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EXPLORING THE EFFICACY OF KINESTHETIC LEARNING STRATEGIES IN EARTH SCIENCE: AN INVESTIGATION OF STUDENT ENGAGEMENT, CONCEPTUAL MASTERY, LONG-TERM RETENTION AND STUDENTS' PERFORMANCE

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ABSTRACT

This study determined the efficacy of kinesthetic learning strategies in earth science: an investigation of student engagement, conceptual mastery, and long-term retention. Specifically, this study answered the following questions: The level of the efficacy of kinesthetic learning strategies in earth science. The level of student engagement in kinesthetic learning strategies in earth science. The level of conceptual mastery in kinesthetic learning strategies in earth science. The level of long-term retention in kinesthetic learning strategies in earth science. The students' performance in terms of diagnostic test and summative test. The utilization of kinesthetic learning strategies in earth science has significant difference on the diagnostic and summative of the student. The utilization of kinesthetic learning strategies in earth science has significant effect on the student engagement. The utilization of kinesthetic learning strategies in earth science has significant effect on the conceptual mastery. The utilization of kinesthetic learning strategies in earth science has significant effect on the long-term retention.

The study used a descriptive design in comparing variables, since the researcher's only concern is providing a description of the circumstance or case they are studying. The study was conducted to prove that kinesthetic learning strategies in earth science has significant effect on the student engagement, conceptual mastery and long-term retention. Also, to determine that kinesthetic learning strategies has significant difference on the diagnostic and summative of the students.

The respondents of the study were composed of thirty-three and thirty-seven Grade eight students from Santa Cruz Integrated National High School. In this study, purposive sampling method was used in choosing the respondents. The researcher made questionnaires validated by the set of expertise who are not part of the respondents from the schools in the District of Santa Cruz, Schools Division of Laguna.

Based on the data presented and interpreted in Chapter 4, For the level of efficacy of kinesthetic learning strategies in earth science in terms of simulation, hands-on activities, interactive presentations and movement-based exercises all was interpreted to a very great extent. While for level of efficacy of student engagement in terms of behavioral engagement, cognitive engagement and emotional engagement all was interpreted to a very great extent. For the level of efficacy of level of students' conceptual mastery in kinesthetic learning strategies in earth science in terms of immediate understanding and depth understanding was both interpreted to a very great extent. For the level of efficacy of students' long-term retention in earth science in terms of knowledge retention, transfer of learning and practical application was all interpreted to a very great extent. The students' performance in terms of diagnostic and summative test, it is evident that the students' performance in summative test is high, furthermore their performance in diagnostic test is evidently low. It only implies that they performed higher after the used of kinesthetic learning strategies. For the test of difference between the performance in utilization of kinesthetic learning strategies in earth science. Data obtained through a paired t-test indicated that the increase in the scores in performance is significant. For the effect of utilization of kinesthetic learning strategies in earth science on the student engagement. The Simulations, Hands-on Activities, Interactive Presentations and Movement-based Exercises of kinesthetic learning strategies in earth science has a significant effect to the student's motivation. Students' motivation is greatly impacted by their Immediate and Depth Understanding of kinesthetics learning strategies in Earth Science. For the effect of utilization of kinesthetic learning strategies in earth science on the long-term retention.

Based on the findings, the following were conclusions derived from the data and results of the study presented, analyzed, and interpreted: (1) Kinesthetic learning strategies in earth science has significant difference on the diagnostic and summative of the students, rejecting the first null hypothesis; (2) Kinesthetic learning strategies in earth science has significant effect on the student engagement thus, rejecting the second null hypothesis; (3) Kinesthetic learning strategies in earth science has significant effect on the conceptual mastery, rejecting the third null hypothesis; and (4) Kinesthetic learning strategies in earth science has significant effect on the long-term retention, rejecting the last null hypothesis. Hence, the utilization of kinesthetic learning strategies in earth science was effective.

Based on the conclusions formulated from the findings, the following recommendations were given. Maintain a multisensory approach by combining visual, auditory, and tactile elements in all kinesthetic learning strategies to check if it enhances comprehension, retention, and enjoyment of learning. Incorporate regular feedback mechanisms and reflection opportunities for students to assess their progress, identify areas for improvement, and reinforce learning outcomes.

KEYWORDS: *efficacy; kinesthetic learning strategies; earth science*

1. INTRODUCTION

From the famous quote by Nelson Mandela, "The most powerful weapon you can use to change the world is education." Every country needs to have a solid educational foundation in order to keep up with scientific and technological breakthroughs. Because of this, countries put a lot of effort into enhancing their educational frameworks and implementing innovative, effective teaching methods. Some children find it easy to concentrate and stay in class for long stretches of time. However, many children also find it difficult to learn by the traditional approach of listening and making notes. Students may find themselves distracted by their friends, social media, homework, jobs, or even by simply dozing off in class (Gashgari, 2017).

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In the dynamic field of education, pedagogical approaches are constantly being evaluated and refined to enhance the educational experience for students. This study explores the effectiveness of kinesthetic learning strategies and how they affect students' engagement, conceptual understanding, and long-term memory. It takes readers on an engaging journey through the realm of earth science teaching. As academics and educators explore for new approaches to bridge the gap between theory and practice, kinesthetic learning methodologies are emerging as a viable route for building a closer connection between students and the intricate laws of science.

A look into kinesthetic learning, which integrates academic material with physical movement and sensory experiences, is warranted by the distinct nature of earth science and calls for an approach that goes beyond conventional teaching approaches. The goal of this research is to better understand the possible long-term benefits of kinesthetic learning tactics through long-term information retention, in addition to examining the immediate effects of these strategies on student engagement and conceptual understanding.

