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Research Article

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The effectiveness of Electro Briefcase intervention in improving the test performance in Science V

Saireen May Tuando Nalagon [1]*, Disierie Mahinay [1], Jocelyn Micabalo [1], Hannah Danielle Monterde [1], Jomelyn Napoto [1], Angelika Eunice Naval [1], Jyzle Shaine Anthonette Nebit [1], Jovar Pantao [1]

[1]GSC College of Education, Mindanao State University - General Santos City, General Santos, PHILIPPINES
***Corresponding Author:** saireenmay.nalagon@msugensan.edu.ph

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ABSTRACT

The research aimed to improve the test performance in science of the Grade V - Einstein pupils of Dadiangas West Elementary School, particularly on the topic of electricity and circuits through the "Electro Briefcase" intervention, emphasizing the use of tangible learning materials and active learning strategies. A mixed method approach was employed. Data were collected through pre-tests, post-tests, and interviews, and analyzed using a t-test and thematic analysis. Results revealed a significant improvement in test scores—from a mean of 7.88 (low performance) to 26.09 (very high performance) post-intervention ($p < 0.0001$). Qualitative key findings indicate that tangible learning materials and active learning support conceptual understanding of abstract science topics. These results demonstrate that the Electro Briefcase intervention is effective in improving test performance in Science V. It is recommended that science teachers integrate tangible materials like the Electro Briefcase when teaching abstract concepts. Future researchers are encouraged to explore similar interventions across different science topics and grade levels to further validate its impact.

Keywords: test performance, tangible instructional material, active learning, Dadiangas West Central Elementary School

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INTRODUCTION

Interpretation of concepts related to sciences is unfeasible without the learners' knowledge and literacy in scientific methods. This posits the idea that scientific literacy is needed for the learners to understand science and its applications (Hale, 2023). In connection, test performance in science is crucial to determine whether the learners are able to acquire knowledge about scientific processes and concepts. However, abstract ideas, such as electricity and circuits without the support of effective instructional material and teaching strategies, can lead to low level of test performance.

In the recent Program for International Student Assessment (PISA) conducted by the Organization for Economic Cooperation and Development (OECD), the mean performances of countries between the years 2018 (OECD, 2019) to 2022 have suffered regression. On average, PISA (OECD, 2023) stated that reading and science trajectories had been falling for a decade. In global context, results have shown that three quarters or 74% of students from North Macedonia perform poorly in reading and mathematics. In addition, 65% of learners have shown poor performance in science.

In connection, the Philippines have been lagging behind of its many Asian neighbors when it comes to the country's poor performance in global and regional ranking (Sison, 2022). In 2018, the Filipino learners' average scores rank second to last among 78 countries that were shown in the result of PISA 2018 (Bernardo et al., 2023). This result matches another international assessment, the Trends in International Mathematics and Science Study (TIMSS) in 2019. Filipino learners who participated in TIMSS 2019 achieved an average scale score of 240—the lowest among 58 participating country (Bernardo et al., 2023).

Furthermore, the recent result of PISA 2022 has shown no significant difference in the Philippines performance, showing that Philippines scores are still below OECD average (Chi, 2023). According to OECD (2023) as cited in Philstar Global (Deiparine, 2023), the average score of the country dropped by one point from 356 to 355 and ranked third-lowest in science among 81 countries that participated. Mullis et al. (2020) also stated that majority of Filipino learners show limited understanding in scientific concepts and limited knowledge of foundational science facts.

This educational issue is also evident at Dadiangas West Central Elementary School in grade V - Einstein learners. In the latest assessment conducted, from the test that consist of all the competencies from the third quarter of Science V curriculum, the data gathered has

shown that the competency for the sixth week shows the lowest scores. Therefore, it is an apparent issue of low test performance regarding the topic electricity and circuits in science that needs attention for intervention.

After further deliberation about the low test performance of the grade V - Einstein learners in science, specifically electricity and circuits, the researchers have found these solutions as listed:

(1) tangible learning materials and

(2) active learning approach.

Considering the solutions, Electro Briefcase intervention was formulated. It is an intervention that utilized a tangible learning material with the same name as the intervention and did the sessions using active learning approach.

LITERATURE REVIEW

Tangible Learning Materials

The Department of Education (2019) aims to equip learners with 21st-century skills to meet the world's pressing demands. The Philippine educational system has witnessed this goal as its curriculum has been continuously updated to recognize the needs of learners in every generation. Specifically, Filipino learners should develop effective communication skills, life and career skills, information, media, and technology skills, as well as learning and innovation skills. Thus, the scope of the curriculum topics should be more inclusive, covering competencies from simple to complex.

