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Effect of outdoor learning inquiry-based activities on learners performance in science: A sequential explanatory design

Maria Liza I. Berandoy* , Region XI, Mankilam, Tagum City, Davao del Norte.
Glen L. Villonez, Region XI, Mankilam, Tagum City, Davao del Norte, Philippines.

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Abstract

This study aimed to determine the effect of Outdoor Learning Inquiry-Based Activities (OLIBA) on the performance of grade 5 students in science. A sequential explanatory mixed methods design was used in the study. The respondents were the 180 grade 5 students from the representative divisions in Region XI. Sixty (60) grade 5 students from each division namely Davao Occidental, Tagum City, and Davao City were considered as respondents. The study utilized two instruments; the standardized test and the researcher-developed interview guide. The statistical tools employed were Mean and standard deviation and Independent Samples t-test. The results revealed the pretest performance of the students in the experimental and control groups in the three divisions was described as fairly satisfactory. Also, the students in the experimental group demonstrated an outstanding performance in the posttest due to the use of OLIBA while the control group registered a very satisfactory performance with the use of the traditional style of teaching. The result of qualitative analysis of participant's experiences in the pretest revealed similarities in content difficulty. After the implementation of OLIBA, both pupils and teachers revealed similarities in knowledge acquired and engagement due to OLIBA.

Keywords: Inquiry-based; learners; outdoor learning; performance; sequential explanatory

* ADDRESS FOR CORRESPONDENCE: Maria Liza I. Berandoy, Department of Education, Region XI, Mankilam, Tagum City, Davao del Norte*. E-mail address*: marializa.berandoy@deped.gov.ph

1. Introduction

The need to improve the quality of the science education received by secondary school students, including those with no particular science-related aspirations (Sheldrake, 2020), is widely accepted and, in many countries, justified by the recent Programme for International Student Assessment (PISA) reports (Organization for Economic Cooperation and Development [OECD], 2016). To a certain extent, this view explains that, for a long time, science education has concentrated on developing students' substantive scientific knowledge rather than other dimensions that have great value for students (Fernandez et al., 2022). The latter provides an understanding of the knowledge and structure of various disciplines; it helps students adapt this information to the demands of a constantly evolving society in which scientific knowledge has taken on particular relevance in daily life (Mkimbili & Odegaard, 2019).

In recent years, many countries have shown great interest in redirecting the aims of the secondary science curriculum (Cheung, 2018) because, as future consumers, voters, and policymakers, secondary students–both Science, technology, engineering, and mathematics (STEM) and non-STEM majors–must be prepared to examine and understand socio-scientific issues and make responsible, science-informed decisions about them (Dauer et al., 2017). According to Forsthuber et al., (2011), International student assessment surveys carried out under agreed conceptual and methodological frameworks to provide policy-oriented indicators in Europe indicate that there is a decrease in relative standings in the performance of science subjects among European members (Kimaro, 2020). In Uganda, Lugonda (2018) found out that poor performance in science subjects in secondary schools has been a serious concern to educationists, business organizations, and the government. This problem has been due to many factors, including the need for more incentives and motivation for teachers to increase their efficiency and effectiveness to improve student performance (Forson et al., 2021).

According to statistics, many youngsters lose interest in science in the fourth grade. Quality science instruction is equally critical in the higher elementary grades, as these are the last years in which Science is part of the regular curriculum for kids (Siverton, 1993). A series of research concluded that there need to be more science teaching facilities such as laboratories, tables, chairs, classes, and, most of all, laboratory equipment in schools to teach science education (Shitu, 2014). This situation is more critical in rural areas than in urban where access to primary education infrastructure is negligible.

The manifestation of the lack of laboratories could affect the performance or mastery of science concepts. In science classrooms, particularly those across the Western world, it is apparent that inquiry-based teaching and learning are well embedded (Oliver, 2021). However, in the Philippines, there is a lesser focus on science laboratories, especially in public schools. Issues arose as an inadequate number of laboratory rooms as against the number of students, lack of laboratory materials, enough training of Science teachers in this venture, and most especially, safety readiness and resilience of schools during laboratory experiments accidents (de Borja & Marasigan, 2020). Additionally, many Philippine schools still have teacher-centered classes. Science teachers resort to lecturing rather than offering students engaging and challenging tasks that allow them to generate creative ideas due to a lack of content and pedagogical abilities appropriate for science instruction. Science education is still frequently textbook-based, and concepts are frequently irrelevant to real life or the community. The need for more science laboratories in primary schools impacts elementary science education, limiting teachers to lectures and reporting exercises for pupils instead of laboratory experiments that show how concepts work in practice. Students in the Philippines have notions and terminologies that are only sometimes conducive to Science's appeal. Instead of asking questions, making predictions, and conducting tests, they prefer to remember and regurgitate information.