The study endeavors to provide significant contributions to the field of education by elucidating the complex interplay between kinesthetic learning methodologies and the diverse facets of earth science, as we commence this extensive inquiry. We hope to give educators evidence-based advice to improve their educational approaches and enable students to master science fundamentals by exploring the relationship between physical activity, cognitive processes, and knowledge retention. Our goal in conducting this study is to change the way earth science is taught, creating an atmosphere that makes learning interesting and memorable.

1.1 Statement of the Problem

Specifically, this study answers the following questions:

1. What is the level of the efficacy of kinesthetic learning strategies in earth science in terms of:
   - 1.1 Simulations;
   - 1.2 Hands-on Activities;
   - 1.3 Interactive Presentations; and
   - 1.4 Movement-based Exercises?
2. What is the level of student engagement in earth science in terms of:
   - 2.1. Behavioral engagement;
   - 2.2. Emotional engagement; and
   - 2.3. Cognitive Engagement?
3. What is the level of students' conceptual mastery in terms of:
   - 3.1. Immediate understanding; and
   - 3.2. Depth understanding?
4. What is the level of students' long-term retention in terms of:
   - 4.1. knowledge retention;
   - 4.2. transfer of learning; and
   - 4.3. practical application
5. What is the students' performance in terms of:
   - 5.1. Diagnostic Test;
   - 5.2. Summative Test?
6. Does the utilization of kinesthetic learning strategies in earth science have significant difference on the Diagnostic and Summative Test of the students?
7. Does the utilization of kinesthetic learning strategies in earth science have significant effect on the student engagement?
8. Does the utilization of kinesthetic learning strategies in earth science have significant effect on the conceptual mastery?
9. Does the utilization of kinesthetic learning strategies in earth science have significant effect on the long-term retention?

2. METHODOLOGY

The study used a descriptive design in comparing variables, since the researcher's only concern is providing a description of the circumstance or case they are studying. It is a theory-based design process that was developed through data collection, analysis, and presentation. This enables a researcher to explain the how and why of their work. This is to determine the efficacy of kinesthetic learning strategies in earth science: a comprehensive investigation of student engagement, conceptual mastery, and long-term retention. Descriptive research, according to Rillo and Alieto (2018), is a purposeful process of collecting, evaluating, categorizing, and tabulating data about current conditions, practices, procedures, trends, and cause-and-effect relationships, followed by providing an adequate and accurate interpretation of the data—with, without, or with the occasional minimal assistance from statistical methods.

3. RESULTS AND DISCUSSION

This chapter enumerates the different results and discusses the results that were yielded from the treatment of the data that was gathered in this study. The following tabular presentations and discussions will further characterize the efficacy of kinesthetic learning strategies in earth science through a comprehensive investigation of student engagement, conceptual mastery, and long-term retention.

Level of the Efficacy of Kinesthetic Learning Strategies in Earth Science

Tables 1 to 5 presents the level of efficacy of kinesthetic learning strategies in Earth Science in terms of simulations, hands-on activities, interactive presentations and movement-based exercises.

Level of Efficacy of Kinesthetic Learning Strategies in Earth Science in terms of Simulation

Table 1 below illustrates the level of efficacy of kinesthetic learning strategies in earth science in terms of Simulations

Students strongly agree that using kinesthetic learning strategies in earth science particularly through simulation, enhance their understanding *(M=4.76, SD=0.46)*. Furthermore, they believe that this strategy adequately provides them with knowledge *(M=4.41, SD=0.63)*. The level of efficacy of kinesthetic learning strategies in earth science in terms of Simulations attained a weighted mean score of 4.53 and a standard deviation of 0.31 and was Very Great Extent among

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the respondents.

This means that the efficacy of kinesthetic learning strategies is evident during simulation, in teaching and learning earth science. Since engaging students through physical movement and hands-on experiences boosts their participation and comprehension of the concepts. Integrating visual, auditory, and tactile elements enriches the learning experience, allowing students to apply theoretical knowledge in practical scenarios. This active engagement improves their retention and makes learning more enjoyable.

Table 1. Level of Efficacy of Kinesthetic Learning Strategies in Earth Science in terms of Simulations

STATEMENTS	MEAN	SD	REMARKS
1. Kinesthetic learning strategies in Earth Science, mainly through simulations, enhance students' understanding.	4.76	0.46	Strongly Agree
2. The efficacy of kinesthetic learning strategies in Earth Science using simulations is apparent in students' increased engagement and retention.	4.44	0.56	Strongly Agree
3. Including kinesthetic elements, such as simulations, greatly boosts the efficacy of Earth Science learning by providing a hands-on experience.	4.54	0.58	Strongly Agree
4. The efficacy of kinesthetic learning strategies, especially when employing Earth Science simulations, will provide enough knowledge.	4.41	0.63	Strongly Agree
5. The use of kinesthetic learning, mainly through simulation-based activities, is a powerful tool in improving the overall effectiveness of Earth Science.	4.51	0.74	Strongly Agree
Weighted Mean		4.53	
SD		0.31	
Verbal Interpretation		Very Great Extent	

Level of Efficacy of Kinesthetic Learning Strategies in Earth Science in terms of Hands-on Activities

Table 2. Level of Efficacy of Kinesthetic Learning Strategies in Earth Science in terms of Hands-on Activities

STATEMENTS	MEAN	SD	REMARKS
1. Incorporating kinesthetic learning strategies in Earth Science, mainly through hands-on activities, significantly enhances students' comprehension.	4.66	0.51	Strongly Agree
2. The efficacy of kinesthetic learning in Earth Science is evident when students engage in hands-on activities, fostering a deeper understanding of theoretical concepts.	4.44	0.58	Strongly Agree
3. Hands-on activities in Earth Science, as part of kinesthetic learning strategies, effectively bridge the gap between theory and practical application.	4.60	0.60	Strongly Agree
4. The efficacy of kinesthetic learning strategies, particularly those involving hands-on earth science activities, has a positive impact on student learning outcomes.	4.53	0.61	Strongly Agree
5. Kinesthetic learning strategies play a crucial role in improving the overall efficacy of earth science.	4.61	0.55	Strongly Agree
Weighted Mean		4.57	
SD		0.26	
Verbal Interpretation		Very Great Extent	

The efficacy of kinesthetic learning strategies in earth science is demonstrated by Table 2 above in terms of hands-on activities.

