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Utilizing Context-Based Stem Education Approach on Teaching Science 4

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ABSTRACT

This study used an experimental research design with a one-group pre-test and posttest design to determine the impact of utilizing a context-based STEM education approach on teaching Science to Grade 4 learners of Sultan Naga Dimaporo Memorial Integrated School (SNDMIS), Lanao del Norte. The respondents of the study were thirty-eight (38) Grade 4 pupils from Section A, officially enrolled during the Academic Year 2025–2026. A 20-item multiple-choice test aligned with the Science 4 curriculum was administered before and after the intervention to measure pupils' performance, and data were analyzed using frequency and percentage distribution and a paired t-test. Findings revealed that pre-test scores were low, with most pupils performing below average, while post-test results showed that most pupils were above average, implying significant improvement from pretest to posttest scores. The mean score increased from 10.92 to 14.32, and the t-test confirmed a significant difference between pre-test and post-test scores ($t = 6.83$, $p < 0.05$). This indicates a significant improvement in science performance after utilizing the context-based STEM education approach. Pupils designed and constructed a vertical garden prototype using recyclable and affordable materials, which were evaluated in terms of creativity and neatness, teamwork, and effort, scoring 96.67% and 95.33% respectively and interpreted as Outstanding. These results highlight the efficacy of hands-on learning. The study concludes that the utilization of context-based STEM education and integration of local and relatable situations improves pupils' motivation, engagement, understanding of scientific concepts, and problem-solving skills in meaningful learning environments.

Keywords: Context-Based, STEM Education, Experimental Research, Motivation, and Engagement

INTRODUCTION

STEM (formed from the words Science, Technology, Engineering, and Mathematics) education is an educational approach that has grown popularity recently. This educational approach integrates knowledge and/or skills from various disciplines implied in the acronym, oriented to problem-solving and contextualized in situations with different levels of authenticity (Aguilera & Ortiz-Revilla, 2021). While 21st CentEd (2023) specified the aim of STEM education to prepare students for the challenges and opportunities of the 21st century and equip them with the skills they need to succeed in the modern workplace. The preparation for STEM workforce involves multidimension of students, STEM concepts, skills, ways of thinking, and attitude towards STEM careers. However, STEM education must not be limited to only those students who will pursue STEM professions but also all must engage in a natural and material environment with at least a set of knowledge, skills, and attitudes encompassing STEM.

STEM education is an educational approach that merges the disciplines of Science, Technology, Engineering, and Mathematics into the learning and instruction process that promotes science and technology literate individuals. However, traditional science teaching tends to lean on lectures and textbooks that encourage memorization over the deep understanding necessary to apply scientific principles in actual real-world situations. To address this challenge, teachers have been researching a lot of innovative teaching methods, and that includes the context-based STEM education method.

The context based instructional approach helps students relate the situations they encounter in their daily lives to the content in the classroom. Context-based approach has already been adopted in science, such that scientific contexts and applications can serve as a starting point for developing scientific ideas, versus conventional approaches wherein students are first taught scientific ideas and only thereafter learn to apply them (Schriebl et al., 2023). Context-based approach in STEM Education focuses on connecting real world problems and projects in learning to make it more engaging and relevant.

Guerra-Reyes et al., (2024) observes that students often struggle to understand science concepts, including biology, largely because of persistent misconceptions shaped by prior experiences and everyday knowledge. This is true in the Philippines. According to the 2022 PISA (CEDTyClea, 2024), Filipino students were among the world's weakest in mathematics, reading and science. The Philippines ranked 77th out of 81 countries and performed worse than the global average in all categories. Fifteen-year-old Filipino students ranked 63rd out of 64 countries in terms of creative thinking, the Organization for Economic Cooperation and Development, citing the same report. Overall, students performed better at the knowledge level by memorizing facts and principles compared to comprehension and understanding. Students' ability to recall facts or succeed on knowledge-based assessments does not necessarily indicate genuine conceptual understanding, since misconceptions often persist even after instruction (Nehm et al., 2022).

According to Simsek and Hamzaoglu (2023) STEM supporting context-based learning method is more effective on students' scientific literacy. They suggest that integrating context-based STEM Education approach effectively enhances students' scientific literacy and motivation. They conclude that the context-based STEM Education approach is effective. However, despite the growing recognition of STEM education's benefits, many elementary schools specifically here in the Philippines still face challenges in implementing context-based STEM education approach due to lack of teacher training and curriculum integration.

This study aimed to investigate how a context-based STEM Education approach can be effectively utilized in teaching grade 4 Science in Sultan Naga Dimaporo Integrated School. Specifically, it sought to examine its impact on pupils' motivation, engagement, understanding of scientific concepts, and problem-solving skills.

Statement of the Problem

This study aimed to utilized context-based STEM Education approach in teaching Grade 4 Science in Sultan Naga Dimaporo Memorial Integrated School. This study also aimed to answer the following questions

1. What are the demographic profiles of the respondents in terms of:
    a. age; and
    b. gender?
2. What are the pre-test scores of the pupils before utilizing context-based STEM Education approach?
3. What are the post-test scores of the pupils after utilizing context-based STEM Education approach?
4. Is there a significant difference between the pre-test and post-test scores before and after utilizing context-based STEM Education?
5. What is the impact of utilizing context-based STEM Education approach on teaching Grade 4 Science?

Hypothesis

***Ho*:** There is no significant difference between the pre-test and post-test scores of the pupils before and after utilizing context-based STEM Education approach.

Objectives of the Study

This study utilized the context-based STEM Education approach on teaching Grade 4 Science on the topic Effects of Environment on the Life Cycle of Organism. Specifically, it aimed to:

1. determine the demographic profile of the respondents in terms of age and gender;
2. determine the pre-test scores of the pupils before utilizing STEM Education approach;

3. determine the post-test scores of the pupils after utilizing STEM Education approach;
4. determine if there is a significant difference between the pre-test and post-test scores;
5. investigate the impact of utilizing context-based STEM Education approach;

Theoretical Framework

This study anchored three theories: **Constructivist Learning Theory** (Piaget, 1950; Vygotsky,1978), **Experiential Learning** (Kolb, 1984) and **Situated Learning Theory** (Lave & Wenger, 1991).

Constructivist theory, by Lev Vygotsky (1978), is based on the concept that individuals actively construct or create their own knowledge and that their learning experiences determine the nature of reality. As people experience the world and reflect upon those experiences, they build their own representations and incorporate new information into their pre-existing knowledge (schemas).

In relation to the study, learners should construct or make their own knowledge to determine the problems and apply and relate it to real life situations. In context-based STEM Education approach, this theory is relevant because it promotes active learning that learners construct meaning only through active engagement with the world (such as experiments or real-world problem-solving) and it is important because in context-based STEM Education approach where students make their own knowledge through the activities that they later on relate to real life scenarios.

Experiential learning theory, by David Kolb (1984), defines learning as “the process whereby knowledge is created through the transformation of experience. Knowledge results from the combination of grasping and transforming experience” (Kolb, 1984: 41). Experiential learning focuses on the idea that the best ways to learn things is by having experiences. Those experiences then stick out in your mind and help you retain information and remember facts.

To the current study, learners should experience hands-on activities and reflect to it so that they can effectively connect the knowledge learned in the classroom to real-life situations. In context-based STEM Education approach, this theory is highly relevant because it emphasizes that learning is acquired through experience and it is important in context-based STEM Education approach where students will experience a lot of activities which they can connect to real life situations.

Situated learning theory, by Jean Lave and Etienne Wenger (1991) states that learning occurs best when it takes place in the context in which it is applied. Situated learning essentially is a matter of creating meaning from the real activities of daily living (Stein, 1998,) where learning occurs relative to the teaching environment.

Linking to the current study, learners will learn best if they apply the knowledge they learned in authentic activities, contexts and culture. Meaning, learners will acquire the best knowledge if it is applied to real world situations. This theory is highly relevant because it also promotes group work and the ability to transfer learning to workplace which is crucial in context-based STEM Education approach where students usually work in groups and apply or transfer what they learn to the community and workplace.

Conceptual Framework

Figure 1.1 presents the schematic diagram of the study, illustrating the process of utilizing context-based STEM education approach on teaching Science to Grade 4 pupils at Sultan Naga Dimaporo Memorial Integrated School. This study used the Input-Process-Output (IPO) model. The **i**nput consisted of a pre-test of the control and experimental group, assessing pupils' prior knowledge before the intervention. The process involved implementing the context-based STEM education approach as the intervention for the experimental group while the control group follow the traditional teaching approach. The output includes a post-test of both groups to measure pupils' progress following the intervention applied in experimental group. The results will provide an empirical data to determine whether there is a significant difference between the pre-test and post-test scores.

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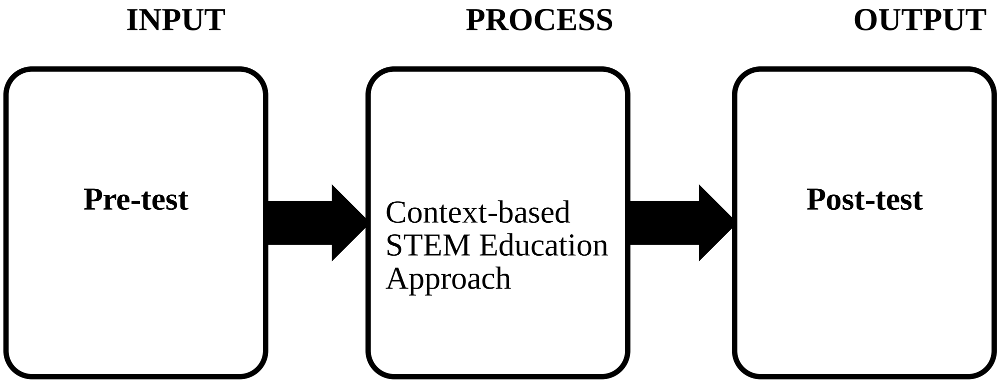

Figure 1.1 Schematic Paradigm Showing the Relationship between the Variables.