Further, an international assessment like Mullis et al., (2019) indicated that Filipino students lagged behind other countries in the international assessment for science for grade 4. Their poor performance is due to the lack of support for a scientific culture reflected in the deficiencies regarding the school curriculum, the flawed teaching-learning process, insufficient instructional materials, and the lack of teacher training. Also, the need for more excellent and engaging textbooks and science equipment has hindered the conduct of scientific investigations and hands-on activities among Filipino pupils (Magsambol, 2020).

In Region XI, several elementary schools have experienced obstacles because of the lack of science facilities. Most students need more facilities and materials to perform hands-on activities. The limited face-to-face setup has also hindered the attempt to expose students to hands-on activities.

Despite the limited facilities and laboratories, inquiry learning may enhance students' science performance (Ramnarain, 2023; Ge et al., 2024). UNESCO (2020) pointed out that maximizing the use of learning outside the classroom is one of the interventions to explore to make elementary Science classes relevant during the pandemic and address the scarcity of science laboratories as learning does not take place solely in the classroom. What pupils learn in school is only a tiny part of their education. Outdoor learning and outside-the-classroom efforts bring value to the in-classroom learning experience, mainly when used in tandem (Frances et al., 2024; Schroth, 2023).

Similarly, the claim above is supported by Ofsted (2011), indicating that the UK Government reports attributed positive outcomes to inquiry, noting that in schools that showed improvement in science, an important factor facilitating students' progress was more practical science lessons and the development of the skills of scientific inquiry. This view is consistent that laboratories are an integral part of teaching and learning Science and are often seen as a prerequisite for quality science teaching (Sjøberg, 2018).

1.1. Purpose of study

There is a growing body of research on the effect of outdoor learning on students' performance in science. However, there still needs to be a research gap examining the impact of inquiry-based outdoor learning activities. While some research suggests that outdoor learning can have a positive impact on students' science achievement, there needs to be more research that specifically examines the impact of inquiry-based outdoor learning activities. One possible reason for this research gap is that inquiry-based learning requires a certain level of teacher expertise and support, which may only be available in some settings. Future research could help to fill this gap by exploring the impact of inquiry-based outdoor learning activities on students' science performance and identifying the factors that contribute to the successful implementation of such activities.

This mixed methods study aimed to determine the effect of Outdoor Learning Inquiry-Based Activities (OLIBA) on grade 5 students' performance in science. Specifically, it sought answers to the following questions:

- What is the pretest performance of the students in the experimental and control group in Science 5?
- What is the post-test performance of the students in the experimental and control group in Science 5?
- Is there a significant difference in the pretest and posttest performance of the experimental and control groups in Science 5?

- What are the experiences of the participants about the effect of OLIBA on their performance in science?