It is strongly agreed upon by students that kinesthetic learning strategies, especially through hands-on activities, improve their comprehension in earth science (M=4.66, SD=0.51). Moreover, they think that this approach effectively promotes a deeper comprehension of theoretical ideas (M=4.44, SD=0.58). With a weighted mean score of 4.57 and a standard deviation of 0.26, the respondents' level of efficacy for kinesthetic learning strategies in earth science in terms of hands-on activities was to Very Great Extent.

This simply indicates that the efficacy of kinesthetic learning strategies is evident when teaching and learning earth science through hands-on activities. Allowing them to interact with objects, models, and experiments, making abstract concepts easier to comprehend. This hands-on approach improves retention rates by encouraging active participation. In addition, it promotes critical thinking, observation skills, data analysis, and drawing conclusions, while also enhancing social interaction and collaborative skills.

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Level of Efficacy of Kinesthetic Learning Strategies in Earth Science in terms of Interactive Presentations

The efficacy of kinesthetic learning strategies in earth science is demonstrated by Table 3 below in terms of interactive presentations.

It can be seen that the efficacy of kinesthetic learning strategies is evident through interactive presentations. Students strongly agreed that interactive presentations make earth science more accessible and memorable for them (M=4.66, SD=0.56). Also, its positive impact is clear, which aligns to enhance the overall teaching of earth science (M=4.38, SD=0.60) was strongly agreed upon by the students. The weighted mean score of 4.54, along with a standard deviation of 0.53, indicates that the respondents found kinesthetic learning methodologies to be very effective in earth science as it can be interpreted as to very great extent.

Table 3. Level of Efficacy of Kinesthetic Learning Strategies in Earth Science in terms of Interactive Presentations

STATEMENTS	MEAN	SD	REMARKS
1. The efficacy of kinesthetic learning in earth science is particularly notable when presented interactively, as it caters to diverse learning styles and encourages active participation.	4.66	0.59	Strongly Agree
2. Integrating kinesthetic learning strategies in earth science through interactive presentations enhances student engagement and understanding.	4.46	0.61	Strongly Agree
3. Interactive presentations within kinesthetic learning strategies effectively reinforce earth science concepts, making the subject more accessible and memorable for students.	4.66	0.56	Strongly Agree
4. The positive impact of interactive presentations in kinesthetic learning strategies is clear, aligning to enhance the overall efficacy of earth science.	4.38	0.60	Strongly Agree
5. The interactive nature of presentations within kinesthetic learning encourages students to explore and apply earth science concepts actively.	4.53	0.72	Strongly Agree
Weighted Mean		4.54	
SD		0.53	
Verbal Interpretation		Very Great Extent	

This only shows that when teaching and learning earth science through interactive presentations, the effectiveness of kinesthetic learning methodologies is clear. Because it shows that students are more engaged and involved in their learning when they participate in interactive presentations. This not only helps them understand the subject better but also allows for immediate feedback to reinforce their learning. Preparing these presentations to each student's individual learning style can increase their motivation and enjoyment of learning by prompting critical thinking, analysis of the material, and establishing connections between different ideas.

Level of Efficacy of Kinesthetic Learning Strategies in Earth Science in terms of Hands-on Movement Based Exercises

The efficacy of kinesthetic learning strategies in earth science is demonstrated by Table 4 below in terms of movement-based exercises.

Table 4. Level of Efficacy of Kinesthetic Learning Strategies in Earth Science in terms of Movement-based Exercises

STATEMENTS	MEAN	SD	REMARKS
1. Combining kinesthetic learning strategies and movement-based exercises is a powerful approach to making earth science more enjoyable and effective.	4.60	0.60	Strongly Agree
2. The positive impact on student comprehension and retention is notable, making it easy to agree on the efficacy of incorporating movement-based exercises in earth science.	4.63	0.59	Strongly Agree
3. Movement-based exercises within kinesthetic learning strategies contribute to improved retention of earth science concepts by allowing students to interact with the material physically.	4.44	0.58	Strongly Agree
4. The efficacy of kinesthetic learning in earth science is evident when movement-based exercises are integrated, fostering a more dynamic and immersive learning experience.	4.47	0.70	Strongly Agree
5. Merging movement-based exercises within kinesthetic	4.50	0.61	Strongly Agree

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learning strategies in earth science enhances student engagement and understanding.	
Weighted Mean	4.53
SD	0.32
Verbal Interpretation	Very Great Extent

Based on the table students strongly agreed that incorporating movement-based exercise in teaching and learning earth science have positive impact on their comprehension and retention (M=4.63, SD=0.59). Moreover, they also strongly agreed that this kinesthetic learning strategy can contribute in improving their retention by allowing them to interact with the material physically (M=4.44, SD=0.58).

The weighted mean score of 4.53, accompanied by a 0.52 standard deviation, suggested that the participants highly valued kinesthetic learning approaches in the field of earth science.

This merely demonstrates how effective kinesthetic learning approaches are for teaching and learning earth science through movement-based exercises. This interactive method helps students see and comprehend difficult ideas. It lets them actively engage with the material, making the learning experience more engaging and memorable. By immersing students in the subject matter, their ability to observe and analyze was improved. These hands-on activities cater to different learning preferences and promote active participation.

Level of Student Engagement in Kinesthetic Learning Strategies in Earth Science

Tables 5 to 7 presents the level of students' engagement in earth science in terms of behavioral engagement, emotional engagement and cognitive engagement.

