based instructional strategies is recommended in Science instruction. Future researchers are encouraged to replicate the study using larger samples, longer intervention periods, and other subject areas to further validate the effectiveness of the intervention.

Keywords: *conceptual retention, Dual Coding, Elaborative Interrogation Prompts, Science education, students' performance*

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Chapter 1

INTRODUCTION

Context and Rationale

In science education, developing students' long-term conceptual understanding remains a key goal of effective instruction. Conceptual retention refers to learners' ability to store and retrieve scientific knowledge over time, which is often influenced by the learning strategies teachers employ. Prior studies in cognitive science show that dual coding improves memory because it requires deeper mental processing than simply reading or writing, making it a form of desirable difficulty (Gorman, 2022). In addition, the Elaborative Interrogation Prompts (EIP) learning strategies such as summarizing, self-explanation, and creating mind maps have been reported as more effective than other techniques in helping students understand and retain information (Sambeth, 2022). The integration of Dual Coding and Elaborative Interrogation Prompts (EIP) represents a promising instructional innovation designed to strengthen retention and comprehension. These approaches address cognitive load, foster self-regulated learning, and improve conceptual retention by encouraging active engagement with scientific material (Nebel & Sumeracki, 2025; Mir et al., 2023).

Despite the growing interest in effective learning strategies, research has revealed that empirically supported techniques such as dual coding and elaborative interrogation remain underutilized in classrooms (Surma et al., 2022). Studies show that both students and novice teachers frequently depend on ineffective strategies like rereading and highlighting, which contribute little to long-term understanding (Seban et al., 2024). This limitation emphasizes the need for explicit integration of evidence-based strategies that promote meaningful learning (Carpenter et al., 2022). Furthermore, while dual coding supports the visualization of abstract concepts, it may not equally cater to all learning preferences, and elaborative interrogation can be time-consuming if not properly scaffolded (Mir et al., 2023).

The challenge of poor conceptual retention among students has been documented across various educational levels (Tise, 2021). Studies indicate that many learners struggle to recall scientific concepts after instruction due to passive learning approaches and limited cognitive engagement (Seban & Urban, 2024). Science teachers often prioritize content delivery over strategies and training, which restricts students' ability to independently regulate their learning (Gorman, 2022). As a result, despite exposure to scientific information, students frequently exhibit surface-level understanding and fail to transfer knowledge to new contexts. This issue highlights the importance of combining

visual aids and reasoning prompts to improve the depth and durability of learning outcomes in science classrooms.

Supporting evidence shows that the dual coding strategy enhances recall by activating both the verbal and visual systems of memory, effectively reducing cognitive overload and facilitating knowledge integration (Lee & Lee, 2022). Similarly, elaborative interrogation prompts foster metacognitive engagement, allowing learners to link new information to prior knowledge and improve inferential thinking (Farooq & Maher, 2021). These techniques align with the broader cognitive theory of multimedia learning, which suggests that using multiple representational modes leads to deeper conceptual processing (Nebel & Sumeracki, 2025). Empirical studies in different contexts have validated the effectiveness of these strategies in improving scientific literacy, retention, and comprehension (Moreno et al., 2021).

Nevertheless, a research gap in practical knowledge seems evident in previous research and persists in the localized and combined use of dual coding and elaborative interrogation prompts in secondary science education (Fox, 2024). Most existing studies have independently explored either visual or elaborative techniques; however, there is a limited number of practical studies or action research projects that examine their integration as a unified instructional intervention (Miles, 2017). Addressing this gap can

provide context-based insights into how these strategies enhance students' comprehension and retention in science.

This study determined the effectiveness of integrating Dual Coding and Elaborative Interrogation Prompts (EIP) in enhancing students' conceptual retention and understanding of scientific concepts in science education. Specifically, it explored how the combined use of visual and verbal representations with reasoning-based questioning improved students' long-term memory, comprehension, and engagement in learning science. The findings provided educators, curriculum developers, and future researchers with data-driven insights into strategies that enhanced students' long-term conceptual understanding. Moreover, the scope of the study targeted Grade 8 students at the secondary level in one of the public schools in the city to examine how these strategies effectively improved the retention of key scientific concepts in early secondary education. In doing so, this research supported the advancement of innovative, learner-centered pedagogies that promoted critical thinking, deep learning, and sustained academic performance in science education.

Strategy

Evidence-based teaching techniques like Dual Coding and Elaborative Interrogation Prompts (EIP) improve students' capacity to comprehend, arrange, and remember scientific material. Dual Coding, derived from cognitive psychology, emphasizes combining verbal and visual representations to enhance memory formation and recall (Dogomeo & Alias, 2022). This learning strategy, rooted in cognitive science, stresses the integration of spoken explanations and visual representations, allowing students to develop deeper conceptual understanding and more complex mental models (Clark & Paivio, 2021).

Elaborative Interrogation involves prompting learners to generate explanations to “why” and “how” questions, thereby promoting deeper processing and meaningful learning connections (Killian et al., 2024). By asking students to explain "why" a fact or concept is true, elaborative questioning facilitates meaningful learning by connecting new material with existing knowledge and real-world settings (Rittle-Johnson et al., 2022). When combined, these techniques foster critical thinking, long-term retention, and active engagement skills crucial for 21st-century science learners.

The intervention will be implemented for one to two months in the Science curriculum using Dual Coding and Elaborative Interrogation Prompts, beginning each

lesson with the researcher introducing key scientific concepts through visual and verbal representations such as diagrams, flowcharts, illustrations, and concept maps to support students' initial understanding. Students interpret these visuals, describe their observations, and connect them to the lesson's main ideas. The researcher applies elaborative interrogation by asking reasoning-based questions that prompt students to explain why concepts work, how processes occur, or why certain features are important, guiding them to link new knowledge with prior learning. Students work individually or in groups to answer the prompts, discuss insights, and refine their explanations through collaboration. In lesson activities, students analyze visuals and respond to “why” and “how” questions, share their interpretations, and adjust their understanding based on peer and researcher feedback. Throughout the sessions, students create their own diagrams, summarize concepts visually, and respond to analytical prompts, strengthening their reasoning, comprehension, and long-term retention of scientific concepts.

Statement of the Problem

This action research aimed to enhance Grade 8 students' performance in Science through Dual Coding and Elaborative Interrogation Prompts (EIP) strategies.

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

1. What is the performance of students in conceptual retention in Science before the implementation of Dual Coding and Elaborative Interrogation Prompts (EIP)?
2. What is the performance of students in conceptual retention in Science after the implementation of Dual Coding and Elaborative Interrogation Prompts (EIP)?
3. Is there a significant difference in students' performance in conceptual retention in Science before and after the implementation of Dual Coding and Elaborative Interrogation Prompts (EIP)?

Null Hypotheses

H₀₁: There is no significant difference in the level of conceptual retention of students in science before and after the implementation of Dual Coding and Elaborative Interrogation Prompts (EIP).

Chapter 2

METHODS

Research Design

This study employed a classroom-based action research approach using a single pretest–posttest design. A single pretest–posttest design evaluated an intervention by measuring participants’ outcomes before and after its implementation without the use of a control group (Marcos et al., 2024). This design was well-suited to the study, as it allowed measurable assessment of learning gains resulting from the application of cognitive-based instructional strategies. The test approach provided clear quantitative data to evaluate changes in students’ retention and comprehension of scientific concepts (Llido et al., 2025).

Research Setting

The study was conducted in one of the junior high schools located in Ozamiz City, within the province of Misamis Occidental. It involved Grade 8 students from a selected class section. The institution was a complete secondary school that offered education from Grades 7 to 12. It implemented various academic programs, including the Regular

Curriculum, Special Science Curriculum, Special Program for the Arts, Strengthened Technical-Vocational Education Program (STVEP), and the Open High School Program.

The school was dedicated to delivering curriculum-based, high-quality, and affordable education to the local community. It fostered a diverse and inclusive learning environment that accommodated students with different backgrounds, interests, and abilities. This made it an ideal setting for implementing the Dual Coding and Elaborative Interrogation Prompts (EIP) strategies, which aimed to enhance students' conceptual understanding and retention in Science.

Respondents of the Study

The study involved forty (40) Grade 8 students. Participants were chosen using purposive sampling, based on the following criteria: (1) students enrolled as Grade 8 learners in a specific secondary institution in Ozamiz City for the academic year 2025–2026; (2) students were observed to need support in science learning; and (3) students who provided voluntary consent to participate in the study. Before administering the survey, the researcher ensured that all criteria were met.

Research Instruments

To gather data, the researcher used the following research instruments:

A. Test (Appendix A). The instrument was a 50-item test covering the intended topics of Science 8 from the fourth grading period. The same set of questions was used for both tests; however, in the posttest, the items were rearranged to prevent memorization. The first test measured the students' baseline knowledge of Science concepts, while the last test evaluated the effectiveness of the Dual Coding and Elaborative Interrogation Prompts (EIP) learning strategies in improving their academic performance in Science.

The test underwent expert evaluation by the research adviser, cooperating teacher, school head, and principal to verify its content validity. The evaluation focused on content, alignment with the curriculum, clarity of questions, and appropriateness for the target grade level. Moreover, a pilot test was carried out on a separate group of students from other sections. The instrument's reliability was then analyzed using Cronbach's Alpha, and the researcher ensured that it achieved a score between 0.7 and 1.0, indicating acceptable to excellent internal consistency.

In determining the test performance, the following scale was used.

Score	Grade Equivalent	Interpretation
42 – 50	90-100	Outstanding
38 – 41	85-89	Very Satisfactory
34 – 37	80-84	Satisfactory
30 – 33	75-79	Fairly Satisfactory
1 – 29	Below 75	Did not meet expectations

Lesson Plan (Appendix B). The researcher developed a series of lesson plans focused on various Physics topics, as guided by the cooperating teacher. These lesson plans incorporated Dual Coding and Elaborative Interrogation Prompts (EIP) to enhance students' understanding and performance in Science. Before implementation, the cooperating teacher carefully reviewed the lesson plans, and the researcher made necessary revisions to ensure alignment with the prescribed curriculum and the attainment of the intended learning objectives.

Data Collection

This action research gathered quantitative results. Grade 8 students' science performance was measured using a researcher-made instrument, such as test questions.

A. Pre-Implementation Phase. During this phase, the researcher observed emerging challenges that students experienced in their science learning. Insights and

information about these challenges were obtained through extensive observations. The researcher began writing the research proposal, created lesson plans, prepared the pre-test and post-test, and developed prototype strategies. The researcher then requested permission from the Superintendent of the Division of Ozamiz City, as well as consent from the principal and cooperating teacher, to conduct the study in a secondary school in Ozamiz City.

B. Implementation Phase. The implementation stage included collecting data, which involved administering the pre-test to the participants, implementing the targeted learning strategies for a specific period, and monitoring the participants' performance and attitude. After the intervention, the researcher conducted the post-test assessment. This phase also included retrieving, tallying, analyzing, and interpreting the data to determine whether the strategies were significantly effective.

C. Post-Implementation Phase. The post-implementation phase involved drawing conclusions, making recommendations, proofreading, revising, and completing the research project. It also included properly communicating the research findings to the intended audience.

Ethical Considerations

Ethics in research referred to the standards and principles that guided choices about data collection, analysis, and distribution (Gedutis et al., 2022).

Prior to conducting the research, the researcher requested consent from the Misamis University Research Ethics Committee (MUREC) to ensure compliance with institutional and ethical research standards and to ensure that the study met the institution's ethical standards. In addition, the researcher sought approval from the Superintendent of the Division of Ozamiz City, as well as consent from the principal and cooperating teacher, to conduct the study in one of the junior high schools in Ozamiz City.

After receiving the approved letter, the researcher secured informed consent from the participants. The participants were informed of the study's aims, data confidentiality, potential advantages, and other relevant details, as well as their anonymity throughout the process. Furthermore, the researcher reminded the participants that their participation was entirely voluntary and that they could choose to respond or decline if they felt uncomfortable. In order to preserve the confidentiality and dignity of the participants and their organization, the researcher strictly followed Republic Act No. 10173, also known as the "Data Privacy Act of 2012," along with the ethical guidelines when collecting, analyzing, and disseminating the study's findings.

Data Analysis

The study utilized the following tools for analyzing the collected data using Jamovi software:

Mean and Standard Deviation were used to determine the students' average performance and the consistency of their scores before and after the integration of Dual Coding and Elaborative Interrogation Prompts (EIP).

Frequency and Percentage were used to identify the level of students' performance before and after the integration of Dual Coding and Elaborative Interrogation Prompts (EIP).

Paired T-test was used to examine whether there was a statistically significant difference in student performance before and after the integration of Dual Coding and Elaborative Interrogation Prompts (EIP).

Dissemination Plan

The findings of the study were communicated to school administrators, cooperating teachers, and Grade 8 learners through reports, focused discussions, and user-friendly summaries. These materials highlighted how Dual Coding and Elaborative Interrogation Prompts improved students' conceptual retention and engagement in Science. When sharing the results with learners and parents, consent and assent

procedures were emphasized to uphold ethical considerations throughout the dissemination process. The study's results were also presented in university research forums, faculty development sessions, and professional learning communities to inform and inspire other educators. Plans for presenting the outcomes during seminars, conferences, and academic gatherings further promoted the integration of research-based strategies in Science teaching.