To ensure a comprehensive learning experience, the curriculum progressively integrates both fundamental and advanced competencies. Among the topics introduced at the elementary level is electricity and magnetism, taught under the broader theme of force and motion of Science V. This content area has remained a consistent component across three major curriculum reforms: the Basic Education Curriculum and Revised Basic Education Curriculum (Bureau of Elementary Education, Department of Education, 2002), the K-12 Curriculum (Department of Education, 2013), and the MATATAG Curriculum (Department of Education, 2023). This shows that electricity and magnetism are important lessons that the learners should understand. Furthermore, the MATATAG Curriculum (2023) explicitly outlines in the grade level standards of grade V that learners should be able to observe and describe the basic features of electricity and electric current and explain their applications in everyday contexts at home and in the community. Detken (2023) supports the early introduction of such topics, stating that "young children at the age of six to eight already have detailed ideas about energy that can be related to the different core aspects of energy and its conceptualization." This affirms the relevance of teaching concepts such as electricity from the primary grades.

Given this context, science is a complex subject because of its ever-changing nature that aligns with the evolving trends of generational scientific findings. Although proven data stays the same as it was first tested, the small and the large concepts that construct it or are added over time cannot be encapsulated in a short amount of time. For that reason, the educational institutions, especially in the Philippines, curate a framework in science following a spiral progression to slowly but surely deliver knowledge to the learners as they progress. This framework suggests competencies, learning standards, and learning materials that would help the learners acquire the scientific knowledge they are supposed to learn. One of these learning materials is the tangible learning material that is deemed effective in improving their cognition and critical thinking, which would result in better test performance.

According to Ipapo et al. (2021), tangible learning materials are used to help enhance learner's comprehension and interest. This aims to instill learning by letting the learners experience first-hand how things or concepts work that improve their critical thinking and cognition that can uplift their retention and assessment performance in science as reinforced by Millar et al. (2018) who state that the physicality of the learning materials effectively improves the performance of the learners in science. To specify, Ojating and Ojating (2022) cited seven key points in using tangible learning materials. They articulate that tangible materials

(1) simplify abstract ideas into real life concepts,

(2) promotes discovery learning,

(3) instruction is made easier for teachers through deploying tangible instruction resources,

(4) learners' engagement is highly sustained,

(5) it helps learners cope with learning tasks,

(6) tangible learning materials make learning fun and less stressful for both teachers and learners, and

(7) instructional objectives are more easily and rapidly achieved through the use of concrete objects.

This suggests that tangible learning materials can impact learners because it scaffolds learning and improves the behavior, and the rational and critical minds (Li et al., 2022).

Moreover, Cheng et al. (2024), explain that tangible objects can create diverse learning scenarios that lead learners to a deep and authentic learning. Gullion (2024), presents that learners learn best when they experience a multisensory environment particularly involving touch. Moreover, Carbonneau et al. (2020) as presented in Gullion (2024) study found that students who used manipulatives performed significantly better on a problem-solving task than students who used no manipulatives. These students show stronger perseverance in the problem-solving task as students see and touch objects and act upon them; they can gain a deeper understanding of ideas especially on science topics that are concerned with abstract and complex systems, that can also include experimentation and problem-solving.

In conclusion, Sensory Edge Education (2025) stated that the inclusion of tangible learning materials in school is not merely for improvement but a necessity. Tangible learning materials have the potential to upgrade traditional teaching methods especially within hard sciences. It bridges the wide gap between theory and practice. In that sense, based on the evidence cited from related literature, the Electro Briefcase, as a tangible learning material, can be an effective intervention to improve the test performance of the learners in science.

Active Learning Approach

Educational institutions are known for integrating different approaches in teaching to cater to the diverse needs of a variety of learners. Their goal is to instill ideas, concepts, and information that will help in improving the learners' retention, understanding, engagement, and motivation. With that being said, one approach that

can achieve the goals of holistic development for the learners is active learning.

Active learning has existed throughout history. Researchers believe that John Dewey (1916) appears to have been the driving force of active learning models (Page, 1990). His theory about learning by doing started different studies that supports that children learn best if they are active in the processes of their education.

In connection, active learning has been widely integrated in modern educational practice as a new paradigm shifts from simple knowledge acquisition. Sahito et al. (2025) stated that active learning is good for academic performance with added improvement on the learner's interest and willingness to learn. This exemplifies that active learning approach leads to positive effect on learners' participation, satisfaction, and performance, including the learners' academic achievement. It leads to higher engagement, improve collaboration skills, builds self-confidence, promote higher retention in learning, provide enjoyment, increase motivation, improve creativity and innovation, enhance critical thinking and problem-solving skills, allows instant feedback, and increase training success (Avelino, 2022).