Level of Student Engagement in Earth Science in terms of Behavioral Engagement

Table 5 below illustrates the level of student engagement in earth science in terms of behavioral engagement.

Table 5. Level of Student Engagement in Earth Science in Terms of Behavioral Engagement

STATEMENTS	MEAN	SD	REMARKS
1. Kinesthetic learning strategies in earth science significantly enhance student behavioral engagement by promoting active participation.	4.61	0.62	Strongly Agree
2. Using kinesthetic learning strategies in earth science encourages behavioral engagement by providing students with physical interactions that make the subject more tangible.	4.53	0.53	Strongly Agree
3. Kinesthetic Learning Strategies contribute to a livelier classroom atmosphere, fostering behavioral engagement.	4.47	0.76	Strongly Agree
4. The hands-on nature of kinesthetic learning strategies naturally aligns with increased behavioral engagement, ensuring students actively participate in the learning process.	4.49	0.58	Strongly Agree
5. Incorporating kinesthetic elements in earth science education enhances behavioral engagement, making the subject more exciting and accessible to students.	4.67	0.50	Strongly Agree
Weighted Mean	4.55		
SD	0.32		
Verbal Interpretation	Very Great Extent		

It can be seen from the table that students strongly agreed that kinesthetic learning strategies enhances their behavioral engagement, making the subject more exciting and accessible to them *(M=4.67, SD=0.50)*. On the other hand, they also strongly agreed that it contributes to a livelier classroom atmosphere, fostering behavioral engagement *(M=4.47, SD=0.76)*. The level of student engagement in kinesthetic learning strategies in earth science in terms of behavioral engagement attained a weighted mean score of 4.55 and a standard deviation of 0.32 and was Very Great Extent among the respondents.

It only means that the students showed a high level of behavioral engagement in earth science, as reported by the respondents based on their behavioral engagement. It doesn't only draw them in but also encourages their active participation, more likely making them fully engage in the learning process. This hands-on approach results in better retention of knowledge, deeper understanding of concepts, and improved learning outcomes overall.

Level of Student Engagement in Earth Science in terms of Emotional Engagement

The level of emotional engagement among students in earth science was shown in Table 6 below.

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Table 6. Level of Student Engagement in Earth Science in Terms of Emotional Engagement

STATEMENTS	MEAN	SD	REMARKS
1. Kinesthetic strategies create a positive emotional connection with earth science, fostering a more favorable attitude towards the subject.	4.66	0.59	Strongly Agree
2. The hands-on nature of kinesthetic learning strategies naturally promotes emotional engagement, making the learning experience more enjoyable and memorable for students.	4.51	0.63	Strongly Agree
3. Incorporating kinesthetic learning strategies in earth science sparks emotional engagement by tapping into students' intrinsic curiosity and interest.	4.47	0.70	Strongly Agree
4. The efficacy of kinesthetic learning is evident in its positive impact on emotional engagement, as students connect with the subject on a deeper, more personal level.	4.51	0.61	Strongly Agree
5. Incorporation of kinesthetic elements in earth science education enhances emotional engagement, creating a more positive and impactful learning environment.	4.40	0.71	Strongly Agree
Weighted Mean		4.51	
SD		0.32	
Verbal Interpretation		Very Great Extent	

Based on the table above, positive emotional connection with earth science fosters a more favorable attitude towards it (M=4.66, SD=0.59), since the students strongly agreed upon this statement. Moreover, students also strongly agreed that the enhance emotional engagement they've experienced, creates more positive and impactful learning environment (M=4.40, SD=0.71). With a weighted mean score of 4.51 and a standard deviation of 0.32, the respondents' level of students' engagement in kinesthetic learning strategies in earth science in terms of emotional engagement was to Very Great Extent.

It only suggests that the respondents showed a high level of emotional engagement in earth science, as reported by the respondents. Not only does a strong emotional engagement enhance students' academic performance, but it also nurtures a lasting curiosity in the subject, sharpens their analytical skills, fosters environmental awareness, and ultimately, makes the learning experience more enjoyable and fulfilling for them.

Level of Student Engagement in Earth Science in terms of Cognitive Engagement

The students' engagement in earth science is demonstrated by Table 7 below in terms of cognitive engagement.

Respondents strongly agreed that cognitive engagement allows students to explore earth science concepts actively (M=4.74, SD=0.47). Also, based on the table below, that experiential learning opportunities can stimulate cognitive engagement (M=4.47, SD=0.65) since most of the respondents strongly agreed on this statement. The weighted mean score of 4.58, accompanied by a 0.31 standard deviation, suggested that the participants are highly engaged in kinesthetic learning approaches in the field of earth science as it can be interpreted as to very great extent.

This merely demonstrates how they are engaged cognitively in learning earth science. Since they use critical thinking skills and problem-solving strategies to deeply understand and connect concepts. Which leads to a more thorough comprehension of the subject. They ask questions, seek answers through research, and develop a scientific mindset, by grasping not only the facts but also the underlying principles and connections between different aspects of the subject, students gain a deeper understanding of earth science. They can apply their skills and knowledge in new situations, which promotes creativity and innovation.

Table 7. Level of Student Engagement in Earth Science in Terms of Cognitive Engagement

STATEMENTS	MEAN	SD	REMARKS
1. Integrating kinesthetic elements in earth science promotes cognitive engagement, making learning more intellectually stimulating for students.	4.59	0.58	Strongly Agree
2. The interactive aspect of kinesthetic learning strategies encourages cognitive engagement, allowing students to explore earth science concepts actively.	4.74	0.47	Strongly Agree
3. The hands-on nature of kinesthetic learning strategies naturally aligns with enhanced cognitive engagement, fostering critical thinking and analytical skills.	4.49	0.63	Strongly Agree
4. Kinesthetic strategies increase cognitive engagement, helping students better understand earth science concepts.	4.59	0.60	Strongly Agree
5. Using kinesthetic learning strategies in earth science	4.47	0.65	Strongly Agree

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stimulates cognitive engagement by providing students with experiential learning opportunities.	
Weighted Mean	4.58
SD	0.31
Verbal Interpretation	Very Great Extent

Level of Students' Conceptual Mastery in Earth Science

Tables 8 to 9 presents the level of students' conceptual mastery in kinesthetic learning strategies in earth science in terms of immediate understanding and depth understanding.