Utilization Plan

The results of the study were utilized through poster presentation and publication. A research poster summarizing the methodology, key findings, and pedagogical recommendations related to Dual Coding and Elaborative Interrogation Prompts was developed and showcased during academic fairs, school research congresses, and regional or division research dissemination activities. This helped Science educators, curriculum planners, and stakeholders easily grasp the practical insights and apply the strategies in their own classrooms. Moreover, the study was prepared for publication in an academic journal to ensure broader dissemination. This extended the study's contribution to the fields of Science education and cognitive learning strategies, supporting future research focused on enhancing students' conceptual retention and promoting more effective, research-informed teaching practices.

Cost Estimates

The following table presents the estimated expenses necessary for the implementation of the study.

The materials listed account for 45 student participants and 6-8 teaching sessions, ensuring sufficient supplies for Dual Coding and Elaborative Interrogation activities.

Materials	Amount
5 reams bond paper (for printing tests & documents)	₱ 875.00
30 sheets cartolina (for visuals)	₱ 450.00
20 sheets manila paper (for group tasks)	₱ 200.00
3 sets colored markers (for multiple sessions)	₱ 240.00
10 rolls masking/Scotch tape (for posting visuals)	₱ 650.00
1 set ink (black & colored)	₱ 400.00
5 pieces documentation supplies (folders, envelopes)	₱ 100.00
Internet load	₱ 600.00
Miscellaneous expenses	₱ 300.00
Total	₱ 3,815.00

Chapter 3

RESULTS AND DISCUSSION

Students' Performance in Conceptual Retention in Science Before the Implementation of Dual Coding and Elaborative Interrogation Prompts (EIP)

Table 1 presented the students' performance in conceptual retention in science before the implementation of Dual Coding and Elaborative Interrogation Prompts (EIP). The overall level of conceptual retention in science was relatively low, with an overall mean score of ($M = 29.9$, $SD = 4.49$), which fell under the Did Not Meet Expectations category. This means that students' learning was limited and traditional instructional approaches alone were not sufficient to support strong conceptual understanding in science. It further implies the need for more effective instructional strategies that actively engage students in meaningful learning and deeper cognitive processing. Moreover, the findings highlight gaps in students' ability to retain and apply scientific concepts, suggesting that enhanced teaching approaches such as Dual Coding and Elaborative Interrogation Prompts may be necessary to improve their learning outcomes.

Among the performance levels, the highest mean score was observed among students classified as Outstanding ($n = 1$, 2.5%, $M = 35.5$, $SD = 5.916$), followed by those in the Very Satisfactory category ($n = 2$, 5.0%, $M = 31.0$, $SD = 3.684$). Students

under the Satisfactory level obtained a mean score of ($n = 5$, 12.5%, $M = 28.0$, $SD = 4.320$), while those categorized as Fairly Satisfactory had a mean of ($n = 12$, 30.0%, $M = 27.4$, $SD = 2.966$). The lowest and largest group of respondents belonged to the Did Not Meet Expectations category ($n = 20$, 50.0%, $M = 29.7$, $SD = 2.082$).

These findings indicate that a considerable proportion of students showed limited conceptual retention in science before the instructional intervention. Recent studies support the use of Dual Coding and elaborative learning strategies in science education. For example, dual coding through infographics has been shown to enhance students' scientific understanding (Dogomeo & Aliazas, 2022), while also improving retention of science concepts among learners (Mir et al., 2023). In addition, elaborative interrogation promotes deeper learning by encouraging students to explain relationships among concepts (Moreno et al., 2021). Similarly, elaboration strategies strengthen meaningful learning and long-term memory retention (Van Hoof et al., 2022). Overall, these studies suggest that integrating Dual Coding and Elaborative Interrogation Prompts is an effective and evidence-based approach to address gaps in science conceptual retention.

The findings suggested that many students experienced difficulty retaining and understanding scientific concepts before the integration of Dual Coding and Elaborative Interrogation Prompts. The dominance of students within the Did Not Meet Expectations

category implied that traditional instructional approaches may not have sufficiently supported deep conceptual processing and long-term retention. Science concepts often involve abstract and complex information, which may become difficult for learners to recall when instruction relies heavily on verbal explanation alone. The relatively low performance levels also reflected possible gaps in students' ability to connect prior knowledge with newly learned concepts. Furthermore, the limited number of students who reached the Outstanding and Very Satisfactory levels indicated that only a few learners were able to independently develop effective retention and comprehension strategies. These results highlighted the need for more engaging and cognitively supportive teaching approaches that encourage active processing, visualization, and meaningful explanation of scientific ideas.

Table 1

Students' Performance in Conceptual Retention in Science Before the Implementation of Dual Coding and Elaborative Interrogation Prompts (EIP)

Performance	Frequency	Percentage	M	SD
Outstanding	1	2.5	35.5	5.916
Very Satisfactory	2	5.0	31.0	3.684
Satisfactory	5	12.5	28.0	4.320
Fairly Satisfactory	12	30.0	27.4	2.966
Did not meet expectations	20	50.0	29.7	2.082
Overall Performance	40	100.00	29.9	4.49

Note: 42–50 (Outstanding); 38–41 (Very Satisfactory); 34–37 (Satisfactory); 30–33 (Fairly Satisfactory); 1–29 (Did Not Meet Expectations)

Students' Performance in Conceptual Retention in Science After the Implementation of Dual Coding and Elaborative Interrogation Prompts (EIP)

Table 2 presented the students' performance in conceptual retention in science after the implementation of Dual Coding and Elaborative Interrogation Prompts (EIP). The overall performance of the students showed improvement, with an overall mean score of ($M = 36.7$, $SD = 4.44$), which fell under the Satisfactory category. This indicates that students were able to better retain and understand science concepts after the intervention. The improvement suggests that the use of Dual Coding and EIP helped

enhance students' learning by making information more meaningful and easier to process, leading to better conceptual understanding in science.

Among the performance levels, students in the Outstanding category obtained the highest mean score ($n = 4$, 10.0%, $M = 43.3$, $SD = 1.258$), followed by those classified as Very Satisfactory ($n = 15$, 37.5%, $M = 39.5$, $SD = 1.125$). Students under the Satisfactory category recorded a mean score of ($n = 13$, 32.5%, $M = 35.6$, $SD = 1.193$), while those in the Fairly Satisfactory level obtained ($n = 5$, 12.5%, $M = 31.4$, $SD = 0.894$). The lowest performance was observed among students who Did Not Meet Expectations ($n = 3$, 7.5%, $M = 27.3$, $SD = 2.887$).

These findings indicate that most students achieved Satisfactory to Very Satisfactory levels of conceptual retention after the instructional intervention. This improvement is supported by previous studies showing that multimodal and elaborative instructional strategies enhance learning in science. For instance, self-explanation prompts have been found to improve comprehension and retention of content (Bai et al., 2022), while visual and arts-based instruction helps students better understand abstract concepts (Gorman, 2022). In addition, elaborative interrogation strategies strengthen learning by encouraging students to explain their answers (Killian et al., 2024). Overall, visual tools such as infographics also improve recall and understanding of scientific

information (Lee & Lee, 2022), supporting the effectiveness of Dual Coding and Elaborative Interrogation Prompts.

The findings suggested that the integration of Dual Coding and Elaborative Interrogation Prompts positively influenced students' conceptual retention in science. The noticeable increase in the number of students who achieved Very Satisfactory and Outstanding performance levels implied that the intervention helped learners process and retain scientific concepts more effectively. Dual Coding likely enhanced learning by combining verbal explanations with visual representations, enabling students to encode and retrieve information through multiple cognitive pathways. At the same time, Elaborative Interrogation Prompts (EIP) may have strengthened students' understanding by encouraging them to explain relationships, justify ideas, and connect concepts to prior knowledge. The relatively lower standard deviations among the higher-performing groups also suggested more consistent academic performance among students after the intervention. Furthermore, the reduced number of students who did not meet expectations indicated that the intervention may have helped address learning difficulties and improve students' overall comprehension and retention abilities.

Table 2

Students' Performance in Conceptual Retention in Science After the Implementation of Dual Coding and Elaborative Interrogation Prompts (EIP)

Performance	Frequency	Percentage	M	SD
Outstanding	4	10.0	43.3	1.258
Very Satisfactory	15	37.5	39.5	1.125
Satisfactory	13	32.5	35.6	1.193
Fairly Satisfactory	5	12.5	31.4	0.894
Did not meet expectations	3	7.5	27.3	2.887
Overall Performance	40	100.00	36.7	4.44

Note: 42–50 (Outstanding); 38–41 (Very Satisfactory); 34–37 (Satisfactory); 30–33 (Fairly Satisfactory); 1–29 (Did Not Meet Expectations)

Significant Difference in Students' Performance in Conceptual Retention in Science Before and After the Implementation of Dual Coding and Elaborative Interrogation Prompts (EIP)

Table 3 presented the significant difference in students' performance in conceptual retention in science before and after the implementation of Dual Coding and Elaborative Interrogation Prompts (EIP). The findings revealed a statistically significant difference between the students' performance before and after the intervention, as reflected by the computed t-value and p-value ($t = 8.50$, $p < .001$). Prior to the implementation of Dual Coding and EIP, students obtained a lower mean score ($M = 29.9$,

SD = 4.49), which increased after the implementation to ($M = 36.7$, $SD = 4.44$). This significant increase in the mean score indicated that the intervention contributed positively to improving students' conceptual retention in science.

The significant finding suggested that the integration of Dual Coding and Elaborative Interrogation Prompts effectively enhanced students' understanding and retention of scientific concepts. The increase in students' mean performance after the intervention implied that combining verbal information with visual representations helped learners process information more efficiently and retain concepts for a longer period. Moreover, Elaborative Interrogation Prompts may have encouraged students to think critically by asking them to explain why concepts occur or how ideas are related, thereby strengthening meaningful learning. The relatively similar standard deviations before and after the intervention further suggested that the improvement in conceptual retention was consistently experienced by the students. These findings supported cognitive learning theories which emphasized that learning becomes more effective when students actively engage in processing and organizing information through multiple representations and reflective questioning.

There were no non-significant findings observed in the study since the obtained p-value was less than 0.05. This indicated that the improvement in students' conceptual

retention was not due to chance but was significantly associated with the implementation of Dual Coding and Elaborative Interrogation Prompts. The rejection of the null hypothesis further confirmed the effectiveness of the intervention in enhancing students' performance in science.

Educational research confirms the effectiveness of Dual Coding and Elaborative Interrogation in enhancing science learning and conceptual retention. Dual Coding improves students' ability to process, organize, and recall information by combining visual and verbal learning pathways (Dogomeo & Aliazas, 2022). Likewise, elaborative interrogation enhances understanding and critical thinking by encouraging students to explain relationships among concepts (Killian et al., 2024). Self-explanation and elaborative prompts also support meaningful learning and long-term memory retention (Bai et al., 2022). In addition, evidence-based strategies such as elaboration and retrieval practice have been shown to improve overall learning outcomes (Nebel & Sumeracki, 2022). Therefore, these findings support the use of Dual Coding and Elaborative Interrogation Prompts as effective strategies for improving science education.

Science teachers were encouraged to integrate Dual Coding and Elaborative Interrogation (EIP) strategies regularly into classroom instruction to improve conceptual retention and promote deeper understanding of scientific concepts. Teachers could

incorporate diagrams, charts, concept maps, animations, and visual organizers alongside guided questioning activities to make lessons more engaging and meaningful. School administrators were encouraged to provide professional development seminars and workshops that would strengthen teachers' competence in applying evidence-based instructional strategies. Curriculum developers could also design instructional materials and learning modules that integrate visual and verbal learning components with higher-order questioning techniques. Furthermore, schools could organize collaborative learning activities, inquiry-based investigations, and reflective discussions to sustain students' active participation and critical thinking skills. Through the consistent use of these innovative teaching approaches, students may develop stronger conceptual understanding, improved retention, and better academic performance in science.

Table 3

Significant Difference in Students' Performance in Conceptual Retention in Science Before and After the Implementation of Dual Coding and Elaborative Interrogation Prompts (EIP)

Performance	M	SD	T-value	P-value	Decision
Before the Implementation of Dual Coding and EIP	29.9	4.49	8.50	<.001	Reject H ₀₁
After the Implementation of Dual Coding and EIP	36.7	4.44			

Note: $p < 0.001$ (Highly Significant); $p < 0.05$ (Significant); $p > 0.05$ (Not Significant)

Chapter 4

SUMMARY, FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

Summary

This action research This action research aimed to enhance Grade 8 students' conceptual retention in Science through the integration of Dual Coding and Elaborative Interrogation Prompts (EIP). Specifically, the study determined the students' performance in conceptual retention before and after the implementation of the intervention and examined whether there was a significant difference in students' performance after the application of the strategies. The study was conducted among forty (40) Grade 8 students in one of the public secondary schools in Ozamiz City during the School Year 2025–2026.