Furthermore, Alisoy et al. (2024) revealed several key outcomes that support the effectiveness of active learning. In detail, active learning approach in their study shows that the learners engagement has increased compared to the traditional-lecture based approach. It was also found that the learners' academic performance has also improved, as well as the quality of interaction and feedback. These suggest that active learning approach impacts not only academic performance but also the student engagement and the learning atmosphere that would lead to more inclusive, accessible, and motivated learners. Thus, the abovementioned factors also demonstrate that active learning approach offer holistic development in education.

This is also supported by Lamon et al. (2020) presenting that active learning encourage interactive and engaging processes where learners are involved in their own learning, resulting in greater knowledge retention. These strategies can involve metacognition, discussion, group work, formative assessment, practicing core competencies, live-action visuals, conceptual design, worksheets, and/or games (Driessen et al., 2020). It is also shown in a recent study by Sahito et al. (2025), where learners in an active learning environment scored better than the learners who were subjected to traditional mode of training during the midterm and final exams proving that active learning approach contribute to the test performance of learners significantly.

Based on the verified related data and evidence, it presented that active learning contribute to many advantages when it comes to the education of learners, including the positive results it posited. In line with these findings, the Electro Briefcase intervention utilized active learning strategies as a tool to improve the test performance of the learners in science.

STATEMENT OF THE PROBLEM

The purpose of this study was to determine the effectiveness of Electro Briefcase intervention in improving the test performance in science of grade V learners of Dadiangas West Central Elementary School.

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

1. What is the level of test performance in science of the learners before Electro Briefcase intervention was applied?
2. What is the level of test performance in science of the learners after Electro Briefcase intervention is applied?
3. Is there a significant improvement in the test performance of learners in science before and after Electro Briefcase intervention was applied?
4. What are the attributes of Electro Briefcase that helped improve the test performance of learners after Electro Briefcase intervention was applied?

CONCEPTUAL FRAMEWORK

This research is anchored on the constructivism learning theory. Constructivism is a theory of how the learner constructs knowledge from experience, which is unique to each individual. Constructivism according to Piaget (1971) is a system of explanations of how learners as individuals adapt and refine knowledge. Furthermore, according to this theory, learning is a process of establishing a link between the new information and the information that exists in individuals, during this process. Much research is evident that constructivism encourages learners to reflect and question their own understanding via active meaning making process.

Based on the chosen theory, this study conceptualized that the independent variable which is the Electro Briefcase is effective in improving the low test performance in science of the learners or the dependent variable (**Figure 1**).

This causation between the variables is represented by a single headed arrow which indicates that the more the pupils are exposed to the intervention, the higher their level of test performance in science.

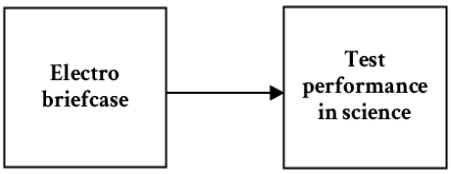

Figure 1. Causation between the variables (Source: Authors)

The framework of this study is supported by McNeil and Jarvin's (2007) as she states: [Through the use of tangible learning materials], students gain a deeper understanding of abstract concepts when those concepts are link to the real world. Manipulative can help children draw on their practical, real-world knowledge. When children were given the opportunity to participate in lessons with manipulative materials, they evidenced greater confidence in their academic performance. The use of tangible learning materials is constructivist because students are actively engaged in discovery during the process. A teacher provides the materials along with the basic direction, but students should be allowed to explore the materials and ask questions before and during the lesson.

However, not all researchers and educators support the use of tangible learning materials. One argument against their use is that they lead students to focus on having fun instead of deep learning. According to McNeil and Jarvin (2007), research often suggests that students tend to view manipulative activities as playtime, an association that may hinder learning as it devalues the potential of these materials as representation for learning.

INTERVENTION

The Electro Briefcase intervention focuses on improving the test performance of the grade V learners in science, specifically in electricity and circuits. Particularly, the Electro Briefcase is a tangible learning material that was used in giving concrete representation to the learners while doing the class sessions (**Figure 2**).

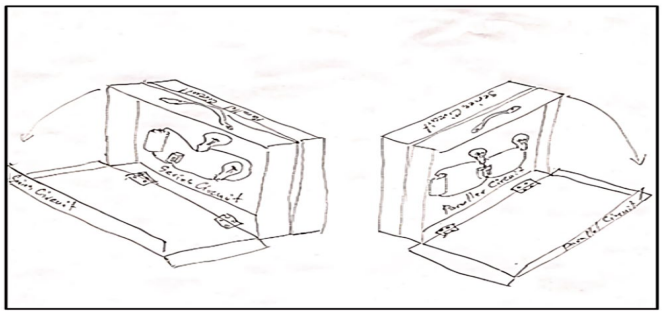

Figure 2. Intervention (Source: Authors)

The intervention mainly focuses on the competency for the sixth week in Science V:

(1) static electricity,

(2) electric current, and

(3) types of electric circuits—series and parallel circuits.