Scope and Delimitation

This study focused on the utilization of the Context-Based STEM Education Approach in teaching Grade 4 Science. It aims to evaluate how integrating real-life applications and interdisciplinary learning can enhance students' understanding, engagement, and academic performance in science. The study primarily targets Grade 4 students from Sultan Naga Dimaporo Memorial Integrated School during the academic year 2025-2026. The participants of this study are limited to one section in Grade 4, which consists of 38 pupils. Furthermore, this study is limited to a lesson about the effects of the environment on the life cycle of organisms. Furthermore, this study is limited to the week 5 lesson on the effects of the environment on the life cycle of organisms, as specified in the K to 12 Curriculum Guide under the code S4LTIIg-h14. Therefore, the findings may not be applicable to other topics or subject areas.

Significance of the Study

The finding of study is relevant and beneficial to the following:

Pupils. This study will give them additional ideas and concepts about context-based STEM Education approach on teaching science. It will enhance the scientific understanding of the pupils and to connect classroom learning to real-life situations.

Teachers. The study may give teachers knowledge that context-based STEM Education approach is helpful in teaching science and in enhancing learner's motivation and engagement. Teachers may be able to increase teaching effectiveness and become engage towards the subject.

School administrators. The result of this study may help them provide maximum and additional school facilities such as multimedia tools. This will also serve as basis for curriculum development and improvement.

Parents. This study will give them information in developing their child's ability to learn Science at home through their guidance with the context-based STEM Education approach.

Future Researchers. This study will give an additional reference to similar studies about the context-based STEM Education approach on teaching science. It will also serve as a foundation for further studies on context-based STEM Education approach in education. Future researchers may explore its impact in different subjects and grade levels.

Definition of Terms

To make this study more understandable to those who might come across it, the researchers included the definition of terms which enable them to have a clearer understanding of the queries they seek to answer. Thus, the following terms were defined conceptually and operationally:

Context-Based Learning. It is an instructional approach that helps students relate the situations they encounter in their daily lives to the content in the classroom and learning should take place in a variety of social, cultural, and physical contexts that are conducive to conceptual learning (Cabbar & Senel, 2020)

In this study, context-based refers to the teaching method that will be used in science 4 to allow pupils to understand scientific concepts by relating it to real-life situations. The utilization of this method will be the focus of this study.

Post-test. A test given to students after completion of an instructional program or segment and often used in conjunction with a pretest to measure their achievement and the effectiveness of the program (Merriam-Webster, 2025).

In this study, it refers to the test given to the participants after utilizing context-based STEM education approach.

Pre-test. A test to evaluate the preparedness of students for further studies (Merriam-Webster, 2025).

In this study, it refers to the test given to the participants before they are taught using the context-based STEM education approach.

Science. Is a knowledge or a system of knowledge covering general truths or the operation of general laws especially as obtained and tested through scientific method (Merriam-Webster, 2025).

In this study, science is the subject that will use in utilizing the context-based STEM education approach in science 4.

STEM (Science, Technology, Engineering, and Mathematics). It is an educational approach that integrates knowledge and/or skills from various disciplines implied in the acronym, oriented to problem-solving and contextualized in situations with different levels of authenticity (Aguilera et al., 2021).

In this study, STEM refers to the integrated curriculum that will be used in teaching science 4 by integrating scientific concepts with real-life applications, allowing students to understand how science connects to their daily lives.

Localized Context-Based STEM Lesson Activities. Is an instructional experience in science, technology, engineering, and mathematics that are designed around meaningful, relevant local contexts (the students' community, culture, environment, economic setting etc.), aiming to connect STEM content with students' everyday lives, local issues, and real-world problems.

In this study, the localized context-based STEM lesson activities refer to the activities that were used to examine its effects on pupils' engagement and motivation. This localized context-based STEM activities promotes meaningful and relevant lesson that pupils can connect to real-life situations.

RELATED REVIEW OF LITERATURE

STEM as a Learning Approach to Improve 21st Century Skills

According to Fajrina et al., (2020) STEM, it is an approach to learning that is used to integrate elements of Science, Technology, Engineering and Mathematics in the learning process. STEM in its application focuses on fostering thinking, investigation, reasoning, teamwork, and 21st century skills that can and must be used by students in life. 21st century skills help the learners enhances their skills and that includes critical thinking, creativity, communication, and collaboration called as the "Four Cs". STEM is not only used to define a learning experience that integrates four disciplines but also used to communicate the results of teaching science, technology, engineering and math.

Thus, integrating the four disciplines, the role of engineering as its focus, while integrating it usually means bridged with the real context and to technology, the commonly used is normally related with a virtual context.

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According to the debate surrounding the STEM approach, researchers concluded the vision of STEM approach to avoid a different viewpoint than the actual aspect. So that STEM is defined as "a learning approach that integrates content and skills for science, technology, engineering, and mathematics Fajrina et al., (2020).

However, this study limits on how to implement STEM learning approach as it lacks teacher training and curriculum integration. There is a lack of exploration on how STEM learning approach can effectively apply and implemented in classroom settings and how teachers and students will apply STEM learning approach.

The Role of STEM Education in Preparing Students for the Workforce

STEM education is becoming increasingly relevant due to the high demand of qualified personnel that adapt to the high level of technological and scientific progress (Jafarov, 2023). STEM education is considered as an educational approach that integrates knowledge and/or skills from various disciplines implied in the acronym, oriented to problem-solving and contextualized in situations with different levels of authenticity (Aguilera et al., 2021). The study found that STEM education is becoming increasingly relevant as it prepares students for the workforce by developing critical thinking, creativity, and innovation skills.

However, the implementation of STEM education has faced challenges, including limited teacher skills, lack of technical capabilities, and inadequate methodological manuals. To address these challenges, researchers recommend training teachers in modern technology, providing self-study opportunities, and monitoring teacher performance. According to Jafarov & Aliyev (2023) that within the framework of STEM education, the study reveals another "bottleneck", specifically the disputes in the international scientific community about which disciplines should be included in this paradigm.

After all, science, technology, engineering, or mathematics represent, although generally comprehensive, but rather one-sided approach to the formation of a completely new modern education system. Despite the increasing relevance of STEM education in preparing students for a rapidly evolving workforce, its implementation still faces challenges. These challenges are lack of teacher training, limited technological resources and instructional materials. There is also limited attention on how to apply these solutions in education, particularly in elementary levels.

A Bibliometric Analysis of Problem-Solving Skill and STEM Integration in Education (Scopus Database 2004-2024)

The need for individuals who follow scientific and technological developments closely and who can adapt to these changes rapidly is increasing. These needs have made it necessary for countries to try various changes, reforms and current approaches required by the age in their education systems (Hebebci and Usta, 2022). STEM education, which has become widely popular among researchers in the national and international literature recently (Admiraal et al., 2019; Chen et al., 2021; Donohue, 2020; Kelly, 2022; Kim et al., 2021; Kocsis et al., 2022).

Problem solving is one of the thinking skills that must be possessed in 21st century education, because problem solving skills are needed to solve all problems that arise. STEM education is a contemporary, multidisciplinary approach that adopts problem-solving skills for today's generation of innovative individuals (Hebebci and Usta, 2022). In this context, it is important to consider all aspects of STEM education holistically in terms of the use and development of SC (Bebek, 2021). According to Hebebci and Usta (2022) integrated STEM education applications positively affect students' problem-solving skills, scientific creativity, and critical thinking dispositions.

The study found that integrated STEM education practices positively affect students' Problem-Solving skills and Critical Skills. However, this study focuses on theoretical potential than its practical application, particularly in elementary level. Although the research shown that integrated STEM education has positive impact on students' problem-solving and critical skills, there is still limited studies that explore how these outcomes are achieved through contextualization teaching strategies in elementary education.

The Effect of Context-Based STEM Activities on Scientific Literacy and STEM Motivation

Context-based learning is a learning model in which individual differences are considered. Its purpose is to connect between daily life and the knowledge learn in science (Simsek & Hamzaoglu, 2023). STEM education is an educational approach that integrates the field of Science, Technology, Engineering, and Mathematics into the learning and instruction process. One of the goals of STEM education is to train individuals with advanced 21st-century skills and to bring them into society. According to Simsek and Hamzaoglu (2023) STEM supporting context-based learning method is more effective on students' scientific literacy. They suggest that integrating context-based STEM Education approach effectively enhances students' scientific literacy and motivation.

The study also found that the STEM activities had a positive effect on students' scientific literacy and motivation levels. The results suggest that implementing STEM activities in the educational process can increase students' motivation levels and improve their scientific literacy. The study's findings are consistent with previous research on the effectiveness of context-based learning approaches and STEM education in improving students' motivation and scientific literacy.

However, the research has conducted higher level education. Thus, it is limited on how the context-based STEM education approach affects students' scientific literacy and motivation in elementary education. It needs further research on how context-based STEM education approach can be applied in Elementary education.

Effectiveness of Contextualization in Science Instruction to Enhance Science Literacy in the Philippines: A Meta-Analysis

The prime aim of science education is to develop functionally scientifically literate learners (Hartig et al., 2020) Considering the new environmental, health , and science challenges we face in the world today, and an answer to science education changes that are focused on essential science content rather than coverage, the need to develop useful science, technology, engineering, and mathematics (STEM) knowledge in individuals through contextualization is imperative (Fortus & Krajcik, 2020).

The study examines the effectiveness of contextualization in science instruction to enhance science literacy in the Philippines. A meta-analysis of 10 Philippine-based studies from 2017 to 2020 found that contextualization has a positive effect on students' achievement. The variables educational level and science domain were found to have no influence on student achievement. The study suggests that contextualized instruction can promote students' understanding of empirical evidence and enhance science process skills.