The study utilized a classroom-based action research approach using a single-group pretest–posttest design. A 50-item researcher-made test was used to measure students' conceptual retention in Science before and after the implementation of Dual Coding and Elaborative Interrogation Prompts. The instrument underwent content validation and reliability testing to ensure accuracy and consistency. Data gathered were

analyzed using frequency, percentage, mean, standard deviation, and paired t-test through Jamovi software.

The intervention was implemented through the integration of visual and verbal learning strategies together with reasoning-based questioning techniques. Students were exposed to diagrams, concept maps, illustrations, and analytical “why” and “how” questions that encouraged meaningful learning and deeper understanding of scientific concepts. The findings of the study revealed that students’ conceptual retention significantly improved after the implementation of Dual Coding and Elaborative Interrogation Prompts. The intervention effectively enhanced students’ understanding, retention, and overall performance in Science.

Findings

The following were the salient findings of the study:

1. The performance of Grade 8 students in Science before the implementation of Dual Coding and Elaborative Interrogation Prompts (EIP) was low.
2. The performance of Grade 8 students in Science after the implementation of Dual Coding and Elaborative Interrogation Prompts (EIP) was satisfactory.

3. There was a very highly significant difference in the students' conceptual retention in Science before and after the implementation of Dual Coding and Elaborative Interrogation Prompts (EIP).

Conclusions

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

1. Students demonstrate low conceptual retention in Science before the implementation of Dual Coding and Elaborative Interrogation Prompts (EIP), suggesting that traditional instructional approaches alone are insufficient in promoting deep understanding and long-term retention of scientific concepts.

2. The implementation of Dual Coding and Elaborative Interrogation Prompts (EIP) positively improves students' conceptual retention in Science. The integration of visual representations and reasoning-based questioning strategies enables students to process, organize, and retain scientific information more effectively.

3. The significant increase in students' performance after the intervention confirms that Dual Coding and Elaborative Interrogation Prompts (EIP) are effective instructional strategies for enhancing conceptual retention and understanding in Science. Thus, the integration of these strategies serves as an effective learner-centered approach in improving science instruction and students' academic performance.

Recommendations

Based on the findings and conclusions, it is recommended that:

1. Science teachers are encouraged to regularly integrate Dual Coding and Elaborative Interrogation Prompts (EIP) into classroom instruction to enhance students' conceptual retention, comprehension, and critical thinking skills.
2. Teachers are encouraged to utilize visual learning materials such as diagrams, flowcharts, concept maps, illustrations, and infographics together with reasoning-based questioning activities to make science lessons more engaging and meaningful.
3. School administrators are encouraged to provide seminars, workshops, and professional development programs that strengthen teachers' knowledge and skills in applying evidence-based instructional strategies such as Dual Coding and Elaborative Interrogation Prompts.
4. Curriculum developers are encouraged to design instructional materials, modules, and learning resources that incorporate visual-verbal integration and higher-order thinking activities to support deeper learning among students.
5. Future researchers are encouraged to conduct similar studies using larger groups of participants, longer intervention periods, or other science disciplines to further validate and expand the findings of this study. The integration of other cognitive and

learner-centered strategies may also be explored to enhance conceptual retention and academic achievement in Science.

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APPENDIX A
PRE-TEST & POST-TEST QUESTIONNAIRE

Multiple Choice Test

Directions: Read each question carefully and encircle the letter of the correct answer.

1. What happens to an object when an unbalanced force acts on it?
 - A. It remains at rest
 - B. It accelerates
 - C. It loses mass
 - D. It stops moving

2. Which quantity describes the rate of change of velocity?
 - A. Speed
 - B. Distance
 - C. Acceleration
 - D. Force

3. When is an object accelerating even if its speed is constant?
 - A. When direction changes
 - B. When mass increases
 - C. When time stops
 - D. When friction disappears

4. Why is acceleration considered a vector quantity?
 - A. It has only magnitude
 - B. It has size only
 - C. It has magnitude and direction
 - D. It has no unit

5. How does increasing force affect acceleration (same mass)?
 - A. Decreases
 - B. Remains constant

- C. Increases
- D. Becomes zero

6. What is the SI unit of acceleration?

- A. m/s
- B. m/s^2
- C. N
- D. J

7. When is acceleration negative?

- A. Speed increases
- B. Object stops
- C. Speed decreases
- D. Direction constant

8. How can you describe uniform acceleration?

- A. Changing randomly
- B. Constant change in velocity
- C. No motion
- D. Circular only

9. Which situation shows no acceleration?

- A. Car speeding up
- B. Car slowing down
- C. Car turning
- D. Car moving straight at constant speed

10. What causes acceleration?

- A. Balanced force
- B. Friction only
- C. Unbalanced force
- D. Mass only

11. Which situation in the local community shows an object slowing down?

- A. A fan spinning steadily
- B. A jeepney approaching a corner
- C. A ball kicked forward
- D. A bicycle moving straight

12. How is acceleration computed?

- A. d/t
- B. vt
- C. $(v_f - v_i)/t$
- D. F/mg

13. What happens when velocity does not change?

- A. Positive acceleration
- B. Negative acceleration
- C. Zero acceleration
- D. Infinite acceleration

14. Which example shows acceleration in daily life?

- A. Book on table
- B. Parked car
- C. Rolling ball speeding up
- D. Sleeping dog

15. A car accelerates at 4 m/s^2 for 5 s and reaches a final velocity of 30 m/s. What was its initial velocity?

- A. 5 m/s
- B. 8 m/s
- C. 10 m/s
- D. 15 m/s

16. A car changes velocity from 5 m/s to 15 m/s in 5 s. What is its acceleration?

- A. 1
- B. 2
- C. 3
- D. 4

17. A bus slows down from 25 m/s to 5 m/s with an acceleration of -4 m/s^2 . How long does it take to slow down?
- A. 5 s
 - B. 4 s
 - C. 3 s
 - D. 6 s
18. Starting from rest, a bike accelerates at 4 m/s^2 for 3 s. What is its final velocity?
- A. 7
 - B. 10
 - C. 12
 - D. 15
19. A runner increases speed from 2 m/s to 8 m/s in 3 s. What is its acceleration?
- A. 1
 - B. 2
 - C. 3
 - D. 4
20. How long to reach 20 m/s from rest at 5 m/s^2 ?
- A. 2 s
 - B. 3 s
 - C. 4 s
 - D. 5 s
21. A car moving 10 m/s accelerates at 2 m/s^2 for 5 s. What is its final velocity?
- A. 15
 - B. 18
 - C. 20
 - D. 25
22. A tricycle stops from 12 m/s in 4 s. What is its acceleration?

- A. -3
- B. 3
- C. -4
- D. 4

23. A runner accelerates uniformly and reaches 15 m/s after 3 s with an acceleration of 5 m/s².
What was the runner's initial velocity?

- A. 0 m/s
- B. 5 m/s
- C. 10 m/s
- D. 20 m/s

24. A train moving at 12 m/s accelerates to 36 m/s at 6 m/s². How long does the acceleration last?

- A. 2 s
- B. 3 s
- C. 4 s
- D. 5 s

25. Why is acceleration zero when $v_i = v_f$?

- A. No time
- B. No force
- C. No change in velocity
- D. No distance

26. What is plotted on the y-axis of a distance-time graph?

- A. Time
- B. Distance
- C. Velocity
- D. Acceleration

27. What does the slope of a distance-time graph represent?

- A. Acceleration
- B. Mass
- C. Force
- D. Speed

28. What does a horizontal line indicate?

- A. Fast motion
- B. Acceleration
- C. No motion
- D. Deceleration

29. How does a steeper slope appear?

- A. Slower
- B. Faster
- C. Stationary
- D. Negative

30. What shape shows uniform acceleration?

- A. Straight line
- B. Zigzag
- C. Curve (parabola)
- D. Horizontal

31. Why is non-uniform acceleration irregular on the graph?

- A. Constant speed
- B. No time
- C. Changing speed
- D. Equal intervals

32. How can you describe motion if the graph curves upward?

- A. Slowing down
- B. Constant
- C. Speeding up
- D. Stopped

33. What is plotted on the y-axis of a velocity-time graph?

- A. Time
- B. Distance

- C. Velocity
- D. Acceleration

34. What does slope represent?

- A. Speed
- B. Acceleration
- C. Distance
- D. Mass

35. What does a horizontal line on a distance-time graph indicate?

- A. Constant acceleration
- B. Constant velocity
- C. No time
- D. Stopped

36. What does an upward slope on a distance-time graph indicate?

- A. Deceleration
- B. Acceleration
- C. Rest
- D. Negative speed

37. What does a downward slope means?

- A. Speeding up
- B. Turning
- C. Slowing down
- D. Zero force

38. Why is it important to label the axes and choose proper scales when drawing graphs?

- A. To make the graph colorful
- B. To make the graph larger
- C. To reduce the number of points
- D. To ensure the data are accurate and easy to interpret

39. What keeps an object moving in a circle?

- A. Friction
- B. Gravity

- C. Centripetal force
- D. Speed

40. Where does centripetal force always point?

- A. Outward
- B. Forward
- C. Toward center
- D. Upward

41. What is the correct symbol used to represent centripetal acceleration?

- A. v_c
- B. a_c
- C. F_c
- D. r_a

42. What is the correct symbol used to represent centripetal force?

- A. F_g
- B. F_a
- C. F_c
- D. F_m

43. What increases centripetal force most?

- A. Larger radius
- B. Smaller mass
- C. Faster speed
- D. Less velocity

44. What type of motion is shown by the blades of an electric fan or a Ferris wheel?

- A. Uniform circular motion
- B. Oscillatory motion
- C. Linear motion
- D. Random motion

45. What is work in physics?

- A. Force only
- B. Energy used

- C. Force $\times$ distance
- D. Speed $\times$ time

46. What is the SI unit of work?

- A. Watt
- B. Joule
- C. Newton
- D. Meter

47. When is work done?

- A. Pushing wall not moving
- B. Carrying bag horizontally
- C. Force moves object
- D. Sitting still

48. What is the formula for power?

- A. Fd
- B. W/t
- C. mv
- D. at

49. What is the unit of power?

- A. Joule
- B. Newton
- C. Watt
- D. Meter

50. If no movement occurs after applying a force on an object, how much work is done?

- A. Maximum work
- B. Negative work
- C. Infinite work
- D. Zero work

APPENDIX B
SAMPLE OF THE FILLED-OUT QUESTIONNAIRE

Name: Yhuan Nicholas N. Buwang
School: OCNHS

Grade & Section: 8-Garret
Score: 90/100

Science 8 – Quarter 4 Pre-Test

Multiple-Choice Test

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- A. m/s
- ☒ B. m/s²
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☒ B. 3 s
C. 4 s
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21. A car moving 10 m/s accelerates at 2 m/s^2 for 5 s. What is its final velocity?
A. 15
B. 18
☒ C. 20
D. 25
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B. No force

- ~~C. No change in velocity~~
D. No distance

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D. Speed

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- C. Slowing down
- D. Zero force

38. Why is it important to label the axes and choose proper scales when drawing graphs?

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- B. Gravity
- C. Centripetal force
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- A. Outward
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- C. Toward center
- D. Upward

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- A. v_c
- B. a_c
- C. F_c
- D. r_a

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- A. F_g
- B. F_a
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D. Fm

43. What increases centripetal force most?

- ☒ A. Larger radius
- B. Smaller mass
- ~~C. Faster speed~~
- D. Less velocity

44. What type of motion is shown by the blades of an electric fan or a Ferris wheel?

- ☒ A. Uniform circular motion
- ~~B. Oscillatory motion~~
- C. Linear motion
- D. Random motion

45. What is work in physics?

- A. Force only
- B. ~~Energy used~~
- ☒ C. Force $\times$ distance
- D. Speed $\times$ time

46. What is the SI unit of work?

- A. Watt
- B. Joule
- ☒ C. Newton
- D. Meter

47. When is work done?

- ☒ A. Pushing wall not moving
- B. Carrying bag horizontally
- ~~C. Force moves object~~
- D. Sitting still

48. What is the formula for power?

- A. Ed
- ☒ B. W/t
- C. mv
- D. at

49. What is the unit of power?

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- B. Newton
- ~~C. Watt~~
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50. If no movement occurs after applying a force on an object, how much work is done?

- A. Maximum work
- B. Negative work
- ~~C. Infinite work~~
- ☒ D. Zero work

Name: Yuan Nikolai N. Bwong
School: OCHS

Grade & Section: 8-Garnet
Score: 45

Science 8 – Quarter 4 Post-Test

Multiple-Choice Test

Directions: Read each question carefully and encircle the letter of the correct answer.