It lasted for four days as suggested by the science curriculum from Department of Education (2023).

METHODOLOGY

The study employed a classroom-based research design that involves using both qualitative and quantitative approach to identify the effectiveness of Electro Briefcase instructional design to improve the test performance in Science V, specifically in electricity and circuits. The data collection instrument was a pre- and post-test questionnaire to assess the difference of the result before and after the intervention is implemented. Moreover, an interview was used to collect insights from the learners about the features of the intervention that contribute to the improvement of the test performance in science.

The subjects of this study were 32 grade V - Einstein learners of Dadiangas West Central Elementary School - General Santos City. The researchers employed purposive sampling to identify the subjects of this study. The researchers conducted a diagnostic test to determine the area of concentration on where the intervention has focused. Moreover, pre- and post-tests were administered to discern the effectiveness of the intervention.

In treating the collected data, percentage and mean were used. The scale in **Table 1** with range and description describe the level of the test performance of the learners based on Ebel's criteria of mastery (Thompson, 2022).

In determining the effectiveness of the intervention in improving the test performance in science of the grade V learners, t-test for independent samples was used. The hypothesis was tested at 0.05 level of significance. In addition, thematic analysis was used to analyze the qualitative data.

Table 1. Scale

Score	Ebel's	Description	Verbal interpretation
25-30	86-100%	Outstanding	Very high
19-24	71-85%	Very satisfactory	High
13-18	40-70%	Satisfactory	Moderate
7-12	15-39%	Fairly satisfactory	Low
0-6	0-14%	Did not meet expectations	Very low

RESULTS

Table 2. Level of test performance in science of the learners in pre-test

Score	F	Percentage	Description	Verbal interpretation
25-30	0	0.00%	Outstanding	Very high
19-24	0	0.00%	Very satisfactory	High
13-18	1	3.13%	Satisfactory	Moderate
7-12	18	56.25%	Fairly satisfactory	Low
0-6	13	40.62%	Did not meet expectations	Very low
Mean			7.88	
Standard deviation			5.88	
Description			Fairly satisfactory	
Verbal interpretation			Low	

Table 2 present the level of test performance in science before the Electro Briefcase intervention.

The data shows that 13 participants or 40.62 % got a score of 0-6 which described as did not need expectations and interpreted as very low, 18 participants or 56.25% got a score of 7-12 which is fairly satisfactory and interpreted as low and one participant or 3.13 % got a score of 13-18 that can be described as satisfactory and interpreted as moderate. Meanwhile, there are no participants who got high and very high scores. The mean score of 7.88 indicates a fairly satisfactory level of test performance among the pupils before the intervention which means that the test performance of the learners is low.

This suggests that the students may have struggled due to their foundational knowledge of the subject matter. It is plausible that their understanding of basic scientific principles and concepts needed to be improved, leading to difficulties in comprehending and applying more advanced content. Addressing these foundational gaps through targeted instructional strategies could enhance academic performance in science.

Table 3. Level of test performance in science of the learners in post-test

Score	F	Percentage	Description	Verbal interpretation
25-30	26	81.25%	Outstanding	Very high
19-24	6	18.75%	Very satisfactory	High
13-18	0	0.00%	Satisfactory	Moderate
7-12	0	0.00%	Fairly satisfactory	Low
0-6	0	0.00%	Did not meet expectations	Very low
Mean			26.09	
Standard deviation			3.70	
Description			Outstanding	
Verbal interpretation			Very high	

Table 3 presents the test performance levels in science after implementing the Electro Briefcase intervention.

The data shows that six participants or 18.75% got a score of 19-24, which indicates a very satisfactory or high performance and 26 participants or 81.25% got a score of 25-30, which can be described as outstanding and is interpreted as very high. Meanwhile, there are no participants who were satisfactory or moderate, fairly satisfactory or low, and did not meet expectations or very low. The mean score of 26.09 reflects an outstanding level of performance among the pupils post-intervention which means that the test performance of the learners is at a very high level.

This substantial improvement in test performance suggests that implementing the Electro Briefcase intervention positively impacted students' comprehension and application of scientific concepts, leading to notable academic advancement. Factors contributing to this increase include a deeper understanding of the lesson content facilitated using tangible materials and active and direct learning provided by the Electro Briefcase intervention, thereby enhancing student engagement and learning outcomes.