However, it also notes that contextualization has its limitations, such as requiring more teacher preparation time. Also, there is a limited exploration into the factors that influence the success of the context-based approach. The study concludes that contextualization is an effective approach to teaching science, but further research is needed to examine the indicators that may influence its implementation.

Effect of Context-Based Instructional Approach on Students' Science Process Skills Acquisition in Environmental Concepts

Over time, various terms like the scientific method, scientific thinking, and critical thinking have been used to describe science process skills. However, currently, the widely accepted term for these skills is "science process skills" (SPS) (Kurniawan et al., 2020). Samba et al. (2020) defined SPS as the abilities required by scientists to conduct scientific investigations. Similarly, Hacıeminoğlu et al. (2022) describe SPS as the competencies, potential, and technical knowledge developed through experience that enables individuals to engage in mental and physical operations in the field of science. SPS plays a vital role in constructing knowledge and facilitating students' comprehension of scientific concepts during the learning process (Gizaw & Sota, 2023).

These skills encompass controlling variables, defining operations, developing hypotheses, interpreting data, experimenting, and creating models (Gizaw & Sota, 2023). In this study, science process skills (SPS) are defined as the various abilities necessary for conducting experiments and solving problems in scientific inquiry. These skills encompass higher-level thinking, including controlling variables, defining operations, formulating hypotheses, analyzing data, conducting experiments, and constructing models.

Research has shown that specific learning approaches can effectively facilitate the development of science process skills (SPS). Ngozi (2021) proposed a context-based instructional approach (CBIA) in science teaching that enhances creativity and the acquisition of SPS. CBIA is a learner-centered approach aligned with constructivist learning theory, prioritizing active engagement and understanding by shifting the focus from teacher-led instruction to student-centered learning (Abu-Rasheed et al., 2023).

Despite all of this, there is limited research exploring context-based instructional approach particularly at elementary level learners impacts the acquisition of science process skills. Also, the interplay between context-based instructional approach and students' engagement and understanding in Elementary level is still underexplored.

The Impact of Place-Based Contextualized Curriculum on Student Engagement and Motivation in STEM Education

According to Holmes et al. (2022) there is a need to improve student engagement and motivation in STEM subjects, as many students see these subjects as abstract and disconnected from their lives. Also, developing ways to improve interest in STEM subjects, so that students see the relevance and value of STEM in their lives, may improve STEM participation rates (Berger et al., 2020). The articles suggest that integrated STEM curricula can improve student learning, collaborative skills, and problem-solving opportunities, but also identify barriers such as lack of teacher confidence, overcrowded curricula, and resourcing issues. Place-based contextualized STEM curriculum increases student motivation by making learning more relevant, engaging, and connected to their lives and communities. It boosts interest, confidence, and a sense of belonging, especially for underrepresented groups.

However, its effectiveness depends on teacher support, resources, and the depth of implementation. The studies propose solutions such as developing place-based STEM curricula, involving industry partners, and providing opportunities for students to solve local problems (Holmes et al., 2022).

The benefits of contextualized approaches to STEM teaching and learning include increased student engagement, interest, and aspirations, as well as improved transferable skills and community connections. However, limitations such as time constraints and difficulty in securing community engagement are also identified (Holmes et al., 2022). There is also a limited examination on how contextualized STEM teaching affects the engagement, interest and learning outcomes of the students. Also, there is a gap in understanding how to effectively support teachers in developing the confidence and skills that is necessary when integrating STEM. All in all, there's a big potential that contextualized approaches may improve STEM literacy, particularly for rural, regional, and remote students and those from disadvantaged backgrounds.

Expanding the STEM Integration Model Introducing the Learning Environment

STEM education, an acronym for Science, Technology, Engineering, and Mathematics, has become a central focus globally as nations strive to equip students with the skills and competencies necessary to thrive in a technologically driven world (Bybee, 2018; Svabo et al., 2024). STEM has evolved from a concept into a critical component of educational reform aimed at developing technical, digital, and mathematical competencies (Møller, 2022).

The conventional structure of education, where subjects are taught in isolation, creates barriers to effective STEM integration. In integrated STEM teaching teachers are required to collaborate across disciplines to provide a cohesive STEM experience, a task that is complicated by the compartmentalized nature of the educational system, where subjects are thought separately. Consequently, they may lack the pedagogical strategies and confidence needed to integrate content across different STEM disciplines effectively (Svabo et al., 2024). Additionally, there is often a lack of administrative support for STEM integration (Svabo et al., 2024). Logistical challenges, such as scheduling and resources, further complicate STEM integration.

This study proposes an expansion of the STEM integration model by introducing the learning environment as a fifth approach, alongside the established methods of integration by context/theme, subject domain, method, and crosscutting concepts (Seidelin & Larsen, 2021). The integration of the learning environment into the STEM integration model is useful and relevant. It aligns with existing principles of STEM teaching, emphasizing real-world applications and participant-oriented approaches (Svabo et al., 2024).

However, there is limited research on how to overcome the challenges faced when integrating STEM content as teachers often lack the necessary strategies and confidence to effectively integrate STEM content. There is also lack of exploration into how schools can provide the support that needed to overcome the challenges and how they can address these challenges and support integration of STEM curricula.

MATERIALS AND METHODS

Research Design

This study used an experimental design with one group pre-test and post-test design to determine the impact of utilizing context-based STEM education approach on teaching Science of the Grade 4 learners of Sultan Naga Dimaporo Memorial Integrated School. Moreover, the quantitative impact of said instructional materials was evident on its effect on the respondents' conceptual understanding which was measured using pre-test and post-test. The researchers measured if there was a difference between the pre-test and post-test score of the respondents of control and experimental group in utilizing the context-based STEM education approach.

Research Locale

This study was conducted at Sultan Naga Dimaporo Memorial Integrated School, located at Purok 1, Poblacion, it is composed of diverse cultures, Muslims and Non-Muslims to be specific. Where Grade 4 students enrolled in science classes serve as the study's respondents. The school is selected as the research site due to its accessibility and relevance to the study's focus on utilizing context-based learning approach within the existing STEM curriculum.

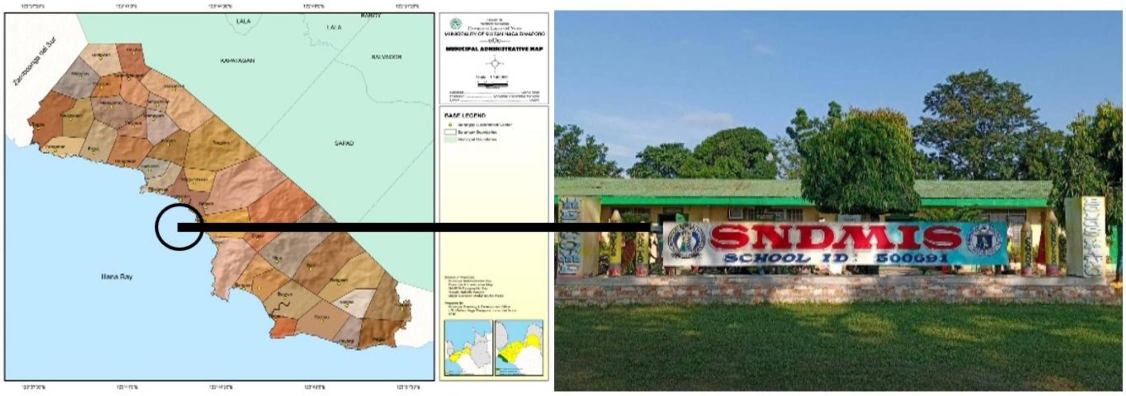

Figure 3.1 Location of the Study

Respondents of the Study

The respondents of the study were the Grade 4 learners of Sultan Naga Dimaporo Memorial Integrated School who were officially enrolled in the school year 2025-2026. There were thirty-eight (38) learners who were officially enrolled in Grade 4 in the academic year 2025-2026 and was purposively chosen as the respondents to make the study more reliable.

Research Instruments

The research instruments that were used in the study were the following:

Pre-test and Post-test Questionnaire. The respondents completed two sets of tests; a pre-test and post-test, each containing 20 multiple-choice items aligned with the Science 4 curriculum standards. These tests were administered to determine the pupils' conceptual understanding before and after the intervention. Adequate time was allotted during both tests were taken to ensure that all pupils were able to answer the items thoroughly without pressure.

STEM Lesson Plan. STEM lesson designed to specifically for Grade 4 Science, aligned with the Most essential Learning Competency (MELC) S4LTIIg-h14, which states: "The effects of environment on the life cycle of organisms." This instructional tool is central to the experimental process and serves as the interventions strategy for determining the impact of a context-based STEM education approach.

All instruments underwent validation by subject matter experts and were pilot-tested to ensure clarity and reliability. The instructions and content were carefully aligned with the study's educational objectives and were adapted to fit the learners' local context.

Localized Context-Based STEM Lesson Exemplar (Instructional Tool)

A lesson plan utilizing STEM context-based strategies served as the instructional material for the experimental group. The lesson plan is designed to incorporate real-life situations, local environmental issues, cultural practices, and community-relevant examples to make learning more meaningful. It also integrated key elements of STEM (Science, Technology, Engineering, and Mathematics) by promoting inquiry, critical thinking, and problem-solving in science learning. This instructional tool supports the contextualization principles of the K to 12 curriculum.

All instruments were validated by subject matter experts and pilot-tested for clarity and reliability. These tools are designed to ensure that assessment and instruction are directly aligned with the educational goals of the study and the learners' local context.