1. What does slope represent?

- A. Speed
- ☒ B. Acceleration
- C. Distance
- D. Mass

2. What happens to an object when an unbalanced force acts on it?

- A. It remains at rest
- ☒ B. It accelerates
- C. It loses mass
- D. It stops moving

3. A bus slows down from 25 m/s to 5 m/s with an acceleration of -4 m/s^2 . How long does it take to slow down?

- ☒ A. 5 s
- B. 4 s
- C. 3 s
- D. 6 s

4. What is the formula for power?

- A. Fd
- B. W/t
- ☒ C. mv
- D. at

5. When is acceleration negative?

- A. Speed increases
- B. Object stops
- ☒ C. Speed decreases
- D. Direction constant

6. What is the correct symbol used to represent centripetal force?

- A. F_g
- B. F_a
- ☒ C. F_c
- D. F_m

7. Which quantity describes the rate of change of velocity?

- A. Speed
- B. Distance
- ☒ C. Acceleration
- D. Force

8. How long to reach 20 m/s from rest at 5 m/s^2 ?

- ☒ A. 2 s

- B. 3 s
☒ C. 4 s
D. 5 s

9. What shape shows uniform acceleration?

- ☒ A. Straight line
B. Zigzag
C. Curve (parabola)
D. Horizontal

10. What is plotted on the y-axis of a velocity-time graph?

- A. Time
B. Distance
☒ C. Velocity
D. Acceleration

11. What keeps an object moving in a circle?

- A. Friction
B. Gravity
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12. A runner accelerates uniformly and reaches 15 m/s after 3 s with an acceleration of 5 m/s². What was the runner's initial velocity?

- ☒ A. 0 m/s
B. 5 m/s
C. 10 m/s
D. 20 m/s

13. What is the SI unit of acceleration?

- A. m/s
☒ B. m/s²
C. N
D. J

14. When is work done?

- A. Pushing wall not moving
B. Carrying bag horizontally
☒ C. Force moves object
D. Sitting still

15. A train moving at 12 m/s accelerates to 36 m/s at 6 m/s². How long does the acceleration last?

- A. 2 s
B. 3 s
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16. What is plotted on the y-axis of a distance-time graph?

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- A. d/t
- B. vt
- ☒ C. $(v_f - v_i)/t$
- D. F/mg

18. What happens when velocity does not change?

- A. Positive acceleration
- B. Negative acceleration
- ☒ C. Zero acceleration
- D. Infinite acceleration

19. What does a horizontal line indicate?

- A. Fast motion
- B. Acceleration
- ☒ C. No motion
- D. Deceleration

20. What increases centripetal force most?

- ☒ A. Larger radius
- B. Smaller mass
- C. Faster speed
- D. Less velocity

21. A tricycle stops from 12 m/s in 4 s. What is its acceleration?

- ☒ A. -3
- B. 3
- C. -4
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22. What causes acceleration?

- A. Balanced force
- B. Friction only
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- A. Book on table
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- C. Linear motion
- D. Random motion

25. What does an upward slope on a distance-time graph indicate?

- ☒ A. Deceleration
- ☒ B. Acceleration
- C. Rest
- D. Negative speed

26. What is work in physics?

- A. Force only
- B. Energy used
- ☒ C. Force $\times$ distance
- D. Speed $\times$ time

27. A runner increases speed from 2 m/s to 8 m/s in 3 s. What is its acceleration?

- A. 1
- ☒ B. 2
- C. 3
- D. 4

28. What does a downward slope means?

- A. Speeding up
- B. Turning
- ☒ C. Slowing down
- D. Zero force

29. How does increasing force affect acceleration (same mass)?

- A. Decreases
- B. Remains constant
- ☒ C. Increases
- D. Becomes zero

30. A car changes velocity from 5 m/s to 15 m/s in 5 s. What is its acceleration?

- A. 1
- ☒ B. 2
- C. 3
- D. 4

31. Why is acceleration considered a vector quantity?

- A. It has only magnitude
- B. It has size only
- ☒ C. It has magnitude and direction
- D. It has no unit

32. What does the slope of a distance-time graph represent?

- A. Acceleration
- B. Mass
- C. Force
- ☒ D. Speed

33. What does a horizontal line on a distance-time graph indicate?

- ☒ A. Constant acceleration
- B. Constant velocity
- C. No time
- D. Stopped

34. What is the unit of power?

- A. Joule
- ☒ B. Newton

- ☒ C. Watt
D. Meter

35. Starting from rest, a bike accelerates at 4 m/s^2 for 3 s. What is its final velocity?

- A. 7
B. 10
☒ C. 12
D. 15

36. Which situation in the local community shows an object slowing down?

- A. A fan spinning steadily
☒ B. A jeepney approaching a corner
C. A ball kicked forward
D. A bicycle moving straight

37. A car accelerates at 4 m/s^2 for 5 s and reaches a final velocity of 30 m/s. What was its initial velocity?

- A. 5 m/s
B. 8 m/s
☒ C. 10 m/s
D. 15 m/s

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- ☒ A. Changing randomly
☒ B. Constant change in velocity
C. No motion
D. Circular only

39. Where does centripetal force always point?

- A. Outward
B. Forward
☒ C. Toward center
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40. Why is acceleration zero when $v_i = v_f$?

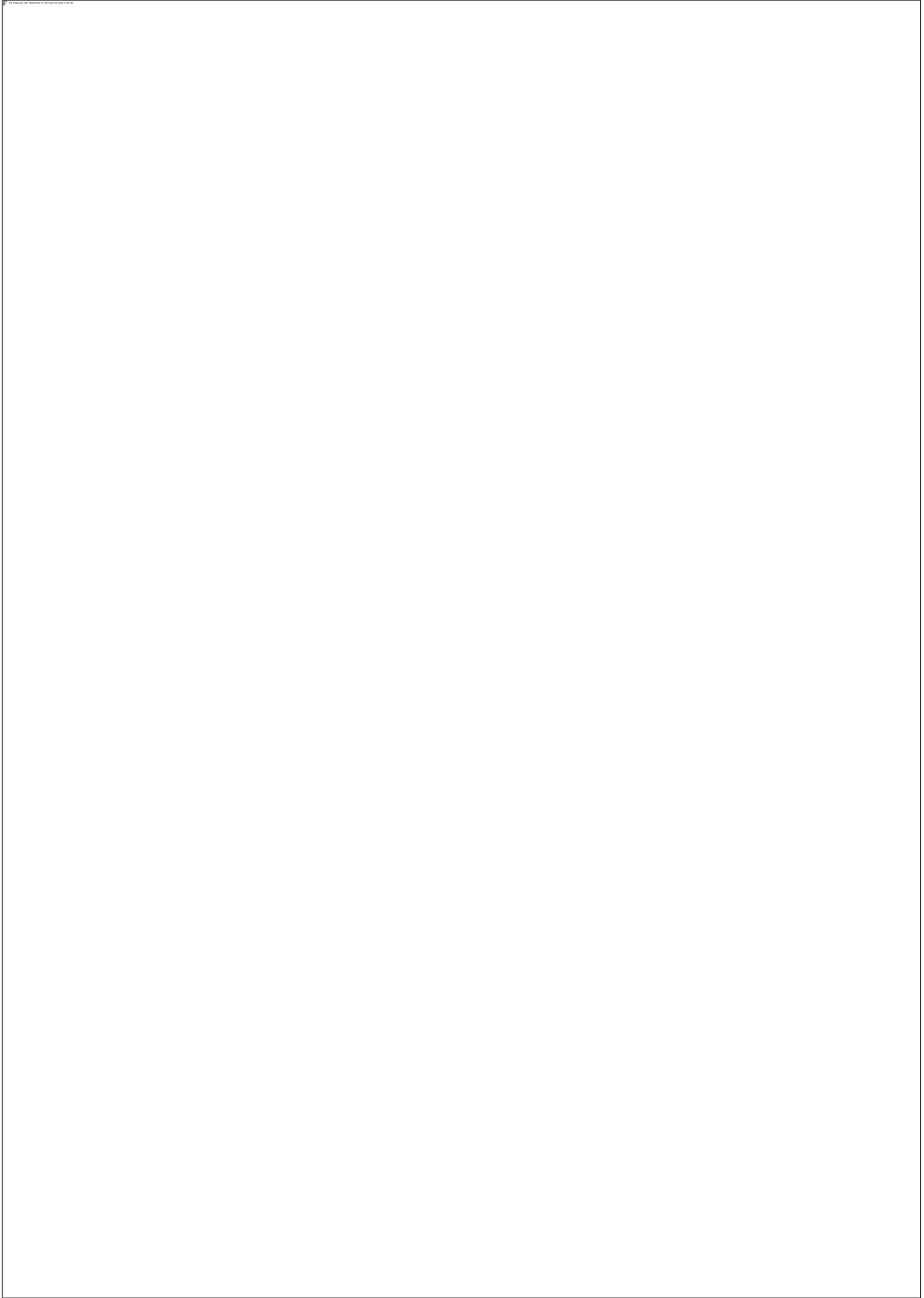
- A. No time
B. No force
☒ C. No change in velocity
D. No distance

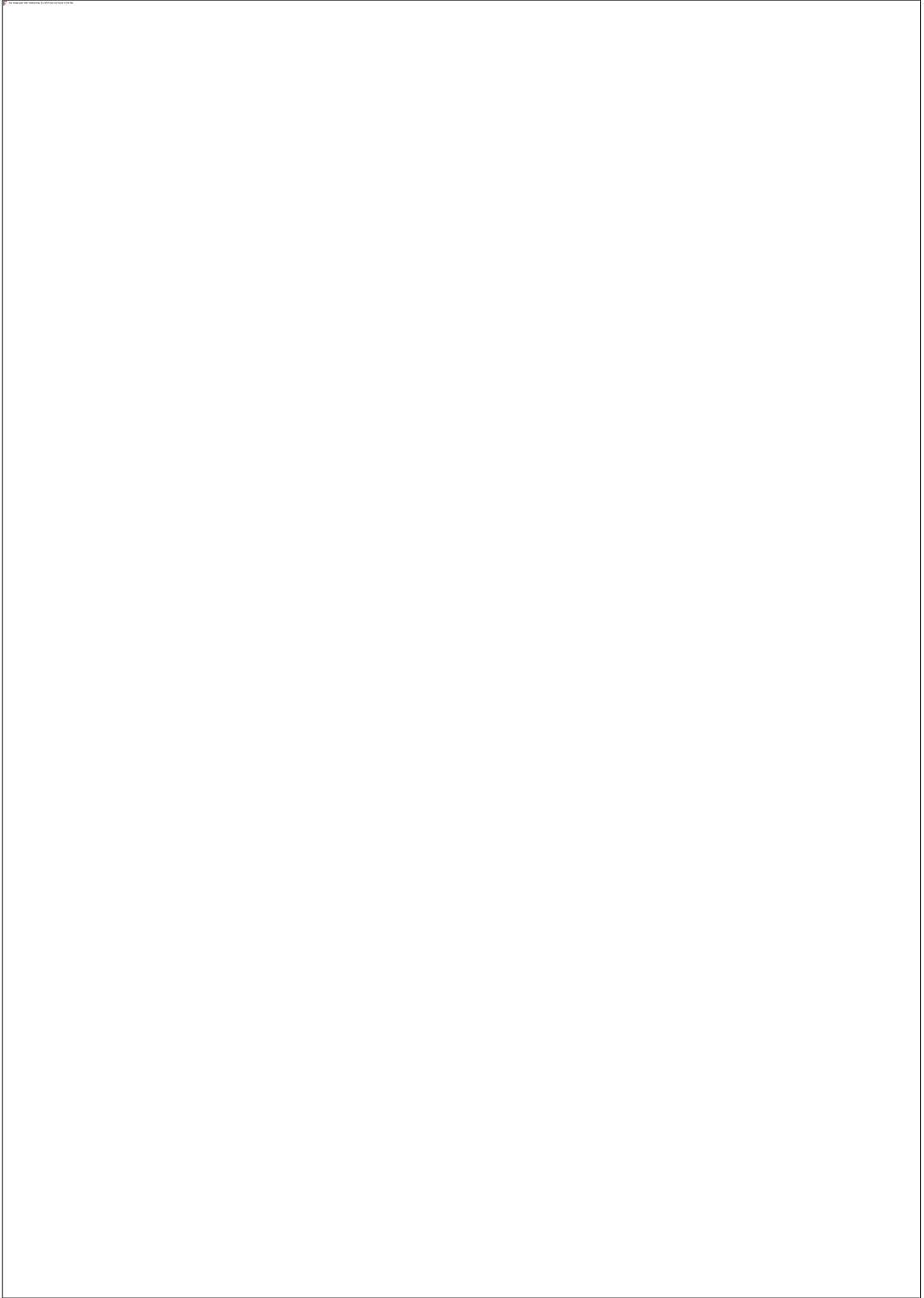
41. What does a steeper slope appear?