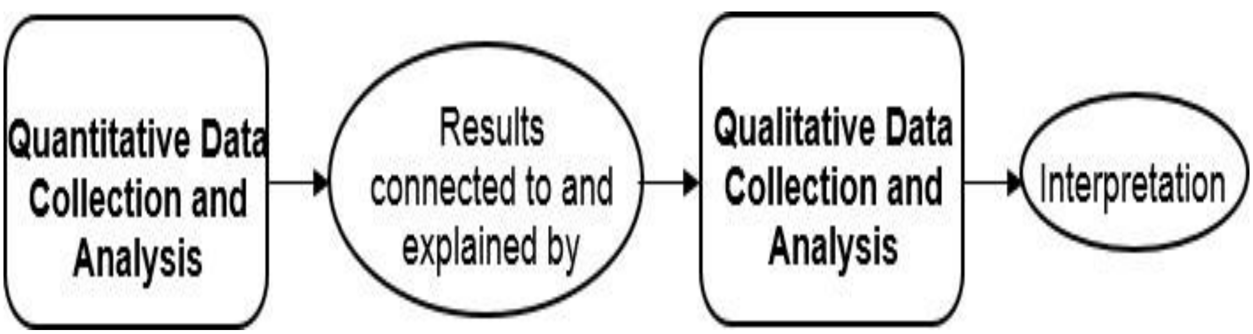
2. Methods and materials

2.1. Research Design

This study utilized a mixed methods sequential explanatory design. Explanatory sequential design starts with an initial phase of quantitative data collection and analysis, followed by the qualitative phase of data collection and analysis (Creswell, 2003). The purpose of this design is to use qualitative results to assist in explaining and interpreting the findings of a quantitative study. In the qualitative phase, the researcher uses a phenomenological approach. A phenomenological study describes the common meaning of a concept or phenomenon for several individuals of their lived experiences. It focuses on the commonality of a lived experience within a particular group. Interviews are conducted with a group of individuals who have first-hand knowledge of an event, situation, or experience. Within the qualitative presentation of results, cross-case analysis was performed. Cross-case analysis is a method that involves the in-depth exploration of similarities and differences across cases to support empirical generalizability and theoretical predictions (Pare, 2019). Also, it is a method that facilitates the comparison of commonalities and differences in the events, activities, and processes, the units of analysis in case studies. Additionally, it is a term for the analysis of two or more case studies to produce a synthesized outcome (VanWynsberghe & Khan, 2007). In some contexts, it has a narrower meaning, referring to a specific method for performing the analysis, and organizing the data from the cases in tables and graphs. This study looked for similarities and differences in students' and teachers' experiences of the effect of OLIBA on Science learning.

Figure 1 presents the process of sequential explanatory design.

Figure 1
Sequential explanatory design



The quantitative study utilized a quasi-experimental design using a nonequivalent group design. In a nonequivalent group design, the researcher chooses existing groups that appear similar, but where only one of the groups experiences the treatment (Thomas, 2022). In this study, two groups from the three divisions were utilized as respondents of the study. On the other hand, the qualitative phase utilized phenomenology. Phenomenological design seeks to describe that experience, and this goal sets it apart from more causal/positivist approaches to social research, particularly behavioral psychology, and explanatory general theories such as Marxism and Functionalism (Education Studies, 2021). Also, it is interested in the subjectivity of the observer but it need not be confined to the level of the individual. Phenomenologists are interested in the way we come to share similar understanding of the world and the way we construct a sphere of intersubjectivity, an implicit agreement about how the world looks, sometimes referred to as the life-world (Chen, 2017). In the context of the study, this explored the themes of the experiences of students and teachers on the effect of OLIBA in Science.

2.2. Participants and sampling design

The respondents of this study were the 180 grade five students from the representative divisions in Region XI. These students were selected purposively since these were the students who were exposed to the conduct of OLIBA. Along with the quantitative respondents were the three teachers who administered OLIBA one from each division. These teachers were interviewed to assert their views on the effect of OLIBA on students learning. Also, three students per group (experimental and control) were interviewed about their exposure to OLIBA. Both teachers and students were selected purposively.

2.3. Data collection instrument

In the conduct of this mixed methods study, a 30-item test was utilized by science teachers given by the regional office focused on the 3rd quarter least learned competency in science 5. Additionally, for the conduct of the interview, a researcher-developed interview guide was administered based on the results of the quantitative analysis. The participants were interviewed on an online platform using Google Meet where the first batch was composed of three students and the next batch was the teachers.

In analyzing the performance of the students in the pretest and posttest, the following numerical and descriptive interpretation was used by DepEd Order No. 8, s. 2015.

Range of Scores	Interpretation
25-30	Outstanding
19-24	Very Satisfactory
13-18	Satisfactory
7-12	Fairly Satisfactory
0-6	Did Not Meet Expectations

2.4. Procedure

Protocols and procedures were followed by the researcher in the collection of quantitative data. Letters requesting to conduct the research study were submitted to the Office of the Regional Director. After the approval was obtained, the researcher forwarded the letter to the Superintendent of each division. With the help of the science teachers, the researcher contacted the teachers at the schools who were able to implement OLIBA and requested the pretest and posttest data.