Table 4. Significant difference in test performance of the grade IV pupils before and after the implementation of Electro Briefcase intervention

Group	Mean	Standard deviation	t-computed	p	Remark
Pre-test	7.88	5.88	-33.13	< 0.0001	Significant
Post-test	26.09	3.70			

Table 4 presents the paired sample t-test results on the level of test performance. Results show that there is a significant difference between the means of the pre-test scores and the post-test scores in the level of test performance in science. This is supported by a t-computed value of -33.13 and a p-value of < 0.0001. A p-value of less than .05 ($p = .000 < .05$) indicates that there is significant difference between the pre- and post-test scores of the participants. It is also revealed that the use of Electro Briefcase intervention has improved the level of test performance in science. Thus, there is a significant improvement in the level of test performance in science after the Electro Briefcase intervention was applied.

The significant difference in scores before and after employing Electro Briefcase intervention demonstrates its effectiveness in improving the test performance in science. Incorporating Electro Briefcase intervention in discussion can lead to significant improvement in students test performance in science. By engaging with tangible material and active and direct learning, students may develop a stronger understanding of abstract concepts and deepen their learning.

Table 5 presents the themes on features that improved the test performance in science of grade V learners.

Table 5. Features of Electro Briefcase that improve the test performance of the learners in science

Response	Code	Construct	Theme
... interactive and fun ang mga ginagawa during sa klase kaya mas naintindihan namin [The activities during the classes are imteractive and fun that's why we understand (the lesson)].	The learner understands the lesson well if interactive and fun	The learners can understand and remember well if classes are interactive and fun	Employing active learning strategy
... mas lalo ko matandaan [ang lesson] po kapag yung makahappy na makapagdiscuss–discuss kami karang kauban sa inyo po [… I can remember the lesson well if it's fun and we can discuss it together].	The learner easily remembers the lesson when it is discussed with peers		
... kay kapag magsali jud ako, mas parang maging aktibo ako sa klase tas meron ako reason para maglisten [… because if I participate, I feel active and I can have a reason to listen].	The learner find reason to listen well if it can participate	The learners learn well through active participation	
... mas natututo ako sa lesson kapag active at nagaparticipate lalo na sa science ... [I can learn well if its active and I participate especially in science].	The learner learn well through active classes		
... mas naintindihan ko kaysa normal lang na lecture kay makita ko yung paunsa siya gawain talaga, tas paunsa siya ginconstruct tas ano gud tas nakakaenjoy din ang experience na mag ano ng mga science [… I find easy to understand compared to normal lectures because I can see how it is constructed and the experiences is enjoyable in science].	The learner prefers employing concrete learning materials in classes.	The learners understand processes and acquire knowledge well through usage of tangible material	Utilization of tangible instructional material
... mas maganda po talaga na may material kami na makita at mahawakan po mas maintindihan namin yung process po ng mga nangyayari [… it nicer if there is a material we can see and hold, we can understand the processs about what is happening].	The learner easily understand processes when using actual representation of the topic		
Malaki po talaga ang tulong kapag mayroon pong mga actual na gamit na makikita at magagamit naming po lalo na sa Science kasi mahirap po talaga sya po kapag ga imagine lang kami po na ganun ang process kesa sa may nakikita po talaga kami at kami po mismo gaoperate po [It can really help if there are really actual materials that I can see and use especially in Science because it is so hard if we will just imagine the process rather than really seeing it and operating ot by ourselves].	The learner lean towards what it can operate to understand the lesson well		
... importante po na may makita kami o mahawakan na example same po ng inyong briefcase para mas madali naming matindihan [… it is really important that we have something we can hold like the briefcase so that we can easilyunderstand the concepts of the lesson].	The learner emphasize the importance of material they can touch	The learners admit the importance of concrete instructional materials in learning science	
...kailangan namin ng example sa science para lalo kaming mas matuto at makilahok kaya nung gigamit namon ang inyo briefcase maam kay mas nakabalo kami [… we need an example in science so that we can learn and participate that's why when we used the briefcase Ma'am, we learned a lot].	The learner need concrete example in science to learn and participate well		
kasi hawod sya po kasi briefcase then while looking at it po , excited ako magparticipate [because it's amazing , then while looking at it, I became excited to participate].	The learner is fascinated by the material that leads to participation	The learners fascination and intrigued toward the materials driven them to listen and participate	
... its really good po if may material tapos pagkita nako sa briefcase maam kay intriguing siya kaya naminaw ko [… its really good if there is a material and then when I see [the briefcase] Ma'am, it feels so intriguing that's why I listened].	The learner is intrigued by the material that will be used in the class		

Table 5 (Continued).