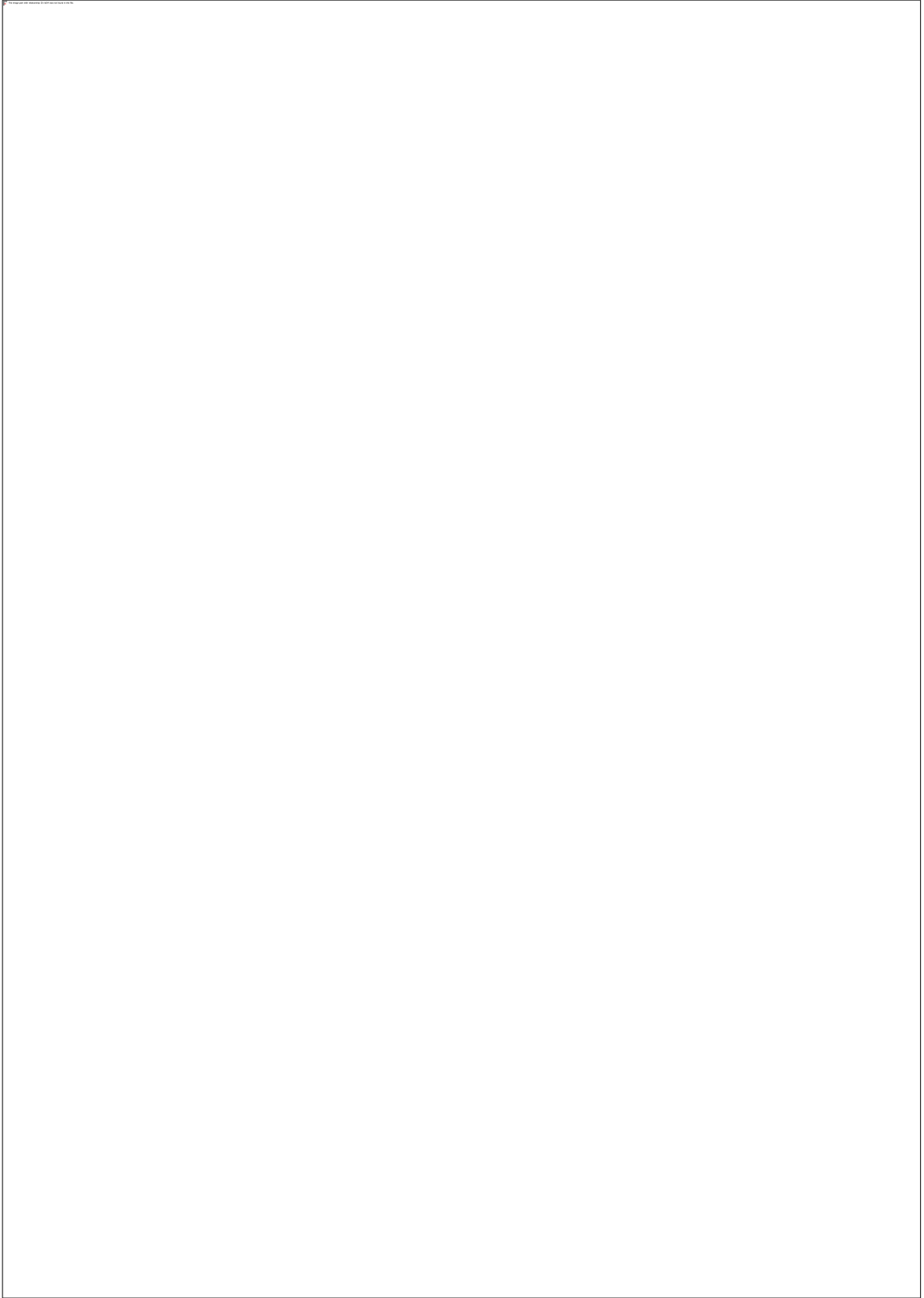
- A. Slower
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42. Why is non-uniform acceleration irregular on the graph?

- A. Constant speed
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☒ C. Changing speed
D. Equal intervals







17. A bus slows down from 25 m/s to 5 m/s with an acceleration of -4 m/s^2 . How long does it take to slow down?

- A. 5 s
- ☒ B. 4 s
- C. 3 s
- ☐ D. 6 s

18. Starting from rest, a bike accelerates at 4 m/s^2 for 3 s. What is its final velocity?

- A. 7
- B. 10
- ☒ C. 12
- D. 15

19. A runner increases speed from 2 m/s to 8 m/s in 3 s. What is its acceleration?

- A. 1
- ☒ B. 2
- C. 3
- D. 4

20. How long to reach 20 m/s from rest at 5 m/s^2 ?

- A. 2 s
- B. 3 s
- C. 4 s
- ☒ D. 5 s

21. A car moving 10 m/s accelerates at 2 m/s^2 for 5 s. What is its final velocity?

- ☒ A. 15
- B. 18
- C. 20
- D. 25

22. A tricycle stops from 12 m/s in 4 s. What is its acceleration?

- ☒ A. -3
- ☐ B. 3
- C. -4
- D. 4

23. A runner accelerates uniformly and reaches 15 m/s after 3 s with an acceleration of 5 m/s^2 . What was the runner's initial velocity?

- ☒ A. 0 m/s
- B. 5 m/s
- ☐ C. 10 m/s
- D. 20 m/s

24. A train moving at 12 m/s accelerates to 36 m/s at 6 m/s^2 . How long does the acceleration last?

- A. 2 s
- ☒ B. 3 s
- C. 4 s
- D. 5 s

25. Why is acceleration zero when $v_i = v_f$?

- A. No time
- B. No force

- C. No change in velocity
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26. What is plotted on the y-axis of a distance-time graph?

- A. Time
B. Distance
C. Velocity
D. Acceleration

27. What does the slope of a distance-time graph represent?

- A. Acceleration
B. Mass
C. Force
D. Speed

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- A. Fast motion
B. Acceleration
C. No motion
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- A. Straight line
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- A. Slowing down
B. Constant
C. Speeding up
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- B. Gravity
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- A. Outward
- B. Forward
- ☒ C. Toward center
- D. Upward

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- A. vc
- ☒ B. ac
- C. Fe
- D. ra

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- A. Fg
- B. Fa
- ☒ C. Fc

D. Fm

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- ☒ A. Larger radius
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45. What is work in physics?

- ☐ A. Force only
- ☐ B. Energy used
- ☐ C. Force $\times$ distance
- ☒ D. Speed $\times$ time

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- ☐ A. Watt
- ☐ B. Joule
- ☒ C. Newton
- ☐ D. Meter

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Name: Kaitlyn Janah M. Lazarino
School: OCNHG

Grade & Section: STE-BGARNET
Score: _____

Science 8 – Quarter 4 Post-Test

Multiple-Choice Test

Directions: Read each question carefully and encircle the letter of the correct answer.

1. What does slope represent?
A. Speed
B. Acceleration
C. Distance
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2. What happens to an object when an unbalanced force acts on it?
A. It remains at rest
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3. A bus slows down from 25 m/s to 5 m/s with an acceleration of -4 m/s^2 . How long does it take to slow down?
A. 5 s
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4. What is the formula for power?
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C. mv
D. at
5. When is acceleration negative?
A. Speed increases
B. Object stops
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6. What is the correct symbol used to represent centripetal force?
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7. Which quantity describes the rate of change of velocity?
A. Speed
B. Distance
C. Acceleration
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8. How long to reach 20 m/s from rest at 5 m/s^2 ?
A. 2 s

40

- B. 3 s
- ☒ C. 4 s
- D. 5 s

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- A. Straight line
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B. 10
☒ C. 12
D. 15

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- A. No time
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D. No distance

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- A. Slower
☒ B. Faster
C. Stationary
D. Negative

42. Why is non-uniform acceleration irregular on the graph?

- A. Constant speed
B. No time
☒ C. Changing speed
D. Equal intervals

43. Which situation shows no acceleration?

- A. Car speeding up
- B. Car slowing down
- C. Car turning
- ☒ D. Car moving straight at constant speed

44. If no movement occurs after applying a force on an object, how much work is done?

- A. Maximum work
- B. Negative work
- C. Infinite work
- ☒ D. Zero work

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- A. v_c
- ☒ B. a_c
- C. F_c
- D. r_a

46. How does a steeper slope appear?

- A. Slower
- ☒ B. Faster
- C. Stationary
- D. Negative

47. A car moving 10 m/s accelerates at 2 m/s^2 for 5 s. What is its final velocity?

- A. 15
- ☒ B. 18
- C. 20
- D. 25

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- A. To make the graph colorful
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- ☒ D. To ensure the data are accurate and easy to interpret

49. How can you describe motion if the graph curves upward?

- A. Slowing down
- B. Constant
- ☒ C. Speeding up
- D. Stopped

50. When is an object accelerating even if its speed is constant?

- ☒ A. When direction changes
- B. When mass increases
- C. When time stops
- D. When friction disappears

APPENDIX C LESSON PLAN

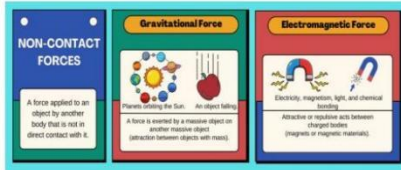
First Lesson Plan



Republic of the Philippines
Department of Education
REGION X – NORTHERN MINDANAO
SCHOOLS DIVISION OF OZAMIZ CITY
OZAMIZ CITY NATIONAL HIGH SCHOOL



Another type of force that doesn't involve direct contact.



Class, we already learned that forces can be contact or non-contact. Now, let's play a game. I will give you a situation, and you will guess the type of force. Are you ready?

First situation: You lift your school bag from the floor using your hand. What force are you using?

Correct! You applied force using your muscles.

Second: A magnet attracts small nails without touching them. What type of force is this?

Yes, teacher.

Applied force!

Magnetic force!



Address: Bernad St., Lam-an, Ozamiz City
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Cellphone Nos. 09709636300/09364337384
Email Address: 304167@deped.gov.ph





Republic of the Philippines
Department of Education
REGION X – NORTHERN MINDANAO
SCHOOLS DIVISION OF OZAMIZ CITY
OZAMIZ CITY NATIONAL HIGH SCHOOL

	Third: A child slides down a slide, but slows down because the slide rubs against their clothes. Fourth: A rubber band snaps back after you stretch it. Fifth: An apple falls from a tree to the ground. What pulls it downward? Sixth: You pull a bucket of water from a well using a rope. What force is acting on the rope? Seventh: A swimmer feels pushed upward while floating in the pool. What force helps them float? Last one: When you stop a rolling ball using your foot, what force did you use to stop it? Why do contact forces require objects to touch each other in order to act? How does the normal force prevent an object from falling through a surface, even though it is invisible? How would walking be impossible without friction?	Friction force! Spring force! Gravitational force! Tension force! Buoyant force! Applied force! Contact forces require physical contact because the force is transferred through direct interaction between objects. The normal force is an upward force exerted by a surface that supports the object and balances the downward pull of gravity. Without friction, our feet would slip on the ground and we would not be able to push ourselves forward.
--	--	--



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	Why can gravitational force act on objects that are not touching? How do gravity, normal force, and friction act together on an object at rest? How can non-contact forces act on objects even when they are not touching each other? Why can a magnet attract certain objects without contact? How is electromagnetic force important in everyday life? Why is classifying forces important in studying motion? Good job, class! We use different types of forces in our everyday activities, even without noticing them.	Gravity acts at a distance and does not require physical contact between objects. Gravity pulls the object downward, the normal force pushes upward, and friction prevents movement. Non-contact forces act through fields, such as gravitational, magnetic, or electric fields, which allow them to influence objects from a distance without direct physical contact. A magnet creates a magnetic field that exerts force on magnetic materials even from a distance. Electromagnetic force is used in electricity, electronics, and devices such as electric motors and appliances. Classifying forces helps us understand how different forces act and affect an object's motion.
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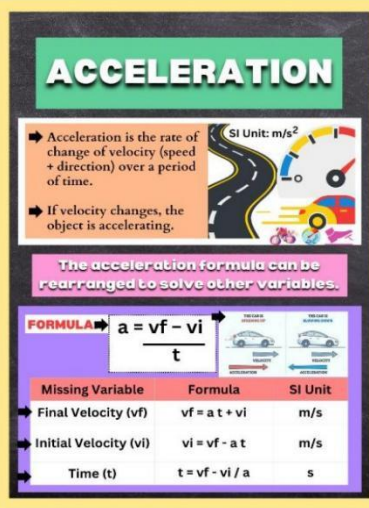
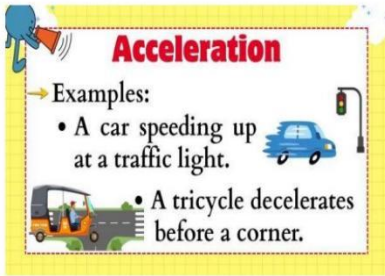


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Second Lesson Plan

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 Based on the poster, what does velocity include? <i>Examples of accelerating objects are the following:</i> 	Velocity includes both speed and direction.	
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	 Acceleration • A ball rolling down a slope. • A swing pushed back and forth. • A bicycle turning around a bend. (A car speeding up at a traffic light) What is changing here, speed or direction? Correct. (A tricycle decelerates before a corner) What causes the acceleration in this case? (A ball rolling down a slope) What happens to its speed? (A swing pushed back and forth) What changes during its motion? Exactly. That is why the swing is accelerating. (A bicycle turning around a bend) Does its speed need to change for it to accelerate? Aside from the examples given, can you identify other objects at home or in your local community that show acceleration?	The speed is increasing, so it is accelerating. The speed of the tricycle is changing, it is decreasing. Its speed increases as it goes down. Both the speed and direction change. No. Even if the speed is constant, changing direction means it is accelerating. A ceiling fan being switched on. A motorcycle starting to move from rest.
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	Excellent! Now, what formula do we use to calculate acceleration? How does the formula describe motion changes? Very good. Why do you think is important to rearrange the acceleration formula ? How does the physics of acceleration influence vehicle control for drivers and pilots, and what role does it play in ensuring passenger safety? Now that we know how to determine if an object is accelerating, let's apply it by solving a sample problem.	An elevator going up or down. A ball rolling down the stairs. We use the formula : $a = \frac{v_f - v_i}{t}$. It shows the rate at which velocity changes per second. It is important so we can find other missing variables like final velocity, initial velocity, or time. Physics of acceleration helps drivers know how much force to use on the brakes or gas pedal. Pilots use it to climb, descend, or turn safely. If acceleration is managed properly, it reduces the risk of injury to passengers.
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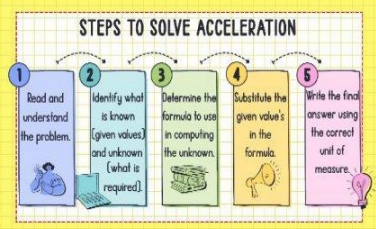


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(The teacher provided sample problems along with solutions.)