Before the conduct of the interview, informed consent and assent were secured especially the assent form since three participants in the interview were minors. The participants were oriented on the goals and processes of the study and requested them to affix their signatures. They were accompanied by their teacher during Google Meet but the interview was conducted one group at a time. The researcher ensured that classes were not disrupted, and internet connectivity was addressed perfectly.

2.5. Data analysis

After the gathering of quantitative and qualitative data, these data were analyzed, thematized, and interpreted to answer the research questions. The following statistical tools listed below were utilized based on the data gathered:

- Mean and standard deviation was used to determine the pretest and posttest performance of the students in the experimental and control groups in Science 5.
- Independent Samples t-test was used to determine significant differences in the pretest and post-test performance in Science 5 between groups.
- Thematic Analysis was used to identify themes such as patterns in the data that are important or interesting and use these themes to address the research or say something about an issue. In this context, this determined themes from the participant's experiences about the effect of OLIBA.
- Cross-case Analysis was used to determine similarities and differences between students and teachers in their experience regarding OLIBA.

2.6. Ethical considerations

Ethical considerations in research are a set of principles that guide the study's research designs and practices. Research ethics matter for scientific integrity, human rights and dignity, and collaboration between science and society. These principles make sure that participation in studies is voluntary, informed, and safe for research subjects. In this context, the researcher has asked for the approval of the higher authorities in conducting the study. Informed consent and assent forms were secured. Also, confidentiality and anonymity of data were observed during the presentation and discussion of the findings.

3. Results

Presented in this section are the findings and discussion of the study. The presentation starts with a discussion on the pretest performance of the students in the experimental and control groups in each division. This is followed by a discussion of their post-test performance. Then, a test of difference is presented to determine the significant difference between the experimental and control groups' performance. Next is qualitative finding where themes are presented based on the responses of the participants.

3.1. Pretest performance of the students in the experimental and control group in Science 5

Table 1 presents the pretest performance of the students in the experimental and control group in Science 5. The result shows that students in the experimental and control groups in the Davao Occidental division garnered pretest mean scores of 3.06 and 3.10 respectively. Both mean scores are described as fairly satisfactory. Therefore, this means that students in both groups obtained fair performance in Science 5 in the pretest. Additionally, the performance of students in the experimental and control groups in Davao City obtained a mean score of 10.01 and 7.90 respectively which are described as fairly satisfactory. This indicates that both groups recorded a fair performance. In Tagum City division, the students in the experimental and control group also obtained a fairly satisfactory performance where each group recorded a mean score of 12.47 for the experimental group and 7.63 for the control group. This means that students in each group have demonstrated fair performance. It can be said that the experimental and control groups in the

Table 1

Pretest performance of the students in the experimental and control group in Science 5

Group	Division	N	SD	Mean	Descriptive Interpretation
Experimental		30	3.06	9.60	Fairly Satisfactory

Control	Davao Occidental (SDO A)	30	3.10	8.53	Fairly Satisfactory
Experimental	Tagum	30	3.04	12.47	Fairly Satisfactory
Control	City (SDO B)	30	2.44	7.63	Fairly Satisfactory
Experimental	Davao City	30	3.28	10.07	Fairly Satisfactory
Control	(SDO C)	30	3.44	7.90	Fairly Satisfactory

three divisions have the same manifestations on how students performed in the pretest. This is attributed to the lack of exposure to the topic specifically on motion. The lack of background knowledge is the reason why students have displayed fair performance in the pretest. Further, no intervention aided students on how to master the concepts.

3.2. Posttest performance of the students in the experimental and control groups in Science 5

Table 2 displays the post-test performance of the students in the experimental and control group in Science 5. The results observed that there were improvements or increases in the mean scores between the groups. In Davao Occidental, the experimental group registers a mean score of 25.23 which is interpreted as outstanding while the control group marks a mean score of 21.37 which is described as very satisfactory. In Tagum City, an outstanding performance with a mean score of 26.10 in the experimental group and 18.77 in the control group of very satisfactory are manifested by the students. In Davao City, the experimental group tallies a mean score of 25.83 which is interpreted as outstanding while the control group records a mean score of 18.63 which is labeled as very satisfactory. The performances of the students in the experimental have shown an immense increase which can be attributed to the exposure of students to the implementation of

Table 2

Posttest performance of the students in the experimental and control groups in Science 5