Response	Code	Construct	Theme
... kasi po kung kasali kami madali lang kami kakuha ug sagot sa mga tanong namin [… because if we join, we can easily get answers].	The learner's questions is easily answered because of participating directly	The learners can find answers and discover new knowledge through active involvement in class	Direct involvement in learning
... mas may malaman po ako kung makagawa ang sarili ko at makadiscover po ako ng something new kung magamit ko na [… I can learn well if I can do it by myself and I and discover something new if I used it (the material)].	The learner discover knowledge through interacting with the material		
Opo, kasi the more po na nagaparticipate ka mas lalo kapo natuto [Yes, because the more you participate, the more you learn].	The learner emphasize that frequency of active involvement in class leads to learning	The learners direct participation and experiences help in the acquisition of science processes	
... nang binigyan po me ng chance na maggamit ng ug katong gamit kag magsali sa mga activity kay mas maka know kami kay hawud kaayo na maexperience siya nakon nga ako jud kay mas magsulod gid sa akon utak ang mga lesson [… when I was given a chance to us ethe material (the briefcase) and join in activities, I can learn well because it's amazing that I can experience it at I can really remember the lesson].	The learner experiences using the material helps in acquisition of knowledge		
Naituro niyo po sa akin sa class niyo po na kahit po sa maliit na changes po natin, sa pagtitipid po sa kuryente ganun, kay makatabang ta para mas mapahawud ang atoang world [In your class, you taught me that even with our small changes, by saving electricity, we can help make our world more sustainable].	The learners see how small change in behaviour can help the world	The learners learned through the class that conserving energy can help sustaining the planet	Integration of energy sustainability in lessons
Opo ang nateach sa akon kay may effect sad diay kung pirmi gasiga ang lights amo na tung nasabi mo iyan po, nagsali mi atong Earth Hour sa balay Ma'am karang gipatay sad namon ang lights para bisan amo to kay nakabulig kami sa mundo [Yes, what I was taught is that it has an impact if the lights are always on, which is why when you said something about Earth Hour, we participated. We turned off the lights to show that even in small ways, we can help the world].	The learner participate in a worldwide activity in helping to save the planet		
Yes, it taught us po. Kasi po habang nagaklase po hindi po gikalimutan ninyo po na imention ang things about energy conservation po. It teach us po mga basic things po halimbawa na patayin ang ilaw pag hindi ginagamit and/ or tanggalin po ang mga nakasaksak na mga wires po para maiwasan po ang uneccesarry na energy consumption po [Yes, it taught us. During class, you didn't forget to mention things about energy conservation. It taught us basic things, like turning off the lights when not in use and unplugging wires to avoid unnecessary energy consumption].	The leaner know basic things about how to conserve energy		
... kasi po kung kasali kami madali lang kami kakuha ug sagot sa mga tanong namin [… because if we join, we can easily get answers].	The learner's questions is easily answered because of participating directly		

Theme 1. Employing active learning strategy: The results show that one of the fundamental features that contribute to the improvement of the test performance in science of the learners is employing active learning strategy. One construct shows that the learners can understand and remember well if classes are interactive and fun:

> ... interactive and fun *ang mga ginagawa during sa klase kaya mas naintindihan namin* [… the activities during the classes are interactive and fun that's why we understand (the lesson)].

One also explains that the learners learn well through active participation:

> … kay kapag magsali jud ako, mas parang maging aktibo ako sa klase tas meron ako reason para maglisten [… because if I participate, I feel active and I can have a reason to listen].

In consonance with the study of Wan Daud et al. (2018) they found out that active learning changes students' attitude towards both English language and active learning strategies itself. Another study conducted by Patton (2015), they stated that student outcomes improve with a more active learning approach, where the educator takes on the role of a facilitator, taking into consideration students learning styles, attention span and specific needs.

This was seen in the intervention in the form of the activities that encourage learners to be more active in class. Active strategy help learners to have the arena to act, ask, be in an interactive discussion that results in improvement in their cognitive skills that leads to their improved performance in the post test. This tells that employing active learning strategies is effective in improving the test performance of learners in science.

Theme 2. Utilization of tangible instructional material: It is apparent after the analysis of the data that utilization of tangible instructional material supports the learning of the learners that contribute to their improvement in the test performance in science. It was shown that the learners understand processes and acquire knowledge well through usage of tangible material. This was attested as stated by one learner:

> … mas naintindihan ko kaysa normal lang na lecture kay makita ko yung paunsa siya gawain talaga, tas paunsa siya ginconstruct tas ano gud tas nakakaenjoy din ang experience na mag ano ng mga science [… I find easy to understand compared to normal lectures because I can see how it is constructed and the experiences is enjoyable in science].

One construct has shown that the learners admit the importance of concrete instructional materials in learning science:

> ... *importante po na may makita kami o mahawakan na* example same *po ng inyong briefcase para mas madali naming matindihan* [… it is really important that we have something we can hold

like the briefcase so that we can easily understand the concepts of the lesson].

Furthermore, it was also shown that the learner's fascination and intrigued toward the materials driven them to listen and participate:

> … it's really good *po* if may material *tapos pagkita nako sa* briefcase Maam *kay* intriguing *siya kaya naminaw ko* [it's really good if there is a material and then when I see [the briefcase] Ma'am, it feels so intriguing that's why I listened].