Acceleration:

A car starts from rest and reaches a speed of 20 m/s in 5 seconds. What is its acceleration?

Given:

- $v_i = 0 \text{ m/s}$
- $v_f = 20 \text{ m/s}$
- $t = 5 \text{ s}$

Required: $a = ?$

Equation: $a = \frac{v_f - v_i}{t}$

Solution: $a = \frac{v_f - v_i}{t}$

$$a = \frac{20 \text{ m/s} - 0 \text{ m/s}}{5 \text{ s}}$$

$$a = \frac{20 \text{ m/s}^2}{5 \text{ s}} = 4 \text{ m/s}^2$$

!
A car starts from rest and reaches a speed of 20 m/s in 5 seconds. What is its acceleration?

Answer:
The car's acceleration is 4 m/s^2 .

Final Velocity:

A bicycle starts with an initial velocity of 2 m/s and accelerates at 0.5 m/s^2 for 2 minutes. What is its final velocity?



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		3. 26 m/s 4. 12 m/s 5. 10 m/s 6. 3 m/s 7. -4 m/s^2 8. 5 s 9. 4 s 10. 3 m/s^2
	Now, class, why is it important to read and understand the problem before attempting to solve it? How does identifying known and unknown values make selecting the correct formula easier? Why is it essential to determine the correct formula before performing calculations? Why is it necessary to write the final answer using the correct unit of measure?	Because understanding the problem helps us to know exactly what is being asked and prevents mistakes. It allows us to match the known quantities with the appropriate variables in the formulas. It is important because using the wrong formula will lead to incorrect results, wasting time and causing errors. This is because units show what quantity is being measured and make the answer meaningful and understandable.



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	Why is accuracy important when presenting acceleration values in real-life situations, such as vehicle safety or sports science? How do you ensure that your computations and presentations of acceleration are both careful and accurate?	Accurate acceleration values can prevent errors in engineering, ensure safety in vehicles, and improve performance analysis in sports. By double-checking the formula used, verifying units, reviewing calculations step by step, and presenting the final answer clearly.
C. Culminating Activities		
I. Practice Exercises	III. Integration At this point, we will now have another fun activity called “<i>Fast Track to Answers!</i>” I will divide you into two groups: Team Girls and Team Boys. I will pick 5 names of girls and boys from the box to actively participate in this activity. These representatives will solve the problems, and their performance will affect the overall group score. Instructions: 1. There are 6 cards, each containing a different problem to solve, such as finding acceleration, final velocity, initial velocity, or time. The possible answers are displayed on the board.	



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Third Lesson Plan



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	(The teacher let students try moving the ball to reinforce the idea physically.) How do you describe the motion or speed of a ball? Correct! Therefore, acceleration doesn't only mean speeding up or slowing down. It also happens when the direction of an object's motion changes. This type of motion is called <i>Uniform Circular Motion (UCM)</i>. (The teacher presents the poster and explains the ideas shown.)	The ball undergoes circular motion. The speed stay constant. The direction is continuously changing.
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It is still accelerating because the

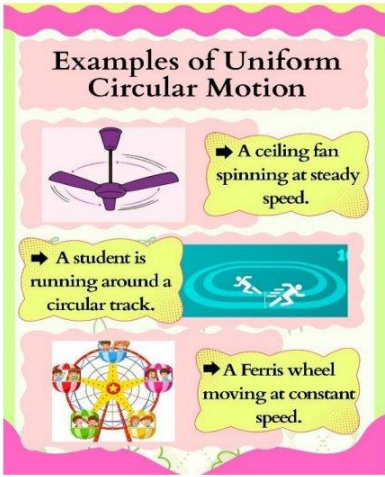


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	Based on these examples, why do you think the object is still accelerating even if its speed doesn't change? Examples of Uniform Circular Motion  ➡ A ceiling fan spinning at steady speed. ➡ A student is running around a circular track. ➡ A Ferris wheel moving at constant speed. Exactly! Now, what force makes an object move in a circular path instead of going straight? Class, does the object need to speed up or slow down to accelerate in circular motion? Can anyone give examples of uniform circular motion that you observe at home, in school, or in the community?	direction of motion changes continuously, even though the speed remains the same. The tension in the string pulls the ball toward the center. This force is called the centripetal force, and it causes centripetal acceleration. No, the object does not need to speed up or slow down. The speed can remain constant as long as the direction of motion is changing. At Home: Clock hands – tips move in a circular path at a constant speed In School: Electric fan – spins in a circle at steady speed In the Community:
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	Very good! Now, how do these examples help you understand acceleration in real life?	Ferris wheel – moves passengers in a circle at constant speed Observing acceleration in daily life like vehicles, swings, or sports activities helps us understand motion and how forces affect objects. This means we see physics everywhere around us.																																										
	III. Repetition with Attention Class, we are going to explore different situations of accelerating objects. Your task is to carefully observe each object and figure out how it is accelerating, it is speeding up, slowing down, or changing direction. Then decide whether its motion is an example of Uniform Circular Motion (UCM) or not. Are you ready, class? <table> <tr> <th>SITUATION</th><th>TYPE OF ACCELERATION</th><th>UCM OR NOT UCM</th></tr> <tr> <td>A satellite orbiting the Earth in a circular path.</td><td></td><td></td></tr> <tr> <td>A ball rolling down a slope.</td><td></td><td></td></tr> <tr> <td>A stone tied to a string and swung in a circle.</td><td></td><td></td></tr> <tr> <td>A swing pushed back and forth.</td><td></td><td></td></tr> <tr> <td>The hands of a clock moving around the clock face.</td><td></td><td></td></tr> <tr> <td>A bicycle turning around a bend.</td><td></td><td></td></tr> </table> What did we learn about acceleration? How about uniform circular motion?	SITUATION	TYPE OF ACCELERATION	UCM OR NOT UCM	A satellite orbiting the Earth in a circular path.			A ball rolling down a slope.			A stone tied to a string and swung in a circle.			A swing pushed back and forth.			The hands of a clock moving around the clock face.			A bicycle turning around a bend.			Yes, teacher. <table> <tr> <th>SITUATION</th><th>TYPE OF ACCELERATION</th><th>UCM OR NOT UCM</th></tr> <tr> <td>A satellite orbiting the Earth in a circular path.</td><td>Changing direction</td><td>UCM</td></tr> <tr> <td>A ball rolling down a slope.</td><td>Speeding up</td><td>Not UCM</td></tr> <tr> <td>A stone tied to a string and swung in a circle.</td><td>Changing direction</td><td>UCM</td></tr> <tr> <td>A swing pushed back and forth.</td><td>Speeding up, slowing down, changing direction</td><td>Not UCM</td></tr> <tr> <td>The hands of a clock moving around the clock face.</td><td>Changing direction</td><td>UCM</td></tr> <tr> <td>A bicycle turning around a bend.</td><td>Changing direction</td><td>Not UCM</td></tr> </table> Acceleration happens whenever there is a change in speed, direction, or both. UCM occurs when an object moves in a circular path at constant speed, but it is still	SITUATION	TYPE OF ACCELERATION	UCM OR NOT UCM	A satellite orbiting the Earth in a circular path.	Changing direction	UCM	A ball rolling down a slope.	Speeding up	Not UCM	A stone tied to a string and swung in a circle.	Changing direction	UCM	A swing pushed back and forth.	Speeding up, slowing down, changing direction	Not UCM	The hands of a clock moving around the clock face.	Changing direction	UCM	A bicycle turning around a bend.	Changing direction	Not UCM
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	Why is it important to know how objects accelerate?	accelerating because its direction keeps changing. Understanding acceleration helps us predict motion, design safe vehicles, and understand natural phenomena like satellites and swings.
C. Culminating Activities		
1. Practice Exercises	IV. Application At this point, we are going to have an activity called “ <i>Accelerating Objects Challenge</i> ”, regroup yourselves into 5 members per group. Your task is to carefully observe each given situation of accelerating objects and identify the type of acceleration whether it is speeding up, slowing down, or changing direction and determine if the motion is an example of Uniform Circular Motion (UCM) or Not UCM. You can earn 20 points for each correct answer. Do you have any questions or clarifications?	No, teacher.



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Fourth Lesson Plan



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	quantities. Very good! There are two types of Motion Graphs: Distance-Time Graph (position-time graph) - shows the distance traveled by a moving object over time - Axes: Y-axis → Distance X-axis → Time - slope of the line represents the speed of the object - the steeper the graph, the greater the speed Distance-Time Graphs 01 Straight Diagonal Line Going Up Uniform Motion (Forward direction) 02 Straight Diagonal Line Going Down Uniform Motion (Backward direction) 03 Horizontal Line No Motion: The distance remains constant over time 04 Curved (Parabolic) Uniform Acceleration: The object's speed is changing at a constant rate over time How do we measure distance and time? We measure distance in meters (m), kilometers(km), or miles, and we measure time in seconds (s) minutes (min) or hours (hr). However, on our graph, we use the SI unit of seconds (s) for time and meters (m) for distance. It shows how the object's distance changes with time. What does a distance-time graph show about the motion of an object?	
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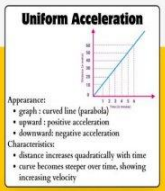
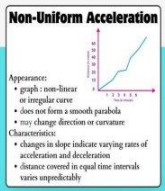


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	How can you determine the speed of an object from a distance–time graph? That’s right ! Now, how can you tell from the graph that an object is speeding up and slowing down? Distance-Time Graph: Uniform Acceleration and Non-Uniform Acceleration Uniform Acceleration  Appearance: - graph : curved line (parabola) - upward : positive acceleration - downward : negative acceleration Characteristics: - distance increases quadratically with time - curve becomes steeper over time, showing increasing velocity Non-Uniform Acceleration  Appearance: - graph : non-linear or irregular curve - does not form a smooth parabola - may change direction or curvature Characteristics: - changes in slope indicate varying rates of acceleration and deceleration - distance covered in equal time intervals varies unpredictably Why does uniform acceleration produce a curved or parabolic line instead of a straight line? Why is the graph not a straight line in non-uniform acceleration? Therefore, slope changes irregularly or unpredictably. Now, does the object cover equal distances in equal time intervals during non-uniform acceleration? Explain. Very good! In contrast to uniform acceleration that the speed increases or decreases equally in equal time intervals.	By finding the slope or steepness of the line. The curve becomes steeper as time increases if speeding up, and the curve becomes less steep or flattens if slowing down. Because the speed changes continuously, the distance increases faster over time. Because the speed is not constant, the distance covered changes unevenly. No, because the speed keeps changing, so the distances are unequal. Yes / No, teacher
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	Are there any questions? Now, let's move on to the next type of motion graph. Velocity–Time Graph - shows how velocity changes over time - Axes: Y-axis → Velocity X-axis → Time - slope of the line represents the acceleration of the object - the steeper the graph, the greater the acceleration Velocity-Time Graph: Uniform Acceleration and Non-Uniform Acceleration Uniform Acceleration Appearance: • graph: straight, sloped line • upward: positive acceleration • downward: negative acceleration (deceleration) Characteristics: • slope of the line represents the constant rate of acceleration. • velocity increases (or decreases) linearly over time, showing a steady change in speed Non-Uniform Acceleration Appearance: • graph: curved line or a series of connected lines with different slopes • curved line in the rate of acceleration Characteristics: • slope of the graph changes, reflecting varying acceleration. • velocity changes non-linearly over time, with the object moving at varying rates The acceleration is constant or uniform. Class, If the velocity increases by the same amount every second, what can you say about the acceleration? Correct! The slope is constant since the velocity changes equally every second. Now, what if the acceleration is not constant but keeps changing? What happens to the graph? The slope changes, it means the acceleration is also changing, so the graph becomes curved or irregular. Therefore, what is the main difference between straight-line and curved velocity–time graphs? A straight line shows constant acceleration, while a curved line shows changing acceleration.	
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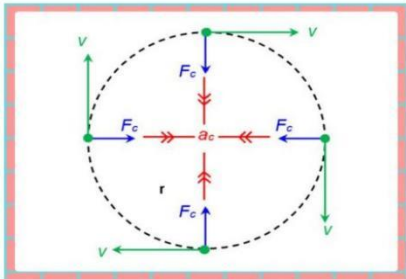
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Fifth Lesson Plan



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	What were the concepts discussed in the video? Yes, that's right. Based on the video and our previous discussion, what is Uniform Circular Motion? How about centripetal acceleration?  Exactly! According to Newton's second law of motion (acceleration), force and acceleration are in the same direction. Thus, the Centripetal acceleration (a_c), of an object moving in a circle of radius r with speed v can be expressed as:	The video explains concepts such as Uniform Circular Motion and centripetal acceleration and force, centrifugal force tangential speed. <i>Uniform Circular Motion</i> is the motion of an object traveling at a constant (uniform) speed on a circular path. <i>Centripetal acceleration</i> is the acceleration experienced by an object moving in a circular path, directed towards the center of the circle.
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$$a_c = \frac{v^2}{r}$$

What does r represent?