Group	Division	N	SD	Mean	Descriptive Interpretation
Experimental	Davao	30	2.10	25.23	Outstanding
Control	Occidental	30	3.97	21.37	Very Satisfactory
Experimental	Tagum City	30	3.06	26.10	Outstanding
Control		30	3.75	18.77	Very Satisfactory
Experimental	Davao City	30	3.26	25.83	Outstanding
Control		30	2.51	18.63	Very Satisfactory

3.3. Test of difference on the post-test performance of the experimental and control group in Science 5

Table 3 shows the test of difference in the post-test performance of the experimental and control group in Science 5. This section compares the post-test performance of the experimental and control group. The result displays that the posttest performance of the students in the Davao Occidental division garners a t-value of -4.72 with a p-value of .000, in the Tagum City division, it has a t-value of -8.31 and a p-value of .000, and Davao City division with a t-value of -12.25 and a p-value of .000 which are less than .05 in the level of significance, indicating significant difference. This rejects the null hypothesis. This means that students' performance in the experimental and control group significantly differ. The experimental group demonstrated better performance compared to the control group which was given lectures. The effect of OLIBA has contributed big to students' mastery of the competency. It allows students to explore outside their classroom which creates freedom and excitement in discovering things outside the four walls of the classrooms. Further, it allows students to establish a network of collaborations while working on their activity about motion, making learning more meaningful. On the other hand, the control group who is exposed to traditional teaching has also displayed significant improvements where the lecture or discussion from a teacher has allowed pupils to gain mastery of the concept. Yet, it is in OLIBA where learning demonstration has been found more exciting, meaningful, and superior.

Moreover, it is indicative that the three divisions that implemented OLIBA have revealed significant differences. This confirms that implementing OLIBA can enhance or improve the least learned competency, particularly in science 5. Truly, using OLIBA is direly promising to inflict change on pupils' mastery of the competencies in science specifically in schools that do not have functional laboratories. Therefore, exploiting and exploring the use of OLIBA may generate a remarkable and outstanding result.

Table 3

Test of difference on the post-test performance of the experimental and control group in Science 5

Group (Exp-Con) (Posttest)	N	df	t-value	p-value	Decision on Ho	Interpretation
Davao Occidental	60	44	-4.72	.000	Reject Ho	Significant
Tagum City	60	58	-8.31	.000	Reject Ho	Significant
Davao City	60	58	-12.25	.000	Reject Ho	Significant

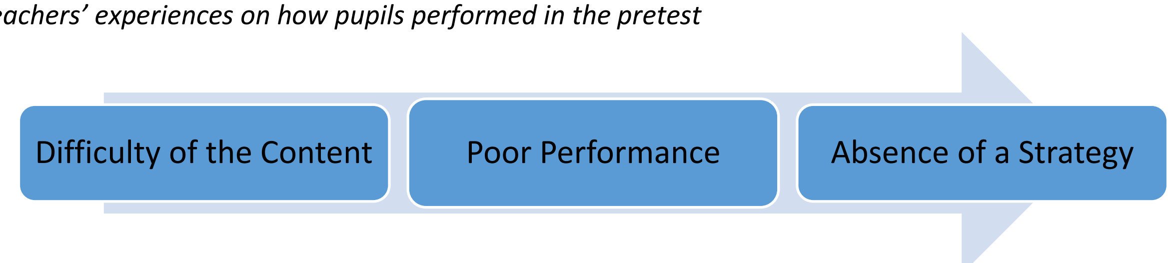
3.4. Experiences of the participants regarding the effect of OLIBA on their performance in Science 5

3.4.1. Experiences before the administration of OLIBA

Highlighted are the themes about participants' experiences before the implementation of OLIBA and the traditional style of teaching in science 5. In the case of the teachers, during the administration of the pretest, the following themes are culled out from their experiences namely, difficulty of the content, poor performance, and absence of a strategy. These themes are displayed in Figure 2.

Figure 2

Teachers' experiences on how pupils performed in the pretest



Difficulty of the Content. This shows that the pupils had no exposure to the topic, thus they performed poorly. As the participants echo that:

Pupils at this level struggle with their understanding of the topic (P1)

The concepts are new, the questions are situational, and higher-order thinking skills are required (P2)

At this stage, the lack of background knowledge has affected pupils on how they have responded to the test since the questions are new to them and require enough skills for them to answer.