Level of Students' Conceptual Mastery in Earth Science in terms of Immediate Understanding

Table 8 below illustrates the level of students' conceptual mastery in earth science in terms of immediate understanding.

Table 8. Level of Students' Conceptual Mastery in Earth Science in terms of Immediate Understanding

STATEMENTS	MEAN	SD	REMARKS
1. The interactive aspect of kinesthetic learning strategies facilitates immediate understanding, allowing students to see and experience earth science concepts.	4.67	0.50	Strongly Agree
2. Incorporating kinesthetic elements in earth science accelerates conceptual mastery, providing students with a direct and immediate understanding of theoretical ideas.	4.41	0.60	Strongly Agree
3. Using kinesthetic learning strategies in earth science promotes immediate understanding by translating abstract concepts into hands-on, practical applications.	4.54	0.50	Strongly Agree
4. Using kinesthetic learning strategies in earth science promotes immediate understanding by translating abstract concepts into hands-on, practical applications.	4.47	0.68	Strongly Agree
5. Kinesthetic strategies contribute to immediate conceptual mastery, helping students connect theory to real-world scenarios seamlessly.	4.47	0.68	Strongly Agree
Weighted Mean		4.51	
SD		0.30	
Verbal Interpretation		Very Great Extent	

From the table, it can be seen that the respondents strongly agreed that the immediate understanding allows students to see and experience earth science concepts (M=4.67, SD=0.50). Also, the strategies used in teaching and learning earth science accelerates their conceptual mastery, providing them with a direct and immediate understanding of theoretical idea, since most of the respondents strongly agreed on this part. The level of conceptual mastery in kinesthetic learning strategies in earth science in terms of immediate understanding attained a weighted mean score of 4.51 and a standard deviation of 0.30 and was Very Great Extent among the respondents.

It only means that the students showed a high level of mastery in earth science, as reported by the respondents based on their immediate understanding. Which allows them to easily and efficiently learn new ideas, as they grasp concepts rapidly by making connections between different concepts, recognizing patterns, and applying their existing knowledge to new scenarios. Those who quickly understand the material are more likely to engage in group activities, share insights, and ask insightful questions, creating a more enriched learning environment. Additionally, this immediate understanding enhances their long-term memory, laying a solid foundation for future educational pursuits and academic achievements.

Level of Students' Conceptual Mastery in Earth Science in terms of Depth Understanding

The students' conceptual mastery level in earth science in terms of depth understanding is shown in Table 9 below.

Table 9. Level of Conceptual Mastery in Earth Science in terms of Depth Understanding

STATEMENTS	MEAN	SD	REMARKS
1. The efficacy of kinesthetic learning is evident in its positive impact on conceptual mastery, as it promotes a deeper understanding of earth science principles.	4.77	0.42	Strongly Agree
2. Using kinesthetic learning strategies in earth science encourages a depth of understanding by engaging students in hands-on experiences that reinforce theoretical knowledge.	4.51	0.53	Strongly Agree
3. Kinesthetic learning strategies in earth science foster a depth of understanding, allowing students to comprehend	4.44	0.63	Strongly Agree

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and appreciate concepts at a profound level.			
4. Kinesthetic strategies contribute to a depth of conceptual mastery, enabling students to explore the intricacies of earth science concepts thoroughly.	4.39	0.73	Strongly Agree
5. Putting kinesthetic elements in earth science accelerates a depth of conceptual mastery, providing students with opportunities for profound insights.	4.46	0.63	Strongly Agree
Weighted Mean		4.52	
SD		0.29	
Verbal Interpretation		Very Great Extent	

Students strongly agreed that the efficacy of kinesthetic learning is evident in its positive impact on their conceptual mastery, as it promotes a deeper understanding of earth science principles (M=4.77, SD=0.42). Furthermore, depth conceptual mastery, enables students to explore the intricacies of earth science thoroughly (M=4.39, SD=0.73), showing a Strongly Agree response. With a weighted mean score of 4.52 and a standard deviation of 0.29, the respondents' level of conceptual mastery in kinesthetic learning strategies in earth science in terms of depth understanding was to Very Great Extent.

It only suggests that the respondents showed a high level of conceptual mastery in earth science in terms of depth understanding, as reported by the respondents. Students who have a deep understanding of concepts in earth science are able to tackle complex topics. This helps improve their critical thinking skills and allows them to apply their academic knowledge effectively to real-life situations. It also enables them to integrate their knowledge with insights from other areas, prompting more innovative thinking. As a result, students become better at communicating ideas and are adept at identifying key challenges in the field.

Level of Students' Long-Term Retention in Earth Science

Tables 10 to 12 presents the level of students' long-term retention in earth science in terms of knowledge retention, transfer of learning and practical application.

Level of Students' Long-Term Retention in Earth Science in terms of Knowledge Retention

The students' long-term retention in earth science is demonstrated by Table 10 below in terms of knowledge retention.