A. Pre-test and Post-test Questionnaire

The pre-test and post-test were composed of a 20 item multiple choice questions. The score is based on the following criteria, adapted from Bloom's Taxonomy-based assessment guidelines (Anderson & Krathwol, 2001):

Scores Range	Description	Verbal Interpretation
16-20	Excellent	Highly Achieved
11-15	Very Good	Moderately Achieved
6-10	Average	Fairly Achieved
1-5	Poor	Not Achieved

B. Verbal Interpretation for Prototype Evaluation

The prototype is evaluated based on the criteria of Creativity and Neatness, Teamwork, and Effort. The overall performance is interpreted using the following scoring plan, adapted from DepEd Order No. 8, s. 2015 – Policy Guidelines on Classroom Assessment for the K-12 Basic Education Program.

Percentage Range	Description	Verbal Interpretation
90-100	Excellent	Outstanding
85-89	Very Good	Very Satisfactory
80-84	Good	Satisfactory
75-79	Fair	Fair Satisfactory
Below 75	Poor	Did Not Meet Expectation

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C. Table of Specifications (TOS)

The table of specifications (TOS) is a tool used in this study is to ensure that a test or assessment measures the content and thinking skills that the test intends to measure. Before constructing the TOS, the researchers decided the total number of items to include (i.e., twenty) and quantity and type of those items (i.e., twenty multiple-choice), and the decision was made based on the time allocated for pupils to complete the test. Next, the teacher referred to the STEM lesson plans and notes to determine the contents.

Data Gathering

In gathering the data, the researchers submitted a manuscript to the Campus Research Ethics Committee (CREC) and prepared a lesson plan on topic for the study.

The researchers made a letter of permission to the school principal and to the class adviser of Grade 4 learners in Sultan Naga Dimaporo Memorial Integrated School.

After the approval of the school administration, the researchers conducted pilot testing then administered pre-test and the learners took an initial test to assess their prior knowledge. After pre-test administration, the utilization of the context-based STEM Learning Approach intervention for five (5) days where in the last day was the exhibit of the prototypes of the pupils to be followed by the post-test to measure learning improvement. The collected data were systematically recorded for statistical tools.

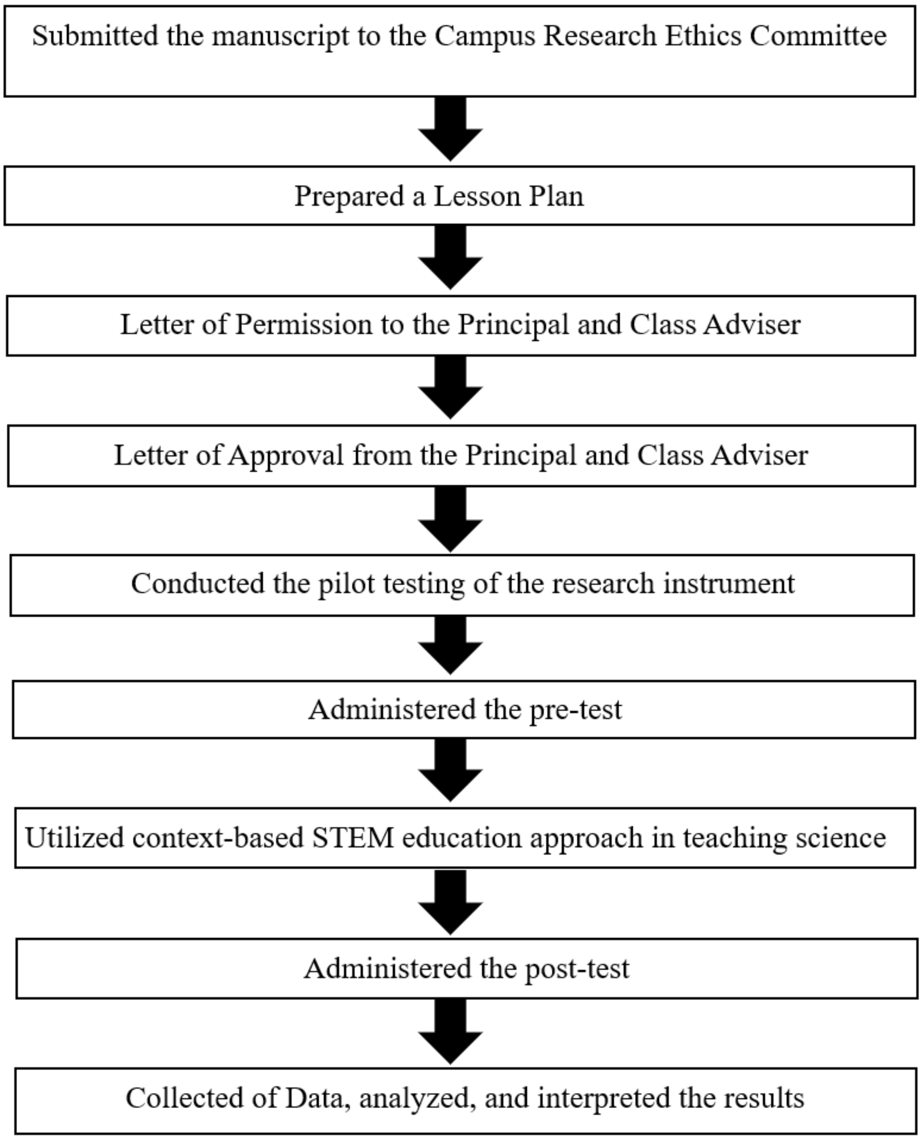

Figure 3.2 Flowchart of Data Gathering Procedure

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Data Analysis

Data will be analyzed using the following statistical tools:

Frequency and/or Percentage Distribution.

This was used to determine the demographic profile of the respondents (SOP 1, SOP2 and table 4.1, table 4.2)

$$P = \frac{f}{n} \times 100$$

Where:

P = Percentage

F = Frequency

N = Total Number of Respondents

100 = Constant

3.6.2 T-test.

This tool was used to determine if there is a significant difference between the pre-test and post-test scores of the respondents in Utilizing Context-Based STEM Education Approach in Teaching Science 4 (SOP 4 and table 4.3)

Formula: $t = \frac{\bar{x}_1 - \bar{x}_2}{\sqrt{\frac{S_1^2}{n_1} + \frac{S_2^2}{n_2}}}$

Where:

$\bar{x}_1$= Mean of the First Test

$\bar{x}_2$= Mean of the Second Test

n_1= Number of Respondents of the First Test

n_2= Number of Respondents of the Second Test

S_1= Standard Deviation of the First Test

S_2= Standard Deviation of the Second Test

RESULTS AND DISCUSSION

Demographic Profile of the Respondents

Age

Table 4.1 shows that among thirty-eight (38) respondents, thirty-one (31) or 81.58% are nine (9) years old, six (6) or 15.79% are ten (10), and one (1) or 2.63% are eight (8) years old. It indicates that most of the respondents' age is appropriate to their grade level.

Most of the pupils were nine (9) years old, which is an expected age for Grade 4 level pupils. This age group is ready for context-based STEM activities as they are preparing to have higher cognitive abilities and they will have a strong STEM identity that will lead to success STEM pathways or careers.

According to Stone (2024) when young children operate in authentic STEM experiences, it will expand their cognitive growth and development, it will also increase their observational capacity, divergent thinking and creative innovation, problem-solving, critical thinking, engagement in science and engineering practices, conceptual development, and meaningful retention.

Table 4.1 Frequency and Percentage Distribution of the Respondent of the Demographic Profile in Terms of Age (n=38)

Age	Frequency	Percentage
10	6	15.79
9	31	81.58
8	1	2.63

Gender

Table 4.2 lists the gender distribution. As seen in the table 4.2 twelve (12) or 31.58% are male, and twenty-six (26) or 68.42% are female. This implies a slightly higher participation of female pupils in the study.

As indicate in the study of Olive et al. (2022) which found that result showed no significant gender difference except for those within the high all profile, where more girls aspire to a STEM-related career. Furthermore, this suggests that when the pupils are highly motivated in general, girls have higher STEM aspirations than boys.

Table 4.2 Frequency and Percentage Distribution of the Respondent of the Demographic Profile in Terms of Gender (n=38)

Gender	Frequency	Percentage
Male	12	31.58
Female	26	68.42

Pre-Test and Post-Test Scores of the Respondents

Table 4.3 presents the pre-test and post-test scores of the respondents. The table shows that in their pre-test, twenty (20) or 52.63% of the respondents scored fairly achieved on their pre-test performance before utilizing context-based STEM education approach on teaching science, nine (9) or 23.68% scored moderately achieved, and six (6) or 15.79% scored highly achieved and three (3) or 7.89% scored not achieved. This entails that most of the pupils are below average, which means that the pre-test scores were moderately achieved.

According to Holmes et al. (2022) there is a need to improve student engagement and motivation in STEM subjects, as many students see these subjects as abstract and disconnected from their lives. Also, developing ways to improve interest in STEM subjects, so that students see the relevance and value of STEM in their lives, may improve STEM participation rates (Berger et al., 2020).

Meanwhile, in their post-test, the table shows that eighteen (18) or 47.37% of the respondents scored highly achieved on their post-test performance, which is interpreted as highly achieved, seventeen (17) or 44.74% scored moderately achieved which is interpreted as achieved. Meanwhile, three (3) or 7.89% scored fairly achieved.

It implies a high jump in changes from respondents' pre-test scores to their post-test scores. This means that there is improvement in pupils' scientific performance after utilizing context-based STEM education approach.

According to Hebebci and Usta (2022) integrated STEM education applications positively affect students' problem-solving skills, scientific creativity, and critical thinking dispositions. In addition, according to Şimşek and Hamzaoğlu (2023) STEM supporting context-based learning method is more effective on students' scientific literacy. They suggest that integrating context-based STEM Education approach effectively enhances students' scientific literacy and motivation.