Poor performance. This refers to the failure to master the competency among students. As one teacher-participant shares her observation:

> *I believe that the prerequisite and fundamental knowledge of the competencies have not been acquired or developed adequately to aid their understanding of the topic* (P1)

There is a failure in the mastery of the competency since the pupils have no information or knowledge of the topic. The lack of information affects their performance.

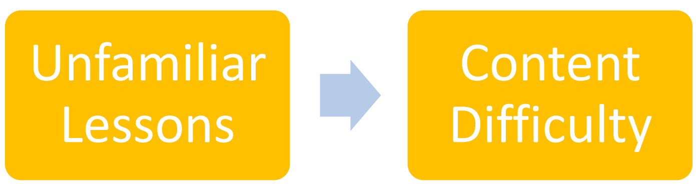
Absence of a Strategy. This refers to the failure to utilize a specific strategy to enhance students' performance. As one participant claims that:

> *The poor performance of the learners in science means teachers should devise a strategy to help them learn more and do more* (P3)

Truly, teachers should devise a strategy that will aid students in mastering the competency. However, during the pretest, the strategy is not yet available since this part measures pupils' understanding of the topic.

Figure 3 presents students' experiences during the administration of the pretest. The following themes emerged namely, unfamiliar lessons and content difficulty.

Figure 3
Students' experiences during the administration of the pretest



Unfamiliar Lessons. This refers to the pupil's lack of exposure to the topic. Participants claim that:

> *My performance is not good because the topic is not familiar* (P1)
> *It was not included in the lessons I took* (P2)
> *Because the lesson was new to me* (P3)

The pupils discovered that the topic was not familiar and they felt that the test was not easy. They encountered words or phrases that were new and not yet discussed by the teacher.

Content Difficulty. This refers to pupils' challenges in answering the test questions. As the participants share that:

> *The test is difficult* (P1)
> *Test was challenging* (P2)
> *Do not have any knowledge yet about the lesson* (P3)

The claim of the participants pointed out the difficulty of the content is due to the lack of exposure and no background knowledge of the topic. This manifestation results in a demonstration of taking a difficult test or the items are found as challenging.

3.4.2. Experiences after the implementation of OLIBA

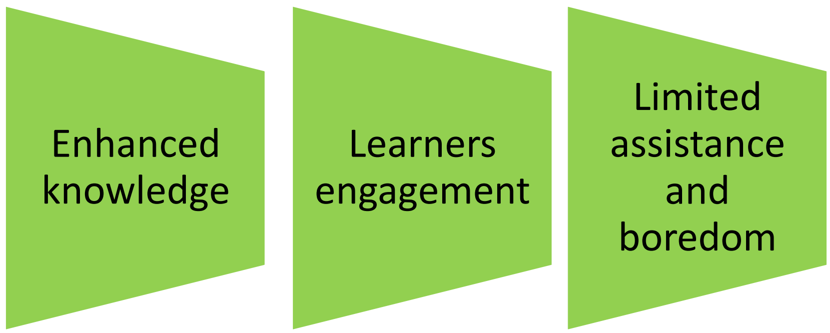
Indicated are the themes after the implementation of OLIBA where the posttest was administered. In the case of the teachers, the following themes emerged namely, enhanced knowledge, learners' engagement, and limited assistance and boredom.

Enhanced Knowledge. Refers to participants' acquisition of knowledge due to exposure to OLIBA.

Learners' knowledge improved evidently when exposed to Outdoor Learning Inquiry-Based Activities (P1)
Their interest and motivation to learn were enhanced (P3)

In this case, OLIBA has contributed big on the part of the pupils. The teacher sees how OLIBA has helped pupils master the competency of motion (figure 4).

Figure 4
Teachers' experience after the implementation of OLIBA



Learners Engagement. Refers to pupils' engagement in activities that apply the knowledge acquired. One participant narrates that:

Not only retained the concept but also engaged in it by applying and assessing their judgment in real-life circumstances (P2),

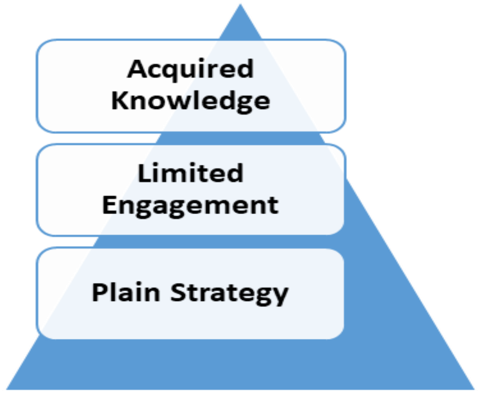
Indeed, OLIBA has aided learners to engage in activities that will enable them to acquire substantial information on the topic. In this context, the more the pupils are exposed to OLIBA, the better the result of their performance or skill.