Table 10. Level of Long-Term Retention in Earth Science in Terms of Knowledge Retention

STATEMENTS	**MEAN**	**SD**	**REMARKS**
1. Kinesthetic learning strategies in earth science contribute to long-term retention, ensuring that students retain knowledge well beyond the initial learning period.	4.57	0.67	Strongly Agree
2. The effectiveness of kinesthetic learning is evident in its positive impact on long-term knowledge retention, as hands-on experiences create lasting memories of earth science concepts.	4.50	0.61	Strongly Agree
3. Applying kinesthetic learning strategies in earth science promotes enduring knowledge retention by engaging students in practical applications of theoretical principles.	4.50	0.68	Strongly Agree
4. The interactive aspect of kinesthetic learning strategies facilitates long-term knowledge retention, allowing students to build a solid and enduring understanding of earth science.	4.67	0.47	Strongly Agree
5. Kinesthetic learning strategies in earth science are effective in helping students retain and apply knowledge well into the future.	4.64	0.57	Strongly Agree
Weighted Mean		4.58	
SD		0.33	
Verbal Interpretation		Very Great Extent	

Based on the table above the respondents strongly agreed that the long-term knowledge retention allows students to build a solid and enduring understanding of earth science (M=4.67, SD=0.47). Nonetheless, they strongly agreed that engaging students in practical applications of theoretical principles promotes enduring knowledge retention (M=4.50, SD=0.68). The weighted mean score of 4.58, accompanied by a 0.33 standard deviation, suggested that the participants have long term retention in kinesthetic learning approaches in the field of earth science as it can be interpreted as to very great extent.

This merely demonstrates how the knowledge retention in kinesthetic learning approaches in learning earth science is evident. This forms a strong foundation for further exploration and study of earth science. It also encourages a mindset of continual learning and enhances critical thinking skills. Retaining this knowledge is advantageous for career advancement in earth science-related fields and enhances

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problem-solving abilities within the industry. Additionally, students who persist in studying earth science are more likely to have a deep understanding of environmental issues

Level of Students' Long-Term Retention in Earth Science in terms of Transfer of Learning

The level of long-term retention among students in earth science in terms of transfer of learning was shown in Table 11 below.

The respondents strongly agree that kinesthetic learning strategies are effective in helping students retain and apply knowledge in practical, real-world settings (M=4.63, SD=0.59). However, based on the results presented respondents also strongly agreed that not only it supports long – term retention but also strengthens the transfer of learning, ensuring students can apply their understanding in various situations (M=4.44, SD=0.65).

With a weighted mean score of 4.51 and a standard deviation of 0.31, the respondents' level of long-term retention in kinesthetic learning strategies in earth science in terms of transfer of learning was to Very Great Extent.

Table 11. Level of Students' Long-Term Retention in Earth Science in Terms of Transfer of Learning

STATEMENTS	MEAN	SD	REMARKS
1. Kinesthetic learning strategies in earth science are effective in helping students retain and apply knowledge in practical, real-world settings.	4.63	0.57	Strongly Agree
2. Incorporation of kinesthetic activities in earth science education supports long-term retention and strengthens the transfer of learning, ensuring students can apply their understanding in various situations.	4.44	0.65	Strongly Agree
3. The interactive aspect of kinesthetic learning strategies facilitates long-term retention and enhances the transfer of learning, empowering students to apply theoretical knowledge beyond the classroom.	4.44	0.61	Strongly Agree
4. Integrating kinesthetic elements in earth science has a lasting impact on knowledge retention and supports the effective transfer of learning to real-world scenarios.	4.51	0.58	Strongly Agree
5. Kinesthetic learning strategies in earth science support the transfer of learning across various problem-solving scenarios.	4.51	0.74	Strongly Agree
Weighted Mean		4.51	
SD		0.31	
Verbal Interpretation		Very Great Extent	

It only suggests that the respondents showed a high level of long term-retention as to transfer of learning in earth science, as reported by the respondents. The transfer of learning enables the students to use their knowledge of earth science in different areas and real-life scenarios. Applying what they have learned makes it simpler to solve problems in various settings. This supports progression in earth science and continuous learning. Many job opportunities in earth science and related fields are available because of applying what they have learned.

Level of Students' Long-Term Retention in Earth Science in terms of Practical Application

Table 12 below illustrates the level of students' long-term retention in earth science in terms of practical application.

Table 12. Level of Students' Long-Term Retention in Earth Science in Terms of Practical Application

STATEMENTS	MEAN	SD	REMARKS
1. The efficacy of kinesthetic learning is evident in its positive impact on long-term knowledge retention, enabling students to apply earth science concepts in real-world situations.	4.70	0.55	Strongly Agree
2. Kinesthetic learning strategies in earth science enhance long-term retention by fostering practical application of theoretical knowledge.	4.44	0.71	Strongly Agree
3. Using kinesthetic learning strategies in earth science promotes enduring knowledge retention, supporting students in applying learned principles practically.	4.54	0.56	Strongly Agree
4. Integrating kinesthetic elements in earth science contributes to lasting knowledge retention and empowers students to apply learned concepts practically.	4.47	0.65	Strongly Agree
5. Incorporating kinesthetic activities in earth science supports long-term retention and strengthens practical	4.54	0.65	Strongly Agree

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application, ensuring students can confidently apply their understanding in realistic settings.	
Weighted Mean	4.54
SD	0.33
Verbal Interpretation	Very Great Extent

The results proved that the impact of kinesthetic learning strategies on the students' long-term retention, enables them to apply earth science concepts in real world situations *(M=4.70, SD=0.55)* by strongly agreeing on the statement. On the other hand, their long – term retention can be enhanced by fostering practical applications of theoretical knowledge since they strongly agree on the statement *(M=4.44, SD=0.71)*. The level of students' long-term retention in earth science in terms of practical application attained a weighted mean score of 4.54 and a standard deviation of 0.33 and was Very Great Extent among the respondents.

It only means that the students showed a high level of long-term retention in earth science, as reported by the respondents based on their practical application. Having a positive effect on long-term memory, helps students use earth science concepts in real-life scenarios through practical application of theoretical knowledge. It also encourages lasting memory retention, assisting students in utilizing principles they have learned and empowering students to confidently apply their understanding of concepts learned.