Table 4.3 Pre-test and Post-test Scores of the Respondents (n=38)

Score	Pre-Test *frequency*	*percentage*	Post-Test *frequency*	*percentage*	Verbal Interpretation
16-20	6	15.79	18	47.37	Highly Achieved
11-15	9	23.68	17	44.74	Moderately Achieved
6-10	20	52.63	3	7.89	Fairly Achieved
1-5	3	7.89	0	0	Not Achieved

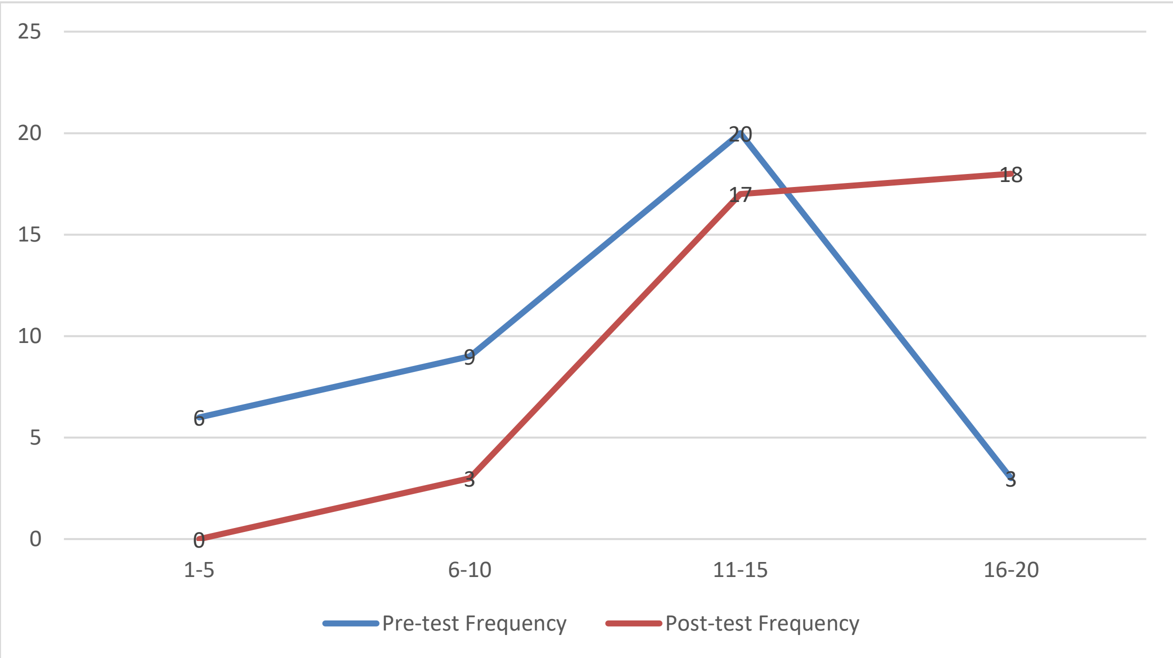

Figure 4.1 Line Graph on the Pre-test and Post-test Scores of the Respondents

Furthermore, Figure 4.1 presents the pre-test and post-test scores of the respondents using the line graph. The graph shows the difference between the pre-test and post-test scores of the pupils in Science before and after utilizing context-based STEM education approach. As seen in the graph, most pupils' pre-test scores were low or can be interpreted as 'Fairly Achieved'. Contrary to their post-test scores where most pupils got high scores or it can be interpreted as 'Highly Achieved'.

The difference between the scores shows that pupils performance got good as it can be seen in the graph. This means that utilizing context-based STEM education is effective in enhancing pupils' motivation and engagement and applying it in real life situations makes it more meaningful. These findings imply that integrating real-world, context activities into STEM instruction can lead to deeper understanding, sustained interest, and better learning outcomes. They also suggest that educators and curriculum developers should prioritize contextualized learning experiences to support both academic achievement and long-term skill development. Additionally, schools may consider providing professional development for teachers to effectively design and implement context-based STEM lessons.

This can be supported by Svabo et al., (2024) that the integration of the learning environment into the STEM integration model is useful and relevant. It aligns with existing principles of STEM teaching, emphasizing real-world applications and participant-oriented approaches.

The result can also be seen in the pupils' prototype if they really applied all their knowledge and understanding in real life from the lesson.

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As seen in the figure 4.2, they had an activity where they were given a situation which are the flood and drought and they would draw what would happen to their chosen insect in these situations.

Figure 4.2 Identification of Potential Solution

As seen in figure 4.3, the learners plan and design on how their vertical garden would look like. According to them, one of the purpose of vertical garden is to help the insects to find food and shelter when there is a flood or drought.

Figure 4.3 Decision Making

As seen in Figure 4.4, the class was divided into two, where each group drew their own design of vertical garden using local and recyclable materials. Using their design, each group made their own version of vertical garden. These prototypes reflect their ability to integrated scientific concepts with available resources, showcasing both creativity and problem-solving skills.

Figure 4.4 Prototype of Respondents on Localized Context-Based STEM

The development of these prototypes complements the findings of the post-test, where respondents exhibited higher performance compared to the pre-test. It indicates that the utilization of context-based STEM approach not only improved test performance but also enhanced learners' capacity to apply scientific knowledge in practical situations.

Overall Evaluation Result of Vertical Garden Prototype

The prototype was presented by the pupils and was rated by the chosen evaluators which are the science experts from the Sultan Naga Dimaporo Memorial Integrated School together with some invited visitors. The evaluation was based on 3 criteria: Creativity and Neatness, Teamwork, and Effort. Each group presented and demonstrated their work, answered the questions from the evaluators and was scored accordingly. After the presentation, the evaluators gave feedback to their prototypes while also giving suggestions to make their prototype better.

As seen in table 4.4, Group 1 scored the highest with 145 (96.67%) out of 150. They scored 49 (98%) in Creativity and Neatness, 48 (96%) in Teamwork, and 48 (96%) again in Effort. Group 2, however, scored 143 (95.33%) out of 150 which is two points lower compared to group 1. They scored 48 (96%) in Creativity and Neatness, 48 (96%) again in Teamwork, and 47 (94%) in Effort.

Table 4.4 Overall Evaluation Result of Vertical Garden Prototype

Group	**Percentage**	**Description**	**Verbal Interpretation**
1	96.67%	Excellent	Outstanding
2	95.33%	Excellent	Outstanding

Difference Between Pre-test and Post-test Scores of the Respondents

Table 4.5 presents the difference between the pre-test and post-test scores using the context-based STEM education approach. It shows that there is significance difference between the results. The p-value of 0.00 is less than a 0.05 level of significance [t (37) = -6.83, p< 0.00] with 37 degrees of freedom. This means that the pre-test and post-test scores before and after utilizing context-based STEM education approach differ from each other. Thus, the null hypothesis is rejected.

The result implied that the scores of the respondents have a significant difference from their pre-test and post-test scores. This means that the lesson becomes more meaningful when it is connected and applied in real world situations.

This is justified by Picardal and Sanchez (2022) that contextualization instruction has a positive effect on students' achievement and can promote students' understanding of empirical evidence and enhance science process skill.

Also, according to Şimşek and Hamzaoğlu (2023) that implementing STEM activities had a positive impact on students' scientific literacy and motivation levels.

Table 4.5 Difference between the Pre-test and Post-test Scores in Utilizing Context-based STEM Education Approach

Paired Scores	**Mean**	**SD**	**t-value**	**p-value**	**Remark**
Pre-Test	10.92	4.12			
Post-Test	14.32	3.15	-6.83	0.00*	***Significant***

* Significant

Implementation of the Localized Context-Based STEM Education Approach

The first day of teaching in Grade 4-A at Sultan Naga Dimaporo Memorial Integrated School (SNDMIS) was both challenging and rewarding.

To capture the pupils' attention, the researcher showed a video about the life cycle of organisms. Before playing it, the pupils were informed that they would be expected to ask questions afterward, which encouraged them to listen attentively. The strategy proved effective—most pupils watched closely and were able to answer questions and share ideas about insect life cycles.

Afterward, the researcher presented another video explaining environmental conditions that affect life cycles, such as floods, droughts, calamities, and ultraviolet (UV) rays. The video was paused at several points to ask questions about what the pupils observed. They responded well, sharing personal experiences with floods and typhoons and providing thoughtful answers about how these factors can influence living things.

Before the class ended, the researcher informed the pupils that those who participated, listened attentively, and behaved well the following day would receive a star sticker. This announcement excited the pupils and motivated them to perform better in the next class.

Despite the rough start, the researchers were pleased to observe the pupils' growing interest and participation. This experience highlighted for the researchers the importance of patience, creativity, and using appropriate strategies to effectively engage learners.

Figure 4.5 Day 1: Identification of Social Issues

On the second day of teaching Grade 4-A at SNDMIS, the researchers were pleased to see the excitement on the pupils' faces. To begin the class, the pupils were shown a picture of a dying plant with no leaves, and the researchers asked guiding questions such as: "What do you see in the picture?", "What could be the reason the plant is dying?", and "What are some possible solutions to this problem?"

They responded well. Some pupils said the plant was dying because of excessive heat, lack of water, or improper care. Others mentioned natural causes such as floods and typhoons. For the solutions, many suggested watering the plant regularly and planting more trees. The researchers were pleased to hear the pupils confidently share their ideas and opinions.

Next, the pupils were shown a picture of a hanging vertical garden. When asked what they saw, most simply answered "plants," but did not know the structure was called a vertical garden. The demonstrator explained that it is a structure where plants grow vertically and that it can serve as a habitat for insects such as butterflies and bees. When asked what insects would be attracted to flowering plants, the pupils enthusiastically answered "butterflies" and "bees."