Limited Assistance and Boredom. Refers to the non-participative nature of the pupils since their teachers are dominating the discussion in the classroom. One participant shared:

But with little guidance from the teacher and/or with some assistance from peers (P3)
In a classroom that is dominated by the teacher, students will get bored once they are not asked or motivated to answer a question. Therefore, every pupil must be actively involved in the activity so they do not get bored (P2).

Figure 5 shows the experiences of pupils after the implementation of OLIBA. Based on the result of the study, the following themes emerged namely, acquired knowledge, limited engagement, and plain strategy.

Figure 5
Students' experiences after the implementation of OLIBA



Acquired Knowledge. Refers to pupils' acquisition of knowledge due to being exposed to OLIBA. As participants echo that:

Allows me to learn the concept of motion (P1)
Understood the concept of motion (P1)
Learned them through the outdoor activities we did at school and home (P2)

The use of OLIBA, helped pupils acquire significant knowledge about motion. In doing so, they may utilize their learning and apply it to their daily activities.

Limited Engagement. Refers to poor participation of pupils during science class. As one participant claims that:

Difficult for me to visualize things that I had not directly touched or encountered (P2)

Therefore, learning via discussion would not contribute particularly to learners' engagement. There should be varied approaches for students to learn and retain his/her learning.

Plain Strategy. Refers to pupils' exposure to the traditional or lecture method. As the participant share:

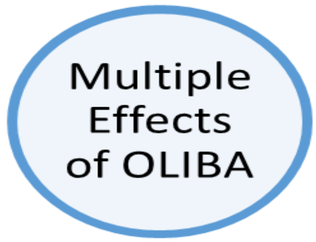
The strategy of the teacher was common and plain (P3)

There should be varied strategies to be employed by teachers in testing the performance of pupils. Every pupil would want to learn the topic with their groupmates or seatmates, thus having activities that will involve them makes the discussion exciting and meaningful.

3.5. Experiences of pupils and teachers on the significant effect of OLIBA

Figure 6 presents the experiences of the participants on the significant effect of OLIBA.

Figure 6
Experiences of the participants on the effects of OLIBA



The teacher-participants identify the following:

Aside from their increase in performance, their interest and excitement to learn were visible during the learning process (P3)
Attention and engagement throughout the lecture discussion (P2)
Have positive effects on student achievement (P1)

The pupil-participants have also shared what they have experienced about the effect of OLIBA:

Simplification of the topic (P1)
Participating in outdoor inquiry-based activities (P2)
I performed better on the test. I was already very knowledgeable about the topic (P3)

Truly, the use of OLIBA has resulted in an improved performance in science. Also, it enables the pupils to acquire substantial knowledge about the topic. It also resulted in collaboration and enjoyment in answering the questions while performing the activities outside the classroom.

3.6. Cross case analysis

Cross-case analysis is a method that facilitates the comparison of commonalities and differences in the events, activities, and processes, the units of analysis in case studies. In this context, pupils' and teachers' experiences are compared based on their experiences before and after strategies are implemented.

Based on the result, in the pretest, both pupils and teachers revealed similarities in content difficulty. The reason behind why pupils performed poorly. The differences highlighted pupils' poor performance, absence of a strategy, and unfamiliar lessons. After the implementation of OLIBA, both pupils and teachers revealed similarities in knowledge acquired and engagement of learners due to OLIBA. Further, the significant effect of OLIBA based on the experiences of the participants has revealed one common theme, multiple effects of OLIBA.

4. Discussion

Outdoor Learning Inquiry-Based Activities. This intervention enables them to acquire substantial skills, particularly in mastering the concept of motion. The outdoor activities that highlighted inquiry-based ways of acquiring knowledge have contributed big to the learning of the grade 5 pupils. This enables them to explore and learn among themselves the topic that is presented. In this regard, a real-time application and acquisition of knowledge are evident in how students understand the topic.