As stated by Ojating et al. (2022) instructional materials that are tangible and concrete make teaching and learning quite a pleasurable experience. Rather than think about or conceptualize abstract ideas, the learner is exposed to real physical objects and they can make meaning of them with ease. The teacher, on his part, exposes the learner to the objects during instruction and in some cases observes him manipulate others for learning to occur through discovery.

In conclusion, the Electro Briefcase itself is a tangible learning material that gives the learners a concrete example on how electricity and circuits work in real life. This has resulted in a proper understanding of the processes and concepts of the topic that would help the learners in improving their test performance in science.

Theme 3. Direct involvement in learning: It is shown in the results that direct involvement in learning improve the test performance in science of the learners. One construct was formed stating that the learners can find answers and discover new knowledge through active involvement in class. As stated:

> *... mas may malaman po ako kung makagawa ang sarili ko at makadiscover po ako ng* something new *kung magamit ko na* [… I can learn well if I can do it by myself and I and discover something new if I used it (the material)].

Also, the learner's direct participation and experience help in the acquisition of science processes:

> … nang binigyan po me ng chance na maggamit ng ug katong gamit kag magsali sa mga activity kay mas maka know kami kay hawud kaayo na maexperience siya nakon nga ako jud kay mas magsulod gid sa akon utak ang mga lesson [… when I was given a chance to us ethe material (the briefcase) and join in activities, I can learn well because it's amazing that I can experience it at I can really remember the lesson].

This is supported by the study of Kuswiyanti (2023), which found out that direct instruction can encourage students to acquire well-structured factual knowledge that can be taught in stages. Direct instruction is effective in all subjects and topics because it is based on the principle of transfer of behavior. Another study conducted by Stockard (2021) states that when taught with direct instruction students learn more and come to see their selves as more successful. The instructional system embodies respect for students and for teachers and addresses the goals of those who advocate other paths to student success.

This determines that the intervention gives chance to learners to directly manipulate and operate the materials. The intervention aims to build knowledge through experiences and let them learn at their own pace and styles. Through being involve in their own learning, it can be apparent that it can contribute to improving the test performance in science of learners

Theme 4. Integration of energy sustainability in lessons: The last occurring theme found in the results is the integration of energy sustainability in lessons that help in inculcating value in the learners that also contribute to the improvement if the test performance of the learner. A construct was formed stating that the learners learned through the class that conserving energy can help sustaining the planet.

> Yes, it taught us po. Kasi po habang nagaklase po hindi po gikalimutan ninyo po na imention ang things about energy conservation po. It teaches us po mga basic things po halimbawa na patayin ang ilaw pag hindi ginagamit and/ or tanggalin po ang mga nakasaksak na mga wires po para maiwasan po ang unnecessary na energy consumption po [Yes, it taught us. During class, you didn't forget to mention things about energy conservation. It taught us basic things, like turning off the lights when not in use and unplugging wires to avoid unnecessary energy consumption].

Through integrating sustainability in the Electro Briefcase intervention, it has inculcated value to the learners. This value can contribute in their will to know more about the topic thus utilize this eagerness in remembering topics about electricity and circuits that can improve the learner's performance in tests.

Overall, the features that contribute to improving the test performance in science of the grade V learners are

(1) employing active learning strategy,

(2) utilization of tangible instructional material,

(3) direct involvement in learning, and

(4) integration of energy sustainability in lessons.

DISCUSSION

The present study aims to improve the test performance in science of the grade V learners. Generally, the findings before the intervention indicate a low or fairly satisfactory level of test performance in science. Several studies support the findings of this research regarding students' test performance in science.

This level shows that learners are struggling to answers questions asking for reasons and justification about a process in electricity and circuit. The learners also find it hard to relate that concepts in real-world applications and were having a difficulty to explain the processes of how electricity and circuits work. Moreover, they also have a low level in analyzing what is factual and not true within the topic and representations of electricity and circuits are not familiar to the learners. These are those that contribute to the low test performance of the learners in science, particularly in electricity and circuits.

A research by Calleja et al. (2023) showed that students' test performance in science was notably low. This finding highlights the significance of social elements at both the classroom and school levels in students' academic performance. Since educational activities in scientific disciplines frequently include collaboration with peers, a feeling of inclusion and mutual assistance are likely crucial for achieving satisfactory academic results. These findings underscore the significance of targeted interventions to strengthen students'

foundational understanding of scientific concepts to improve overall academic performance in science.

In contrast, the test performance of the learners improved to very high or outstanding level of performance after the Electro Briefcase intervention was applied. This presents that there is a substantial improvement in the learners' capacity to comprehend and apply scientific concepts leading to improvement in their test performance.