Students Performance in terms of Diagnostic and Summative Test

Table 13 verifies the students' performance in terms of diagnostic and summative test.

Based on the table below it is evident that the students' performance in summative test is High (*M=37.51)*, furthermore their performance in diagnostic test is evidently Low (*M=13.19).*

Table 13. Students' Performance in Terms of Diagnostic and Summative Test

Kinesthetic Learning Strategies	Diagnostic test		Summative test	
	Mn	SD	Mn	SD
performance	13.19	6.70	37.51	5.47

Legend: Rating Scale

41.00 – 50.00	-	Very High (VH)
31.00 – 40.00	-	High (H)
21.00 – 30.00	-	Moderate (M)
11.00 – 20.00	-	Low (L)
1.00 – 10.00	-	Very Low (VL)

It only implies that they performed higher after the used of kinesthetic learning strategies. Since on the previous discussion of the findings, the strategies can enhance their learning experience by helping them better retain information. By connecting concepts with physical movements, students can gain a deeper understanding of the material and improve their analytical skills. This active approach to learning can also boost motivation and foster a sense of collaboration and community among students.

Test of Difference on the Students' Performance in in Diagnostic and Summative Test

Revealed in Table 14 is the test of difference between the performance in utilization of kinesthetic learning strategies in earth science. Data obtained through a paired t-test indicated that the increase in the scores in *performance* is significant ($p < 0.05$).

Table 14. Test of Difference on the Students' Performance in in Diagnostic and Summative Test

kinesthetic learning strategies	Diagnostic test		Summative test		Mean Difference	95% Confidence Interval of Difference		t	df	Sig (2-tailed)
	Mn	SD	Mn	SD		L	U			
performance	13.19	6.70	37.51	5.47	24.33	23.87	24.79	-105.8	69	0.000

*Legend: *Significant at 0.05*

This implies that the students performed better after the utilization of kinesthetic learning strategies. Their level of students learning strategies has significantly improved from low to high. The study showed that using kinesthetic learning techniques helped students improve their performance. These techniques not only help with retaining information but also enhance comprehension and analytical skills by connecting concepts with physical movements.

Significant Effect of Utilization of Kinesthetic Learning Strategies in Earth Science on the Student Engagement

Table 15 presents the results of a multiple regression analysis examining the effect of utilization of kinesthetic learning strategies in earth science on the student engagement.

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Table 15. Regression Analysis of The Utilization of Kinesthetic Learning Strategies in Earth Science on The Student Engagement

Behavioral engagement	B	SE	β	t	p
Constant	,927	0.564		1.642	0.105
Simulations		0.149	0.376	2.514*	0.014
Hands-on Activities		0.151	0.146	0.964	0.339
Interactive Presentations		0.132	0.147	1.113	0.27
Movement-based Exercises		0.133	0.13	0.98	0.33
R-squared			.432		
Adjusted R-squared			.397		
Standard Error of the Estimate		.247			
F(4, 65)				12.34	.000
Emotional engagement	**B**	**SE**	**β**	**t**	**p**
Constant	1.149	0.588		1.955	0.055
Simulations		0.156	0.188	1.206	0.232
Hands-on Activities		0.158	0.056	0.356	0.723
Interactive Presentations		0.138	0.208	1.51	0.136
Movement-based Exercises		0.138	0.29	2.096*	0.04
R-squared			.394		
Adjusted R-squared			.356		
Standard Error of the Estimate		.257			
F(4, 65)				10.55	.000
Cognitive Engagement	**B**	**SE**	**β**	**t**	**p**
Constant	1.401	0.552		2.536*	0.014
Simulations		0.146	0.309	2.115*	0.038
Hands-on Activities		0.148	-0.033	-0.226	0.822
Interactive Presentations		0.129	0.187	1.444	0.154
Movement-based Exercises		0.13	0.238	1.834	0.071
R-squared			.418		
Adjusted R-squared			.382		
Standard Error of the Estimate		.242			
F(4, 65)				11.67	.000

*p < 0.05

Based on the data above it can be seen that the effect of doing simulations on the students' behavioral and cognitive engagement is evident (p=0.014 and 0.038), furthermore, the effect of movement-based exercise on the students' emotional and cognitive engagement is also evident (p=0.04 and 0.071). As explained simulations offer a lifelike and engaging setting for students to delve into concepts. Incorporating physical movements like gestures, demos, or activities can boost engagement for kinesthetic learners. By utilizing these methods, teachers can establish an interactive learning atmosphere that accommodates various learning preferences and promotes participation, ultimately enhancing learning results. Adding some hands-on tasks and interactive lectures will enable students to directly handle materials or conduct experiments, making them more involve through quizzes, problem-solving, or discussions.

Significant Effect of Utilization of Kinesthetic Learning Strategies in Earth Science on the Conceptual Mastery

Table 16 presents the results of a multiple regression analysis examining the effect of utilization of kinesthetic learning strategies in earth science on the conceptual mastery.

According to the gathered data by the researcher, interactive learning was evidently having significant effect on the immediate understanding of the conceptual mastery of earth science (*p=0.001)*, just like movement-based exercises have significant effect on the students' depth understanding of the earth science concepts (*p=0.029)*. Certainly, engaging in interactive learning leads to immediate understanding and mastery of concepts due to its collaborative and stimulating characteristics.