The results above agree with the findings of Alake-Tuenter et al., (2013); and Gillies and Nichols (2015); that the implementation of inquiry activities with younger students also plays an important role in their engagement in science. Additionally, Tekin and Mustu (2021) revealed that the use of research-inquiry-based strategies in science courses in research was found to have a positive impact on students' academic achievement, attitudes, and science process skills. Also,

Further, Johnson and Cuevas (2016) have shown the positive impacts of implementing inquiry-based learning in the science classroom. This suggests that the incorporation of inquiry-based learning within the classroom, inquiry-based learning can lead to strong increases in student engagement, student motivation, and student academic achievement with long-term knowledge retention.

Moreover, outdoor activities allow students to get to know nature and the environment and to be educated in these environments. With such training, it is stated that positive development of students' sensory and cognitive aspects may take place efficiently. It is also known that different learning environments affect students (Becker et al., 2017; Çetken, 2018; Fortus & Touitou 2021) in a desired fashion. Also, according to Thomas (2019), outdoor education takes place in an active learning process with carefully arranged and placed activities and enables experimental learning with non-teacher-fronted or teacher-centered instruction.

The findings align with the findings of Kaya and Yılmaz (2016) examined the achievements and Scientific Process Skills (SPS) of Grade 7 students with two different methods and found a significant difference in the achievement test and Scientific Process Skills (SPS) Test scores of the experimental group, where research-inquiry based learning was applied, compared to the control group taught with the traditional method. Annisa and Rohaeti's (2018) findings showed that students in the inquiry-based learning condition had higher scores for understanding the concept than those taught using the 5M model. It can be concluded that students can develop a better conceptual understanding through inquiry-based learning.

Also, Abdi (2014) supported the above findings that revealed that there is a significant difference in the means score of students taught sciences education using inquiry-based instruction supported 5E learning cycle and those taught using the traditional approach. Additionally, Pandey et al., (2011) and Akpulluku and Gunay (2011) concluded that the inquiry training model has a statistically significant effect over conventional teaching methods on the academic achievement of students. Therefore, classroom teachers should consider how to prepare learning environments in which students will be active by their characteristics and then present these environments to students.

Further, Irwanto et al., (2018) research showed the experimental group with inquiry-based learning scored higher on the post-test results regarding problem-solving and critical-thinking skills. The data is also supported through participating in inquiry-based activities, students can recognize the nature of science, the phenomenon, and scientific concepts; develop their ability to evaluate scientific data critically, and participate in the scientific community. With this study, the experimental group showed a strong correlation between exposure to IBL and increased acquirement of scientific knowledge and processes.

Moreover, Archer-Kuhn et al., (2020) showed the results of their study confirmed the participants had a strong increase in higher-order learning of conceptual knowledge succeeding the participation in inquiry-based learning. Results also discussed the positive increase in the ability to reflect and integrate students' learning with exposure to inquiry-based learning.

5. Conclusions

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

The pretest performance of the students in the experimental and control groups in the three divisions was described as fairly satisfactory. The students in the experimental group demonstrated an outstanding performance in the posttest due to the use of OLIBA while the control group registered a very satisfactory performance with the use of the traditional style of teaching. There was a significant difference in the post-test performance of the students in the experimental and control groups where the experimental group demonstrated an outstanding performance. The improved performance of the students was attributed to the use of OLIBA.

The result of qualitative analysis of participant's experiences in the pretest revealed similarities in content difficulty. The differences highlighted pupils' poor performance, absence of a strategy, and unfamiliar lessons. After the implementation of OLIBA, both pupils and teachers revealed similarities in knowledge acquired and engagement due to OLIBA. Further, the significant effect of OLIBA based on the experiences of the participants has revealed one common theme, multiple effects of OLIBA.

6. Recommendations

From the conclusions drawn, the following recommendations are offered:

1. Strengthen the implementation of Outdoor Learning Inquiry-Based Activities in Science class.
2. Incorporate OLIBA in doing experiments.
3. Monitor Science teachers' utilization of OLIBA.
4. Teachers may employ OLIBA twice in a quarter.
5. Conduct similar studies that may validate the findings.

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