What does the letter v stand for?

What do you mean by tangential speed?

Correct! The tangential speed is the magnitude of the velocity of the object. Although the speed remains constant, the direction of the velocity changes continuously.

What does T stand for?

$$v = \frac{2\pi r}{T}$$

Why is $2\pi r$ is used?

Radius of the circular path.

The v in that formula is tangential speed.

Tangential speed refers to the linear speed of an object moving along a circular path.

T stands for period time for one complete revolution.

Because $2\pi r$ represents the circumference of the circle,



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	What does this equation tell us about speed and time? <i>Centripetal force</i> pulls the object <i>towards</i> the center of the circle. This is the net force that acts on an object to keep it moving along a circular path. How can we derive the formula for centripetal force?	which is the total distance traveled in one complete revolution. Speed is inversely proportional to the period. If time increases, speed decreases. By substituting the equation for centripetal acceleration into $F = ma$ (Newton's law of acceleration). $F_c = ma_c$ ↓ $F_c = \frac{mv^2}{r}$
	What is Newton's Third Law of Motion?	For every action, there is an equal and opposite reaction.

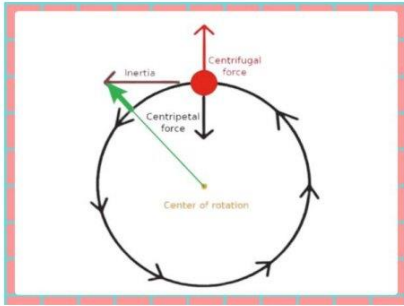


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	What does equal and opposite mean? If centripetal force pulls an object toward the center. What is the opposite force that directs <i>away</i> from the center of the circle? Why centrifugal force is considered equal and opposite to centripetal force?  Between centripetal and centrifugal forces, which one is center-seeking and which one is center-fleeing? Excellent observation! The following are the differences between centripetal force and centrifugal force: (The teacher presents the diagram and discuss the ideas shown.)	Same magnitude or same size of force but opposite direction <i>Centrifugal Force.</i> Because <i>centrifugal force</i> draws the object away from the center of the circular path, while <i>centripetal force</i> is a real force acting on the object toward the center of the circular path Centripetal – center-seeking Centrifugal – center-fleeing
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Centripetal Force vs. Centrifugal Force

	Centripetal Force	Centrifugal Force
Definition	A real force.	Not a real force (only felt).
Direction	Pulls an object toward the center of the circle.	Feels like it pushes an object away from the center.
Nature	Keeps an object moving in a curved path.	Is caused by the object's inertia.
	Exists because of friction, tension, or gravity.	Is observed only inside a rotating system.
Examples	Friction between tires and road when a car turns.	Feeling pushed to the side when a car turns.

Do you have any questions or clarifications?

No, teacher.

Sample Problem: A jeepney has a mass of 8000 kg and moves at a constant speed along a rotunda with a radius of curvature of 17 m. Compute for its centripetal force and acceleration if it turns at a) 36 km/h and b) 54 km/h.

GIVEN: $m = 8000 \text{ kg}$ $r = 17 \text{ m}$ a) $v = 36 \text{ km/h}$ b) $v = 54 \text{ km/h}$	REQUIRED: F_c at : a) $v = 36 \text{ km/h}$ b) $v = 54 \text{ km/h}$	EQUATION: $a_c = \frac{v^2}{r}$ $F_c = ma_c$
SOLUTION:		
a) $v = \frac{36 \text{ km}}{\text{h}} \times \frac{1000 \text{ m}}{1 \text{ km}} = \frac{36,000 \text{ m}}{\text{h}}$ $v = \frac{36,000 \text{ m}}{\text{h}} \times \frac{1 \text{ h}}{3600 \text{ s}} = 10 \text{ m/s}$	b) $v = \frac{54 \text{ km}}{\text{h}} \times \frac{1000 \text{ m}}{1 \text{ km}} = \frac{54,000 \text{ m}}{\text{h}}$ $v = \frac{54,000 \text{ m}}{\text{h}} \times \frac{1 \text{ h}}{3600 \text{ s}} = 15 \text{ m/s}$	



Address: Bernad St., Lam-án, Ozamiz City
Telephone No: (088) 521-3385
Telefax: (088) 545-2821
Cellphone Nos. 09709636300/09364337384
Email Address: 209167@deped.gov.ph



APPENDIX D INFORMED CONSENT

PARENTAL CONSENT

Greetings!

I, a student researcher of *Misamis University* under the program of *Bachelor of Secondary of Education Major in Science*, respectfully request your permission for your child/children, who are under 18 years of age, to participate in our study.

This study aims to determine how the use of Dual Coding² and Elaborative Interrogation Prompts (EIP) can enhance Grade 8 students' conceptual retention in Science. As part of this research, participants will be engaged in lessons where these strategies are applied to help improve understanding, recall, and active participation in Science topics.

Your participation will be a great help for the success of our study.

Thank you very much!

Respectfully yours,


MAICA JOY M. ELECCION
Researcher

Noted: _____

ACKNOWLEDGMENT

I have read this consent form and give my consent for my child/children to participate in this study.

Guardian's name: Gen N. Rinsing
Contact no.: 0917 158 1699

Date: 3-16-26
Signature: 

Approved:

Name: _____

Ethics Review Board Chair

Contact no.: _____

ASSENT FORM

I, Yuhan Nicholas N Biwang, willingly agree to take part in the study titled "Enhancing Students' Conceptual Retention in Science through the Integration of Dual Coding and Elaborative Interrogation Prompts (EIP)".

Part of the study includes participating in Science lessons where I will use Dual Coding (using pictures, diagrams, or visuals with text) and Elaborative Interrogation Prompts (answering guiding questions) to help me understand and remember the lesson. I may also answer short exercises or reflections during class to check my focus and how well I remember the lesson.

I understand that I am not forced, threatened, or pressured in any way to join this study.

Yuhan
Signature of Student

03-16-2020
Date

Witness:
Leah N Biwang
Name and Signature of Parent/Guardian

03-16-2020
Date

PARENTAL CONSENT

Greetings!

I, a student researcher of *Misamis University* under the program of *Bachelor of Secondary of Education Major in Science*, respectfully request your permission for your child/children, who are under 18 years of age, to participate in our study.

This study aims to determine how the use of Dual Coding and Elaborative Interrogation Prompts (EIP) can enhance Grade 8 students' conceptual retention in Science. As part of this research, participants will be engaged in lessons where these strategies are applied to help improve understanding, recall, and active participation in Science topics.

Your participation will be a great help for the success of our study.

Thank you very much!

Respectfully yours,


MAICA JOY M. ELECCION
Researcher

Noted: _____

ACKNOWLEDGMENT

I have read this consent form and give my consent for my child/children to participate in this study.


Guardian's name: Meriam M. Lazarina
Contact no.: 09126370960

Date: 01-05-2020
Signature: _____

Approved:

Name: _____

Ethics Review Board Chair

Contact no.: _____

ASSENT FORM

I, Kaitlyn Janah M. Lazarina, willingly agree to take part in the study titled "Enhancing Students' Conceptual Retention in Science through the Integration of Dual Coding and Elaborative Interrogation Prompts (EIP)".

Part of the study includes participating in Science lessons where I will use Dual Coding (using pictures, diagrams, or visuals with text) and Elaborative Interrogation Prompts (answering guiding questions) to help me understand and remember the lesson. I may also answer short exercises or reflections during class to check my focus and how well I remember the lesson.

I understand that I am not forced, threatened, or pressured in any way to join this study.

KAITLYN JANAH M. LAZARINA
Signature of Student

01-05-2026
Date

Witness: MERIAM M. LAZARINA
Name and Signature of Parent/Guardian

01-05-2026
Date

APPENDIX F
APPROVED LETTER OF CONSENT



Misamis University
Ozamiz City



MISAMIS UNIVERSITY RESEARCH CENTER

CERTIFIED: ISO 21001: 2018 Educational Organizations Management System by DNV
ACCREDITED: Philippine Association of Colleges and Universities Commission on Accreditation (PACUCOA)

MU-RC-042/13 November 2024

Thesis/Research Data Gathering Approval Form

Date: _____

Name of Authors: _____

College/Department: _____

Research Title: _____

Data Gathering Procedure:

a. Type of Research: (Kindly check)

☐

Quantitative

☐

Qualitative

☐

Experimental

☐

Approved Research Title
& Problem/Objectives

☐

Approved Data
Gathering Procedure

☐

Approved Data Gathering
Instrument/Data Sheets

b. Respondents/Participants/Subject/Samples to be Collected: _____

c. Procedure:

☐

Survey

☐

Interview

☐

Experimentation

☐

Laboratory Testing

d. Place of Implementation/Study Area: _____

If to be conducted outside the school campus, indicate the nature of transportation to be used:

☐

Own private vehicle

☐

public utility vehicle

☐

rental

☐

Others, please
indicate _____

e. Date/s of Implementation/Sampling: _____

Attachments:

☐

Approved Letter of Consent from the designated authority in the area/place where the study is to be conducted

☐

Signed Parents' Consent

The thesis proposal mentioned above is hereby recommended for the commencement of data gathering implementation.

Recommended by:

Thesis/Research Adviser

Thesis/Research Instructor

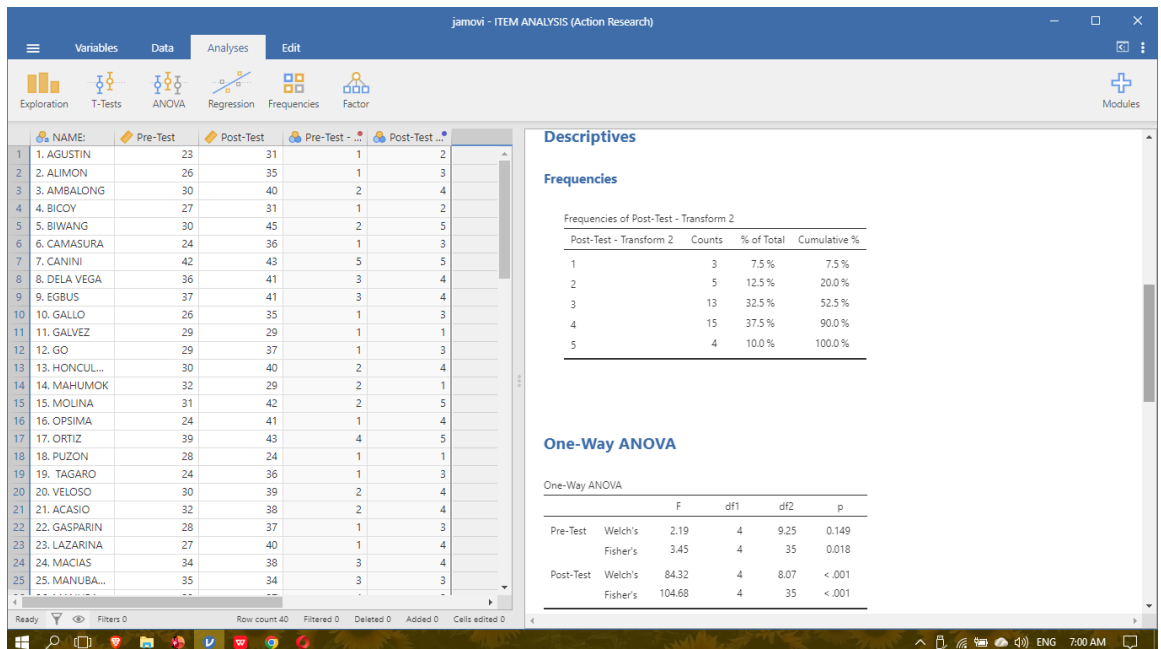
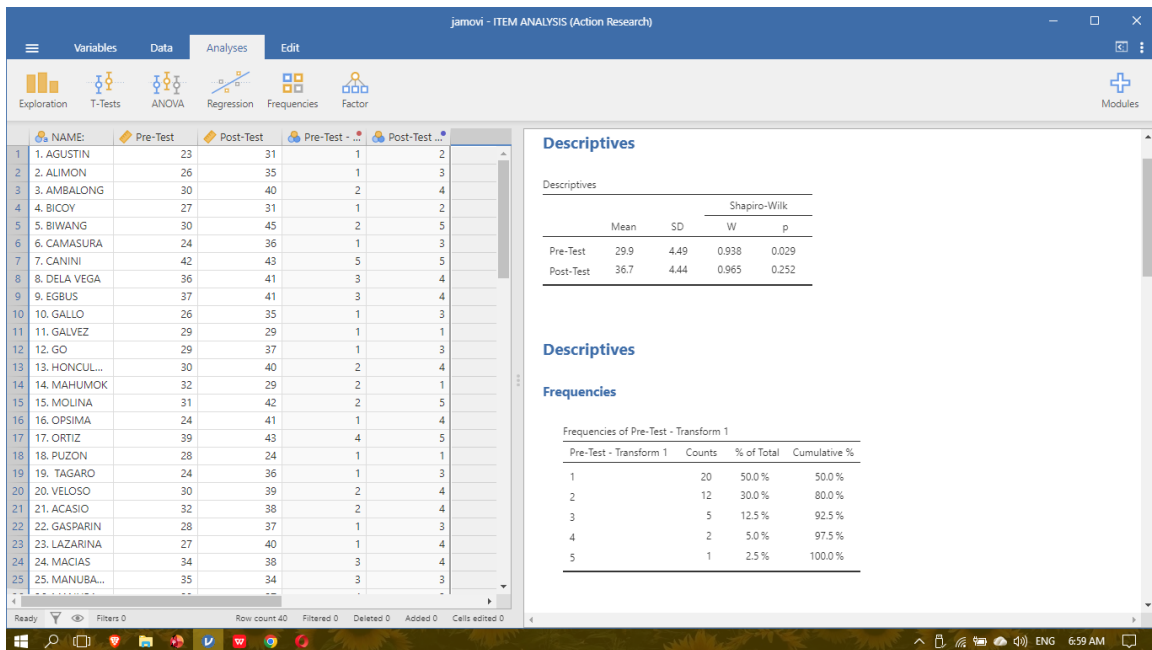
Approved by:

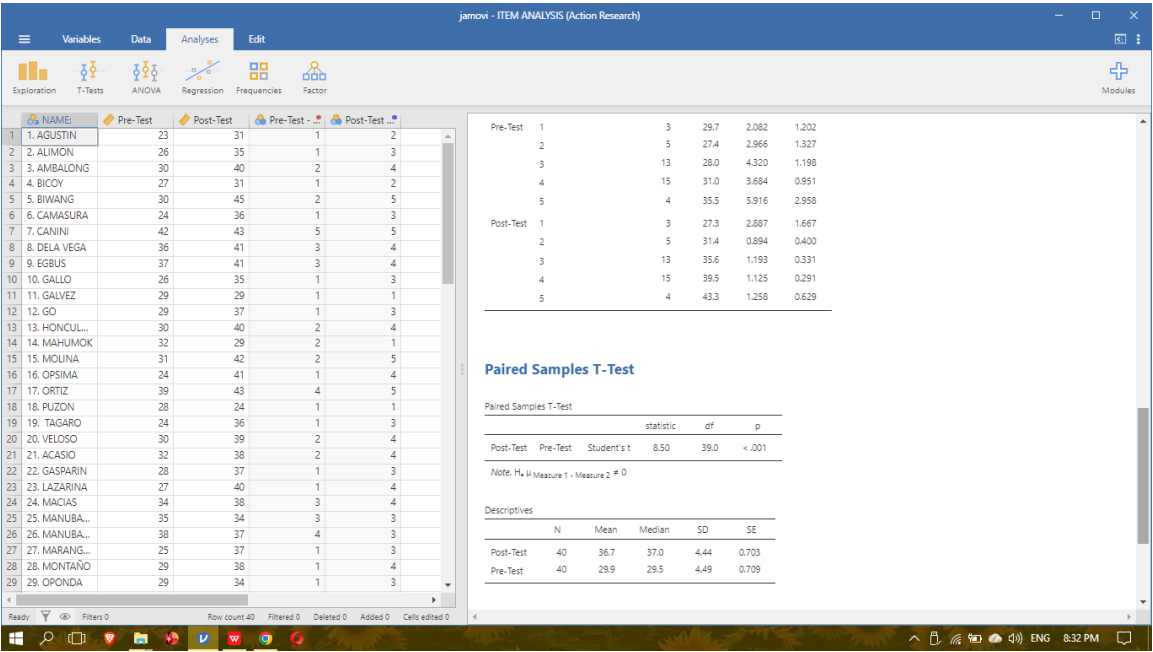
College Dean

CONTROLLED DOCUMENT

APPENDIX G

STATISTICAL COMPUTATIONS





NAME:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	Pre-Test
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2. ALMON	0	1	0	1	1	1	0	1	1	0	1	1	1	1	0	1	1	0	0	1	0	0	1	1	0	0	0	0	0	0	0	0	0	0	1	0	0	1	1	1	1	0	1	1	0	0	1	1	0	25	
3. AMBALONG	1	0	1	1	1	1	1	0	1	1	1	1	1	1	0	0	1	1	0	1	1	0	1	0	1	0	0	0	1	0	1	1	0	1	1	1	1	1	0	0	1	1	0	0	1	0	0	0	30		
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15. MOLINA	0	1	1	1	0	1	0	0	1	0	1	1	1	1	0	1	1	1	0	1	1	1	0	0	1	0	0	1	0	0	1	0	0	1	1	0	0	1	1	1	1	1	1	1	1	1	1	1	1	32	
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33. RABDOIN	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	0	1	1	1	0	1	1	1	0	0	0	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	1	0	1	37	
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37. UY	1	1	1	1	1	0	0	1	1	1	1	1	1	1	0	0	1	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	1	1	1	1	0	1	1	0	1	1	30		
38. VERGIERE	1	1	1	1	0	1	0	1	1	1	1	1	1	1	0	0	1	0	0	1	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	1	1	1	1	0	1	0	1	0	0	0	1	1	0	27	
39. VISMAYAS	1	0	1	1																																															

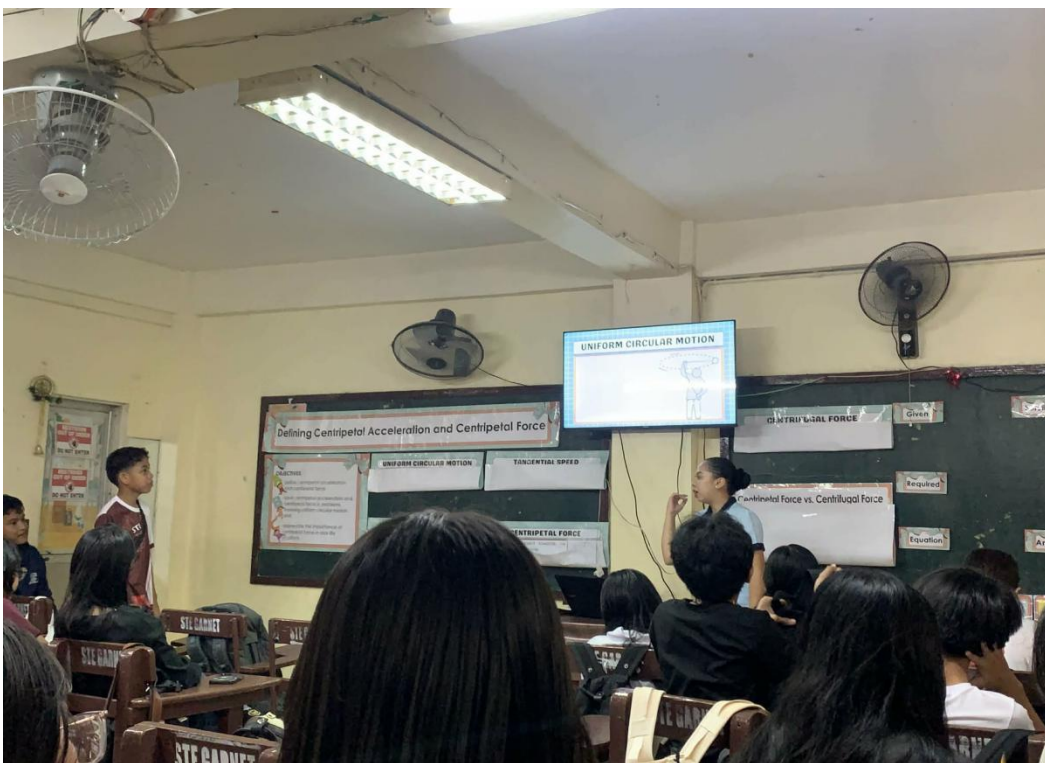
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2. ALIMON	26	35
3. AMBALONG	30	40
4. BICOY	27	31
5. BIWANG	30	45
6. CAMASURA	24	36
7. CANINI	42	43
8. DELA VEGA	36	41
9. EGBUS	37	41
10. GALLO	26	35
11. GALVEZ	29	29
12. GO	29	37
13. HONCULADA	30	40
14. MAHUMOK	32	29
15. MOLINA	31	42
16. OPSIMA	24	41
17. ORTIZ	39	43
18. PUZON	28	24
19. TAGARO	24	36
20. VELOSO	30	39
21. ACASIO	32	38
22. GASPARIN	28	37
23. LAZARINA	27	40
24. MACIAS	34	38
25. MANUBAG S. I.	35	34
26. MANUBAG S. D.	38	37
27. MARANGGA	25	37
28. MONTAÑO	29	38
29. OPONDA	29	34
30. PAMAYLAON	31	40
31. PERALES	26	35
32. PLAZA	30	34
33. RABADON	37	38
34. REVELO	24	36
35. SANTOS	29	33
36. TABAL	31	31
37. UY	30	39
38. VERGEIRE	27	31
39. VISMANOS	28	40
40. YLANAN	30	40

APPENDIX I DOCUMENTATION



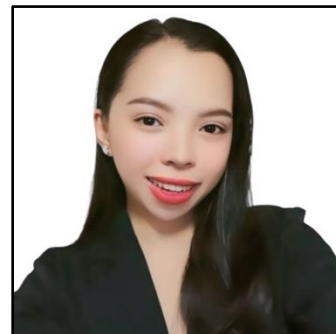








CURRICULUM VITAE



PERSONAL DATA

Name : Maica Joy M. Eleccion
Address : P-5, Tabid, Ozamiz City, Misamis Occidental
Date of Birth : April 20, 2003
Place of Birth : Ozamiz City, Misamis Occidental
Sex : Female
Civil Status : Single
Parents : Mr. & Mrs. Marcelino N. Eleccion Jr.

EDUCATION

College : Bachelor of Secondary Education Major in Science
Misamis University
H.T. Feliciano St, Ozamiz City, Misamis Occidental
June 2025-2026

Secondary : Senior High School
Misamis University
Ozamiz City, Misamis Occidental
June 2021-2022

Junior High School
Tabid National High School
Tabid, Ozamiz City, Misamis Occidental
April 2019-2020

Elementary : Diego Tuastomban Elementary School
Litapan, Ozamiz City, Misamis Occidental
April 2015-2016

Eleccion (September 01, 2026)

by cheri

General metrics

37,773	5,108	383	20 min 25 sec	39 min 17 sec
characters	words	sentences	reading time	speaking time

Score



This text scores better than 90% of all texts checked by Grammarly

Writing Issues

11	✓	11
Issues left	Critical	Advanced

Unique Words

Measures vocabulary diversity by calculating the percentage of words used only once in your document

18%

unique words

Rare Words

Measures depth of vocabulary by identifying words that are not among the 5,000 most common English words.

45%

rare words

Word Length

Measures average word length

6

characters per word

Sentence Length

Measures average sentence length

13.3

words per sentence

Eleccion (September 01, 2026)

1

ENHANCING STUDENTS' CONCEPTUAL RETENTION IN SCIENCE
THROUGH THE INTEGRATION OF DUAL CODING AND
ELABORATIVE INTERROGATION PROMPTS

An Action Research Presented to
the College of Education
Misamis University
Ozamiz City

In Partial Fulfillment
of the Requirements for the Degree



MISAMIS UNIVERSITY

Ozamiz City
College of Education



RESEARCH ROUTING FORM

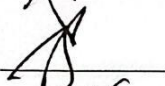
Date: September 02, 2026

Name of Candidate: MAICA JOY M. ELECCION

Sem./SY: 2nd Semester 2025-2026

Program: Bachelor of Secondary Education Major: Science

Title of Research: Enhancing Students' Conceptual Retention in Science through the Integration of Dual Coding and Elaborative Interrogation Prompts

	Signature	Date
Adviser: <u>Ms. Jocelle May V. Dinulos</u>		<u>09/02/2026</u>
Program Head: <u>Jame S. Bazar, MAEd</u>		<u>09/02/2026</u>
Chairman: <u>Genelyn R. Baluyos, EdD</u>		

Grammarly Result: 90/100

.....
Approved for REPRODUCTION/PUBLICATION:


GENELYN R. BALUYOS, EdD
Dean, College of Education