To deepen their understanding of how the environment affects living organisms, the researchers introduced an activity called How the Environment Affects Life. The steps were explained clearly, and the class was divided into two groups. Instructions were given in English and then translated into Bisaya and Tagalog to ensure full

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comprehension. The first step was Choose an Organism. Each group selected a simple organism to focus on, and most chose the butterfly as their example.

The second step was Create Environmental Scenarios. Group 1 was tasked to draw a scenario showing the effects of flooding, while Group 2 illustrated the impact of drought on their chosen organism. The third step was Predict and Discuss.

They were asked to draw what would happen to the organism in each type of environment. The pupils predicted whether the butterfly would survive, grow, migrate, or die. They also imagined how it might behave or adapt to the conditions shown in their scenarios.

The last step was Reflective Questions. After completing their drawings, each group chose a representative to present their work and answer reflective questions such as: *"What challenges did your organism face?"* and *"Why is it important to protect natural environments?"*

This activity encouraged the pupils to think critically and creatively. They were able to apply what they had learned from the earlier discussions and connect it to real-world environmental issues. The researchers were proud to see how engaged and thoughtful the pupils were, especially when they reflected on the importance of caring for nature to help living organisms survive and thrive.

Their participation showed noticeable growth. Although some members of each group were not actively participating, the researchers consistently reminded them of the classroom rules—specifically cooperation and respect—because a few pupils were arguing and shouting. The demonstrator stepped in to address the behavior and guide them back on task.

Overall, it was a fulfilling day, seeing the pupils so active, curious, and eager to learn. As promised, the demonstrator gave them star stickers at the end of the lesson, and it was clear that receiving them made the pupils genuinely happy.

Figure 4.6 Day 2: How the Environment Affects Life

On the third day of teaching Grade 4-A at SNDMIS, the demonstrator began the class by asking the pupils to return to their respective groups. Since the groups were already formed from the previous day, the pupils were informed that they would now start brainstorming and designing their own vertical garden.

The demonstrator allotted 30 minutes for the activity. Each group discussed and planned how they would create their DIY vertical garden using affordable and recyclable materials. The demonstrator walked around the classroom to assist and guide them as they shared ideas, ensuring that everyone in each group was participating and contributing.

After the discussion, each group presented their vertical garden designs to the class. They explained not only how the garden would look, but also how it could help mitigate the effects of environmental factors—such as floods and droughts—on the life cycle of organisms like butterflies and bees.

The activity encouraged collaboration, creativity, and critical thinking. The researchers were impressed by how the pupils connected their designs to real environmental concerns and by how engaged they remained throughout the process. As their teacher, the demonstrator supported them by helping clarify ideas and guiding them in making decisions when needed.

Since there was still time left after the presentations, the demonstrator instructed the pupils to begin constructing their vertical gardens. She gave them 40 minutes to start working on the project. To ensure that all pupils clearly understood the instructions, she translated them into Bisaya and Tagalog. This helped make the steps more accessible, especially for those who had difficulty understanding English.

To make the task more manageable, Group 1 was assigned to cut the plastic bottles horizontally, while Group 2 was assigned to cut the plastic bottles vertically. The demonstrator then provided the necessary materials and a step-by-step guide.

The materials included: plastic bottles, scissors or cutters, nails, ropes or zip ties, potting soil, and seedlings or local flowering plants.

The steps for making the vertical garden were as follows:

1. **Prepare the plastic bottles** by cutting them according to the group's assigned orientation and creating small drainage holes at the bottom.
2. **Arrange and hang the bottles** on a wall or fence using nails, rope, or zip ties, ensuring the location receives 4–6 hours of sunlight daily.
3. **Fill each bottle with soil** and plant the seedlings or flowering plants.
4. **Water the plants daily**—without overwatering—and maintain the garden regularly.

The pupils were excited and very hands-on during the activity. The demonstrator reminded them to be careful when using scissors to avoid cutting their fingers. They worked cooperatively, showing creativity, resourcefulness, and responsibility.

However, as the class was running out of time, the pupils were instructed to pause their work and continue the activity the following morning. Although they were eager to finish, they understood and looked forward to resuming their project. Pleased with their participation, teamwork, and creativity throughout the session, the demonstrator rewarded them with a star sticker and a piece of candy, which made them visibly happy.

Figure 4.7 Day 3: Decision Making

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On the fourth day of teaching, the class was filled with excitement as the pupils were eager to continue working on their vertical gardens. As soon as they settled down, the demonstrator instructed them to return to their groups and resume the activity from the previous day.

Each group brought out their materials and immediately began working. They were reminded of the steps previously discussed: securing the plastic bottles, adding soil, and carefully planting the seedlings. The demonstrator continued to guide and assist them throughout the process, ensuring the activity remained safe, organized, and educational. Some learners helped with cutting and tying the bottles, while others prepared the soil or planted the flowers.

The researchers were pleased to see that many pupils answered confidently when asked questions related to the activity, showing that they had retained what they learned from earlier lessons. They demonstrated an understanding of how vertical gardens can serve as shelter for small organisms and how plants can help improve the environment even in limited spaces.

After completing their gardens, each group presented their final output to the class. They explained how they constructed the garden, what plants they used, and how their design supports the life cycle of organisms. After the presentations, the demonstrator asked reflective questions such as: “Why do you think this kind of garden is important for insects?”, “How can this garden help during floods or drought?”, and “What should we do to take care of the plants?”

The pupils answered confidently. Some shared that vertical gardens provide shelter and food for insects like butterflies and bees. Others explained that plants can help absorb rainwater to reduce flooding and keep the surroundings cooler during drought.

When asked about taking care of the plants, the pupils mentioned the importance of regular watering, providing enough sunlight, and checking the plants daily to keep them healthy.

The researchers were pleased with both their answers and their work. The activity not only allowed the pupils to apply what they had learned but also encouraged teamwork, creativity, and environmental awareness. The session ended with the demonstrator appreciating their efforts and rewarding them with stars and a piece of candy, which made the pupils happy.

Figure 4.8 Day 4: Prototype of the Respondents on Localized Context-Based

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On the fifth day, the Grade 4-A pupils showcased their vertical garden projects outside the classroom for everyone to see. Each group assigned a representative to explain and present their work. Although some pupils felt shy, especially with evaluators and students from other grade levels watching, they still stood up and confidently shared what they had created.

The researchers felt incredibly proud of the pupils. Despite their nervousness, they demonstrated courage and teamwork. Their presentations reflected not only their creativity and effort but also their understanding of how vertical gardens can support the environment and provide shelter for organisms. It was a meaningful experience, both for the pupils and for the demonstrator as their teacher.

After the exhibit, the pupils returned to the classroom. To celebrate their hard work, the researchers gave snacks to all the pupils. Their faces lit up with joy, and the researchers were happy to see them enjoying the simple treat.

Once they finished their snacks, it was time for the researchers to say goodbye. Some pupils looked sad and even asked if there would be another class on Monday. The researchers gently explained that they would not be returning, as the class was only scheduled for five days. One pupil even began to cry, and the researchers comforted them with a warm hug.

Figure 4.9 Day 5: Exhibit

Impact of Utilizing Context-Based STEM Education Approach on Pupils' Academic Performance on Science 4

To determine the impact of the utilizing context-based STEM education approach, pupils were given a lesson journal where they filled in the blank with what they had learned.

The following are what the pupils wrote in their lesson journal reflection:

1. What I Have Learned

- I have learned so many things in just five days, I love the activities and I get so much fun. (G41)

- *I have learned about life cycle.* (G42)

- *We learned about science. We learned so much.* (G43)

- *I have learned about vertical garden and life cycle.* (G44)

- *I have learned making vertical garden and living organism.* (G45)

- *I have learned about how to take care of plants.* (G46)

- *I have learned about some plants and animals and life cycle.* (G47)

- *I have learned so much from the activities.* (G48)

- *I have learned about our lesson, and I love my teacher, my teacher is so good.* (G49)

- *I have learned about the lesson from my teacher and learned how important insect.* (G410)

As mentioned above, pupils learned about the life cycle, living organisms and the vertical garden. According to (G41) she learned so many things in just five days, she loves the activities and she get so much fun. This implied that context-based STEM education approach can improves pupils' motivation and engagement in the learning process. They also learned about vertical garden and life cycle (G44) and living organism (G45) and some plants (G47). This means that pupils learned the life cycle and can identify the living organism. The most important is they learned on how to take care the plants and the importance of the insects (G410) in our environment. It is also need to note that the teacher and its strategies is one of the factors that improves learners' motivation and participation in Science class as what (G49) say that she loves her teacher and most pupils write it in their journal.

The researchers conclude that utilizing context-based STEM education approach is effective and had an impact on pupils' motivation, participation and engagement in Science class and we can determine that the learners understand and applied what they learned in real life situations and it makes the lesson meaningful.

CONCLUSION AND RECOMMENDATIONS

Conclusion

The conclusions that can be drawn in this study are:

The results show that the respondents' profile variables such as age and gender had no significant impact on their Science post-test performance. This implies that demographic characteristics were not a key factor in pupil's achievement.

However, this study found that there was a significant difference between the pre-test and post-test scores of the respondents as their scores were higher after utilizing context-based STEM education approach. This means that pupils have a significant improvement in their performance in science after the utilization of context-based STEM education approach. This indicates the effectiveness of integrating and utilizing context-based STEM approach in classroom instruction.

All in all, based on the data gathered, it can be concluded that pupils' profile may did not affect their Science performance, the utilization of context-based STEM education approach has a positive impact on their motivation, engagement, understanding of scientific concepts, and problem-solving skills. As they made a prototype which is the vertical gardens It supports the effectiveness of context-based STEM education approach as an instrument for the lessons to become meaningful, motivating and engaging.