After further analysis of the results, the learners are now adept at answering questions that require reasoning and justification about electrical processes. They have successfully bridged the gap between theoretical concepts and real-world applications, demonstrating a solid grasp of how electricity and circuits function. Moreover, their analytical skills have improved, enabling them to identify factual information from misconceptions within the topic. Additionally, learners are now familiar with various representations of electricity and circuits, contributing to their enhanced performance in science.

The observed increase in test performance aligns with findings from prior research examining the efficacy of educational interventions in enhancing student outcomes. For instance, in a study by Ipapo et al. (2021), tangible learning materials are used to grasp the learners' comprehension and interest quickly. Millar et al. (2018) stated that the physicality of the learning materials effectively improves the performance of the learners in science. In addition, the learning material's concreteness gives the learners a venue to see concepts and make sense of what is happening (Johnson, 2021). These studies support the notion that targeted intervention, such as the Electro Briefcase intervention, can effectively enhance students' test performance and overall academic achievement in science.

The comparison of both results shows that there is a significant difference between the pre- and post-test scores in the level of test performance in science. This implies that the use of Electro Briefcase intervention is effective in improving the level of test performance in science. This result is in consonance with the finding study of the effect of active learning method on students' academic success, motivation and attitude towards mathematics. Omarbek et al. (2022) found that test findings showed that there is a significant difference in academic achievement between experimental group and the control group in favor of the experimental group because the value found (0.03 < 0.05) This means that in active learning classrooms, there is significant increase in academic achievement or performance compared to traditional classrooms. Another study conducted by Akbaşlı and Yeşilce (2018) have shown that tangible learning materials improve classroom learning and enhances the attainment of instructional objectives in very remarkable and significant ways. Another study conducted by Saied and Eslaminejad's (2017) study showed that there's a relationship between students' achievement, self-directed learning and learning readiness while study by Osman and Kan'an (2015) indicate that self-directed learning is necessary for science students in order to become successful students.

The themes that were found as features that contribute to improving the test performance in science of the grade V learners are

(1) employing active learning strategy,

(2) utilization of tangible instructional material,

(3) direct involvement in learning, and

(4) integration of energy sustainability in lessons.

This can be supported by Abdullahi et al. (2024) stated that by integrating sustainability into the education system, we are forging a path for a more sustainable future. We're also preparing our children to become competent and informed decision-makers in a world that will demand responsible stewardship of resources. Embracing sustainability in education is not just an ethical choice—it is a strategic one that brings educational, societal, and personal benefits. Moreover, as cited by Wan Daud et al. (2018) they found out that active learning changes students' attitude towards both English language and active learning strategies itself; Ojating et al. (2022) that instructional materials that are tangible and concrete make teaching and learning quite a pleasurable experience. Rather than think about or conceptualize abstract ideas, the learner is exposed to real physical objects and he can make meaning of them with ease, Kuswiyanti (2023) found out that direct instruction can encourage students to acquire well-structured factual knowledge that can be taught in stages. Direct instruction is effective in all subjects and topics because it is based on the principle of transfer of behavior.

CONCLUSIONS AND RECOMMENDATIONS

The Electro Briefcase intervention endeavoured to determine its effectiveness in improving the test performance of the learners in science. Before the implementation of the intervention, it was presented that the test performance in science of the learners is at low level. This is in contrast to the results found after the Electro Briefcase intervention was applied as the test performance in science of the learners is at a high level. The compared results of the pre- and post-test have shown a significant difference. The features that were also found includes the positive effect of employing active and direct learning, utilization of tangible learning materials, and integration of energy conservation. These results mean that the Electro Briefcase intervention is effective in the improving the test performance of the learners.

With this, it is recommended that teachers should regularly use tangible materials, like the Electro Briefcase, in teaching abstract processes and concepts in science classes. Furthermore, it is apparent that the school should encourage its teachers and learners to engage in an active learning to foster experiences that can contribute to the learning of the learners.

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Ethics declaration: The study was approved by the action research advisers of Mindanao State University - General Santos City, College of Education - Elementary Department. Proper informed consent to the school principal, science teachers and coordinators, classroom advisers, and pupils and their parents or guardians from Dadiangas West Central Elementary School relative to their participation in this study were also ensured. The content of the consent was sent through formal hardcopy letters. Furthermore, a brief orientation about the participants' participation in the study was also given. The responses of the participants from grade V - Einstein were kept with utmost confidentiality and safety. Since the participants were informed of their participation in the study, the results of their test and the answers to the interview were disclosed and the main purpose of this study was to show them their improvement after the intervention was through.

Declaration of interest: Authors declare no competing interest.

Data availability: Data generated or analyzed during this study are available from the authors on request.

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