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Table 16. Regression Analysis of The Utilization of Kinesthetic Learning Strategies in Earth Science on The Conceptual Mastery

Immediate understanding	B	SE	β	t	p
Constant	1.51	0.556		2.715*	0.008
Simulations		0.147	0.082	0.559	0.578
Hands-on Activities		0.149	0.1	0.671	0.505
Interactive Presentations		0.13	0.448	3.442*	0.001
Movement-based Exercises		0.131	0.031	0.235	0.815
R-squared			.388		
Adjusted R-squared			.35		
Standard Error of the Estimate		.243			
F(4, 65)				10.28	.000
Depth understanding	**B**	**SE**	**β**	**t**	**p**
Constant	2.021	0.576		3.51*	0.000
Simulations		0.153	0.172	1.129	0.263
Hands-on Activities		0.155	-0.041	-0.262	0.794
Interactive Presentations		0.135	0.116	0.858	0.394
Movement-based Exercises		0.135	0.303	2.239*	0.029
R-squared			.299		
Adjusted R-squared			.256		
Standard Error of the Estimate		.252			
F(4, 65)				6.928	.000

*p < 0.05

When students actively participate in discussions, role-playing, hands-on activities, or interactive presentations, they are more inclined to comprehend and remember the material. By providing students with opportunities to apply their academic knowledge through practical experiences, movement-based exercises can further enhance their comprehension. By combining interactive teaching methods with physical activities, students are motivated to develop a genuine interest in the subject while also enhancing their academic achievements.

Significant Effect of Utilization of Kinesthetic Learning Strategies in Earth Science on the Long-Term Retention

Table 17 presents the results of a multiple regression analysis examining the effect of utilization of kinesthetic learning strategies in earth science on the long-term retention.

Based on the table it can be seen that the effect of simulations and interactive presentation on the transfer of learning was evident (*p=0.015 and 0.012)*. Also, again the effect of simulations was evident on the practical application, when it comes to long-term retention (p=*0.000*). Students are more engaged when they use interactive presentations and simulations for learning. These offer a realistic and contextual educational experience, promoting critical thinking, problem-solving, and decision-making skills. Active learning has been shown to improve retention and transfer of knowledge, that's why it is evident that simulations allow for repeated practice in a safe environment, strengthening learning and memory.

Table 17. Regression Analysis of The Utilization of Kinesthetic Learning Strategies in Earth Science on The Long-Term Retention

Knowledge retention	B	SE	β	t	p
Constant	1.246	0.649		1.921	0.059
Simulations		0.172	-0.067	-0.389	0.698
Hands-on Activities		0.174	0.303	1.743	0.086
Interactive Presentations		0.152	0.244	1.609	0.112
Movement-based Exercises		0.152	0.252	1.65	0.104
R-squared			.315		
Adjusted R-squared			.273		
Standard Error of the Estimate		.284			
F(4, 65)				7.477	.000
Transfer of learning	**B**	**SE**	**β**	**t**	**p**
Constant	.52	0.496		1.049	0.298
Simulations		0.131	0.327	2.493*	0.015
Hands-on Activities		0.133	0.149	1.12	0.267
Interactive Presentations		0.116	0.301	2.596*	0.012
Movement-based Exercises		0.116	0.101	0.867	0.389
R-squared			.549		

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Adjusted R-squared			.521		
Standard Error of the Estimate		.217			
F(4, 65)				19.76	.000
Practical application	**B**	**SE**	**β**	**t**	**p**
Constant	.794	0.549		1.447	0.153
Simulations		0.145	0.618	4.249*	0.000
Hands-on Activities		0.147	-0.025	-0.169	0.866
Interactive Presentations		0.128	0.011	0.083	0.934
Movement-based Exercises		0.129	0.223	1.732	0.088
R-squared			.514		
Adjusted R-squared			.484		
Standard Error of the Estimate		.24			
F(4, 65)				17.18	.000

*p < 0.05

4. CONCLUSION AND RECOMMENDATIONS

Based on the findings obtained in the study the following conclusions was drawn:

Kinesthetic learning strategies in earth science has significant difference on the diagnostic and summative of the students, rejecting the first null hypothesis. Hence, the utilization of kinesthetic learning strategies in earth science was effective. Since the result showed that using kinesthetic learning techniques helped students improve their performance. These techniques not only help with retaining information but also enhance comprehension and analytical skills by connecting concepts with physical movements. This hands-on learning approach can also increase motivation and promote collaboration among students, creating a sense of teamwork and community.

Kinesthetic learning strategies in earth science has significant effect on the student engagement thus, rejecting the second null hypothesis. Simulations significantly enhance students' behavioral and cognitive engagement, while movement-based exercise boosts emotional and cognitive engagement. These methods create an interactive learning atmosphere, accommodating various learning preferences and promoting participation.

Kinesthetic learning strategies in earth science has significant effect on the conceptual mastery, rejecting the third null hypothesis. The study showed that when students engage in interactive learning, it helps them better understand earth science concepts. By incorporating interactive teaching techniques with physical activities, students are more motivated to learn and become genuinely interested in the subject, leading to improved academic performance.

Kinesthetic learning strategies in earth science has significant effect on the long-term retention, rejecting the fourth null hypothesis. The results reveal that simulations and interactive presentations significantly enhance learning transfer and long-term retention. These methods promote critical thinking, problem-solving, and decision-making skills, enhancing learning and memory. Active learning, facilitated by simulations, enhances learning in a safe environment.

On the basis of the foregoing findings and conclusion of the study, the following recommendations are offered:

1. Maintain a multisensory approach by combining visual, auditory, and tactile elements in all kinesthetic learning strategies to check if it enhances comprehension, retention, and enjoyment of learning.
2. Incorporate regular feedback mechanisms and reflection opportunities for students to assess their progress, identify areas for improvement, and reinforce learning outcomes.
3. Implement active learning strategies like group discussions, hands-on activities, and collaborative projects to encourage student participation, provide ownership, and incorporate real-world examples and creativity for emotional engagement.

REFERENCE

1. *Gashgari, A., (2017). A Study of Kinesthetic Learning Activities in Teaching Computer Algorithms in Saudi Arabia*
2. *Rillo, R. M. and Alieto, E. O. (2018). Indirectness Markers in Korean and Persian English Essays: Implications for Teaching Writing to EFL Learners. Journal of English as International Language 2018*