Recommendation

The researchers recommended the following:

1. **For Pupils.** Pupils are encouraged to engaged in context-based STEM activities. They should take part in doing the collaborative tasks, inquire to clarify and fully understand concepts and learn and connect Science lessons to real-world situations in their daily lives and community.
2. **For Teachers.** Teachers are suggesting to apply context-based STEM education approach in their teaching, specifically in science to create a meaningful and engaging lessons. Teachers should attend seminars and workshops to effectively utilize context-based STEM education approach.
3. **For Parents.** Parents are encouraged to take part in their child's learning by helping them to reinforce Science concepts at home through simple and understandable real-life applications.
4. **For School Administrations.** School Administrators are advised to provide training and workshops for teachers so that they can enhance their skills to effectively utilize context-based STEM education approach. Administrators should also provide the materials and resources that supports the context-based teaching in Science.
5. **For Future Researchers.** Future researchers are encouraged to use larger sample and explore different science topic to different levels to validate the effectiveness of context-based STEM education approach.

Future researchers should also consider other factors like classroom environment and teachers' teaching strategies.

BIOGRAPHICAL SKETCHES

The first researcher was born on June 06, 2004, at Angeles City, Pampanga. She is now 20 years old and presently residing at Purok 3, Pikalawag, Sultan Naga Dimaporo, Lanao del Norte. She is the daughter of Mr.&Mrs. Agohob.

She obtained her elementary education at Pikalawag Integrated School year 2015-2016, finished her secondary education at Bansarvil National High School and Senior High School at MSU- Lanao del Norte Agricultural College year 2021-2022. She is currently pursuing her tertiary education at MSU- SND with the degree Bachelor of Elementary Education.

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APPENDIX

APPENDIX A

ETHICAL CLEARANCE CERTIFICATE

Republic of the Philippines
MINDANAO STATE UNIVERSITY
LANAO DEL NORTE AGRICULTURAL COLLEGE
Ramain, Sultan Naga Dimaporo, Lanao del Norte, Philippines

ETHICAL CLEARANCE CERTIFICATE

Date: July 8, 2025
Protocol No: 068-2025
Certificate Reference Number: SR-067-2025
Type of review: EXPEDITED

Project Title: Utilizing Context-Based STEM Education Approach on Teaching Science 4

Nature of Project: Student research

Principal Researcher: Angela P. Agohob
Angelene P. Agohob

Co-researcher: a/Prof. Liezel P. Naquines

On behalf of the Campus Research Ethics Committee (CREC), the above type of review is hereby granted with respect to the undertakings contained in the project as mentioned above and the research instruments. Should any other instruments be used or any changes in the methodologies, these require an immediate report to CREC and separate authorization must be sought.

The researcher/s may therefore commence with the research from the date of this certificate, using the reference number indicated above.

The CREC retains the right to:

1. Withdraw or amend this Ethical Clearance if:
   - Any unethical principles or practices are revealed or reported.
   - Relevant information has been withheld or misrepresented.
   - The conditions contained in the Certificate have not been adhered to.
2. Request a progress report or its equivalent during the course or after the completion of the project.

For and in the absence of the Chairperson:

ETHEL THERESA O. ALVIA
CREC Chairperson 7-8-2025

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APPENDIX B

PERMISSION LETTER TO THE PRINCIPAL

REPUBLIC OF THE PHILIPPINES
MINDANAO STATE UNIVERSITY-SULTAN NAGA DIMAPORO
SUSTAINABILITY | NURTURING EXCELLENCE | DEDICATION TO SERVICE

July 23, 2025

RIZZA V. BANDIALA
Principal
Sultan Naga Dimaporo Memorial Integrated School (SNDMIS)
Poblacion, Sultan Naga Dimaporo, Lanao del Norte

Ma'am:

Greeting of Peace and Universal Wisdom!

The researchers are from the College of Education of Mindanao State University – Sultan Naga Dimaporo, Ramain, Lanao del Norte. They are presently conducting research entitled "UTILIZING CONTEXT-BASED STEM EDUCATION APPROACH ON TEACHING SCIENCE 4."

In this regard, they humbly ask your permission to conduct a teaching demonstration to Grade Four - section A pupils of your school. Rest assured that all information gathered for this research will be kept strictly confidential.

Thank you for the time, effort, and approval.

Respectfully yours,

ANGELA P. AGOHOB
Student-Researcher

ANGELENE P. AGOHOB
Student-Researcher

Noted:

LIEZEL P. NAQUINES, MSciED
Thesis Adviser

Approved:

RIZZA V. BANDIALA
Principal

APPENDIX C

PERMISSION LETTER TO THE ADVISER

REPUBLIC OF THE PHILIPPINES
MINDANAO STATE UNIVERSITY-SULTAN NAGA DIMAPORO
SUSTAINABILITY | NURTURING EXCELLENCE | DEDICATION TO SERVICE

July 23, 2025

ESMERA U. BANDING
Grade 4 Class Adviser
Sultan Naga Dimaporo Memorial Integrated School (SNDMIS)
Poblacion, Sultan Naga Dimaporo, Lanao del Norte

Ma'am:

Greeting of Peace and Universal Wisdom!

The researchers are from the College of Education of Mindanao State University – Sultan Naga Dimaporo, Ramain, Lanao del Norte. They are presently conducting research entitled "UTILIZING CONTEXT-BASED STEM EDUCATION APPROACH ON TEACHING SCIENCE 4."

In this regard, they humbly ask your permission to conduct a teaching demonstration to Grade four - section A pupils under your supervision. Rest assured that all information gathered for this research will be kept strictly confidential.

Thank you for the time, effort, and approval.

Respectfully yours,

ANGELA P. AGOHOB
Student-Researcher

For:
ANGELENE P. AGOHOB
Student-Researcher

Noted:

LIEZEL P. NAQUINES, MSciED
Thesis Adviser

Approved:

ESMERA U. BANDING
Classroom Adviser

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APPENDIX D

PERMISSION LETTER TO THE RESPONDENTS

REPUBLIC OF THE PHILIPPINES
MINDANAO STATE UNIVERSITY-SULTAN NAGA DIMAPORO
SUSTAINABILITY | NURTURING EXCELLENCE | DEDICATION TO SERVICE

July 23, 2025

THE RESPONDENTS
Sultan Naga Dimaporo Memorial Integrated School
Poblacion, Sultan Naga Dimaporo, Lanao del Norte

Dear Respondents:

Greeting of Peace and Universal Wisdom!

Please cooperate with our teaching demonstrations so as to come up with the meaningful results for our research study. Your cooperation will be great appreciated and contribution to the requirement and realization of our research study.

We would appreciate it very much if you will cooperate with our teaching demonstrations. Rest assured that all information gathered for this research will be kept strictly confidential.

Thank you for the time, effort, and approval.

Respectfully yours,

ANGELA P. AGOHOB
Student-Researcher

For:
ANGELENE P. AGOHOB
Student-Researcher

Noted:

LIEZEL P. NAQUINES, MSciED
Thesis Adviser

Approved:

ESMERA U. BANDING
Classroom Adviser

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APPENDIX E

PRE-TEST QUESTIONNAIRES

Name: ___________________________ **Score:** ____________________

Grade: ___________________________ **Section:** ___________________

Instruction: Encircle the letter of the correct answer.

1. What is a life cycle?

A. The stages of growth from birth to death
B. A time when animals play
C. A process where animals learn to walk
D. The daily routine of living things

2. What happens to an animal during its life cycle?
A. It only eats and sleeps

B. It stays the same

C. It flies all the time
D. It grows, changes, and reproduces

3. What do plants need for their life cycle to continue?
A. Toys B. Sunlight, water, and air
C. Candy D. Rocks

4. Which environmental factor is important for plant growth?
A. Loud music B. Moonlight
C. Sunlight D. Wind from fans

5. What might happen to a plant if there is not enough water?
A. It will grow taller
B. It will not grow well or may die
C. It will have more flowers
D. It will change color

6. How can too much rain affect a plant's life cycle?
A. It may cause the plant to rot

B. It helps the plant fly
C. It gives the plant toys
D. It makes the plant grow faster always

7. What is one way humans can harm the life cycle of trees?
A. Planting seeds
B. Watering them
C. Cutting down forests
D. Taking care of them

8. What could happen if frog eggs are laid in dirty water?
A. They will grow faster
B. They might not survive
C. They become stronger
D. They hatch into birds

9. How does temperature affect the life cycle of butterflies?
A. Butterflies don't feel temperature
B. Warm weather stops them from flying
C. Temperature has no effect

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D. Cold temperatures may slow their growth

10. Why do some animals stop laying eggs during drought?
    A. They want to sleep
    B. There is not enough water or food
    C. They get angry
    D. They have no shelter
11. What happens to fish when rivers are polluted?
    A. They grow faster
    B. They are not affected
    C. Their eggs may not develop properly
    D. They become frogs
12. What environmental change can shorten the life cycle of insects?
    A. Cold and dry weather
    B. Enough food
    C. Clean air
    D. Balanced temperature
13. What is one way a strong typhoon can affect plants?
    A. It makes them shine
    B. It helps them grow quickly
    C. It can damage or uproot them
    D. It protects them
14. Which human activity helps protect the life cycles of animals?
    A. Littering
    B. Building too many roads
    C. Burning forests

D. Creating nature parks

15. What happens if there is too much sunlight and no shade for young plants?
    A. They grow faster
    B. They become healthy
    C. They may dry up and die
    D. They produce more fruit
16. How does a clean environment help animals?
    A. It makes them tired
    B. It helps them grow and reproduce properly
    C. It stops their growth
    D. It hides them
17. What might happen to a caterpillar if its habitat is destroyed?
    A. It will find a new home quickly
    B. It grows faster
    C. It becomes a plant

D. It may not complete its life cycle

18. Why do frogs need water to complete their life cycle?
    A. To keep their eggs and tadpoles alive

B. To sleep
C. To sing
D. To build nests

19. Which of the following is NOT an environmental factor affecting life cycles?
    A. Temperature B. Sunlight
    C. Size of the animal D. Amount of water
20. What can students do to help the environment and protect life cycles?
    A. Throw trash in rivers

B. Care for plants and animals
C. Step on insects
D. Cut young trees

APPENDIX F

POST-TEST QUESTIONNAIRE

Name: ___________________________ **Score:** ____________________

Grade: ___________________________ **Section:** ___________________

Instruction: Encircle the letter of the correct answer.

1. Why do frogs need water to complete their life cycle?

   A. To keep their eggs and tadpoles alive
   B. To sleep
   C. To sing
   D. To build nests

2. What happens to an animal during its life cycle?
   A. It only eats and sleeps

   B. It stays the same

   C. It flies all the time
   D. It grows, changes, and reproduces
3. How can too much rain affect a plant's life cycle?
   A. It may cause the plant to rot

   B. It helps the plant fly
   C. It gives the plant toys
   D. It makes the plant grow faster always

4. Which of the following is NOT an environmental factor affecting life cycles?
   A. Temperature
   B. Sunlight
   C. Size of the animal
   D. Amount of water

5. What is one way humans can harm the life cycle of trees?
   A. Planting seeds
   B. Watering them
   C. Cutting down forests
   D. Taking care of them

6. Why do some animals stop laying eggs during drought?
   A. They want to sleep
   B. There is not enough water or food
   C. They get angry
   D. They have no shelter

7. What could happen if frog eggs are laid in dirty water?
   A. They will grow faster
   B. They might not survive

C. They become stronger
D. They hatch into birds

8. What might happen to a caterpillar if its habitat is destroyed?
A. It will find a new home quickly
B. It grows faster
C. It becomes a plant

D. It may not complete its life cycle

9. What can students do to help the environment and protect life cycles?
A. Throw trash in rivers
B. Care for plants and animals
C. Step on insects
D. Cut young trees

10. How does a clean environment help animals?
A. It makes them tired
B. It helps them grow and reproduce properly
C. It stops their growth
D. It hides them

11. What might happen to a plant if there is not enough water?
A. It will grow taller
B. It will not grow well or may die
C. It will have more flowers
D. It will change color

12. What happens if there is too much sunlight and no shade for young plants?
A. They grow faster
B. They become healthy
C. They may dry up and die
D. They produce more fruit

13. What is a life cycle?
A. The stages of growth from birth to death
B. A time when animals play
C. A process where animals learn to walk
D. The daily routine of living things

14. What is one way a strong typhoon can affect plants?
A. It makes them shine
B. It helps them grow quickly
C. It can damage or uproot them
D. It protects them

15. What environmental change can shorten the life cycle of insects?
A. Cold and dry weather
B. Enough food
C. Clean air
D. Balanced temperature

16. Which human activity helps protect the life cycles of animals?
A. Littering

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B. Building too many roads
C. Burning forests

D. Creating nature parks

17. What do plants need for their life cycle to continue?
A. Toys
B. Sunlight, water, and air
C. Candy
D. Rocks

18. How does temperature affect the life cycle of butterflies?
A. Butterflies don't feel temperature
B. Warm weather stops them from flying
C. Temperature has no effect

D. Cold temperatures may slow their growth

19. Which environmental factor is important for plant growth?
A. Loud music B. Moonlight
C. Sunlight D. Wind from fans

20. What happens to fish when rivers are polluted?
A. They grow faster B. They are not affected
C. Their eggs may not develop properly D. They become frogs

APPENDIX G

ANSWER KEY

Pre-test	Post-test
1. A	1. A
2. D	2. D
3. B	3. A
4. C	4. C
5. B	5. C
6. A	6. B
7. C	7. B
8. B	8. D
9. D	9. B
10. B	10. B
11. C	11. B
12. A	12. C
13. C	13. A
14. D	14. C
15. C	15. A
16. B	16. D
17. D	17. B
18. A	18. D
19. C	19. C
20. B	20. C

APPENDIX H

STEM LESSON PLAN

Title: Effect of the Environment on the Life Cycle of Organisms

I. Lesson Description: Pupils learn how the environment affects the life cycle of living things and create a simple project to help the environment.

II.Learning Competency: describe the effect of the environment on the life cycle of organisms

III.Lesson Objective

a. describe how environmental factors affect the lifecycle of organisms;

b. create and design a simple solution to help the environment like a vertical garden

c. develop appreciation for organism-environment relationships.

IV. Learning Activities

	Stages	**Activity**
DAY 1	1. Identification of Social Issues	Introduction (15 minutes) • Begins the lesson by asking the learners • *What are the organisms that you can found in our surrounding?*  • The teacher will discuss the organisms that will be found in the community of Poblacion. • The teacher will discuss the life cycle of insects. • The teacher will discuss the relationship and effects of environment on the life cycle of organisms especially the life cycle of insects. Identifying Social Issues (15 minutes)  • Pictures on the common environmental issues in the community of Poblacion. • The teacher lets pupils describe what are things they see in the pictures. • Teacher will ask the pupils how these plants died. • The teacher will ask if pupils have observed similar problems in their communities. • The teacher will ask the pupils the possible solutions to

		avoid the plants from dying. • The teacher will ask the pupils if they are familiar with the vertical garden. • The teacher will show examples of vertical garden.  
DAY 2	2. Identification of Potential Solutions	Allotted Time: 30 minutes • The teacher will group pupils into two. Each group will discuss strategies to solve the problem discussed above. • Steps to guide in making strategies to solve the problem: **Human capital:** Brainstorm ideas on how to solve the problem based on their prior knowledge and experiences in their community. **Social/Technologies:** Making a vertical garden to solve the problem to help the environment and the community. **Physical capital**: They may create or build DIY vertical garden that will help to increase the population of insects (e.g., butterflies). **Financial capital**: The materials used should be affordable. **Natural capital**: The materials used should be recyclable.
DAY 3	3. Need for Knowledge	Allotted Time: 30 minutes • The pupils will do an activity called "How the Environment Affects Life" Activity Instructions: • Step 1: Choose an Organism Ask students to choose a simple organism to focus on. Example: Butterfly • Step 2: Create Environmental Scenarios The pupils will draw the following environmental factors; Group 1: Flood Group 2: Drought • Step 3: Predict and Discuss Ask students to draw: 1. What would happen to their chosen organism in each environment? 2. Would it survive? Grow? Migrate? Die? 3. How would it **look**, **behave**, or **adapt**? • Step 4: Reflective Questions 1. What challenges did your organism faced?

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		2. Why is it important to protect natural environments?
DAY 4	4. Decision-Making	Allotted Time: 30 minutes • Learners will discuss and plan with their group members on how they will make the DIY vertical garden. • Learners will present their ideas and plan to the class. • Learners will present how their vertical garden can help to mitigate the effect of environment on the life cycle of organisms. • Teacher assists pupils in making decision.
DAY 5	5. Development of Prototype or Product	Allotted Time: 40 minutes **What can we make?** Group 1 will cut the bottle horizontally. Group 2 will cut the bottle vertically. Create a DIY vertical garden Goal: A small way to help the organisms and the environment Steps to make a vertical garden. Materials needed: • Plastic bottles • Scissors or cutters • Nails, ropes or zip ties • Potting soil • Seedling or Local plants (especially flowering plants) **Step by Step Guide** Step 1: Prepare the plastic bottles, cut it and make a small drainage hole at the bottom for excess water Step 2: Arrange it and hang the plastic bottles on a wall or fence using nails, rope or zip ties and place it where it gets 4-6 hours of sunlight. Step 3: Fill it with soil and plant the flowering plants or seedlings Step 4: Water it daily but avoid overwatering and maintain the garden.
DAY 6	6. Test and Evaluation of the Solution	Allotted Time: 30 minutes • The teacher will evaluate the prototype according to the rubrics. • Each group shows their project and explains what they did. • Learners will test their prototypes. • The teacher will give an activity sheet of their observation.
DAY 7	7. Socialization and Completion Stage	Allotted Time: 20 minutes • Learners will exhibit their works.

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V. Assessment Instrument:

Simple rubric with 3 criteria

Criteria	5 - Excellent	3 - Good	1 - Needs Improvement
Creativity and Neatness	The garden is very neat and creatively designed.	The garden is neat with some creativity.	The garden is messy or lacks design.
Teamwork	Everyone worked well and helped each other.	Most group members worked together.	Only a few group members participated.
Effort	The group clearly put in a lot of time and effort, going above and beyond.	The group put in a fair amount of effort but could have done more.	The group put in minimal effort, and the project lacks quality.

APPENDIX I

TABLE OF SPECIFICATIONS (TOS)

SUBJECT: **<u>Science</u>** **SCHOOL YEAR:** **<u>2025-2026</u>**

YEAR LEVEL AND SECTION/S: **<u>Grade 4-A</u>** **QUARTER:** **<u>2nd Quarter</u>**

Pretest/Post-test	**1 point each item (Multiple Choice)**					**SCORING SYSTEM**	
Learning Competency	**No. of days/ hours**	**Items Number**	**REMEMBERING/ UNDERSTANDING**	**APPLYING/ ANALYZING**	**EVALUATING/ CREATING**	**No. of Test Items**	**Percentage %**
			EASY 60%	**AVERAGE 30%**	**DIFFICULT 10%**		
1. describe the effects of the environment on the life cycle of organisms	5	1, 2, 3, 4, 11, 13, 17, 19	8	0	0	8	40%
		5, 6, 9	3	0	0	3	15%
		7, 8, 10, 12, 14, 15, 20	0	7	0	7	35%
		16, 18	0	0	2	2	10%
	Total						
			11	7	2	20	100%

Prepared and submitted by:

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APPENDIX J

DOCUMENTATION

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