

ASSESSING THE IMPACT OF FIELD STUDY APPROACHES ON STUDENTS' ENVIRONMENTAL AND RESOURCE LITERACY IN KAFANCHAN, NIGERIA

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Abstract

*This research looked into how effectively a field study approach may improve secondary school students' familiarity with their local environment and its resources in Kafanchan, Nigeria. The study was guided by two objectives, from which research questions and hypotheses were derived and statistically tested at the $p \leq .05$ level. Participants were chosen from both public and private institutions, and the study used a quasi-experimental design based on a pre- and post-test with an unequal control group. There were 129 geography students drawn from four distinct classes at four different institutions using a proportional stratified random sampling technique. Participants were evaluated using a series of multiple-choice questions. Lawshe's approach was used to calculate the content validity ratio (CVR= 0.99), and the Cronbach alpha method was used to ensure the instrument was consistent. Participants' knowledge of the environment, available resources, and environmental issues were summarized using percentages and mean scores, and a two-sample t-test was used to determine whether there was a statistically significant difference between the two groups. There was no statistically significant difference between the two groups before treatment ($p = .64831$ at .05), but the results showed that the control group had a greater rate of success on the knowledge exam (41.5% > 29.7%). Furthermore, remarkable outcomes were attained following treatment; there was a statistically significant difference between the treatment group and the control group in terms of pass rate ($p = .00001$ at .05), with the former having a higher pass rate (81.3% > 52.3%). Participants' literacy of the environment, its resources, and related issues improved greatly because of their participation in field studies, suggesting that this instructional strategy is effective. The best method to increase students' understanding of their environments is to ensure that their teachers employ the most effective pragmatic learning strategies. **Keywords:** Environment and Resources, Environmental Problems and Field Study Strategy*

Introduction

In Nigerian secondary schools, environmental education is not taught as a separate subject as it is in many other countries; rather, environmental topics are integrated into the senior level geography curriculum. Content such as discussion, peer tutoring, demonstration, and field study are encouraged for effective learning of the environment and are described in the curriculum (Federal Government of Nigeria, 2007). Sustainable use of natural resources requires proactive measures to head off potential environmental issues before they arise. Adherence to pedagogical standards and principles, such as the selection of appropriate active instructional procedures and resources, and a supportive learning environment, are essential in fostering environmentally conscious students and graduates of Nigeria's secondary schools. Learning about the environment in a practical way can have a positive impact on students.

College-level courses in environmental science fields including geography, geology, ecology, and meteorology benefit greatly from field trips (Elkins & Elkins, 2007; Fuller et al., 2006), a fact that has been known by environmental educators for some time. This is so that they can have first-hand experience studying the world beyond the university's walls. Using direct observations of nature, data collecting, and analysis as the source of knowledge can greatly enhance environmental studies, but this may not be immediately clear. Regardless of whether environmental education is intended for students in a formal or informal setting, it must employ effective teaching methodologies in order to fulfil the goals of the SSGC (Abdullah et al., 2018). As stated by Damar et al. (2015), field study is the most effective method for observing and comprehending both natural and artificial environmental aspects, as well as human-environment interaction.

Learners have been forced to learn about environmental concepts without ever leaving the classroom, using passive teaching methods like the chalk-talk method and classroom demonstration that do nothing to encourage students to actively participate in the learning process. Students obtain a more theoretical and abstract understanding of environmental issues as a result, but they do not improve their learning in any meaningful way. Everything discussed above points to a lack of field study as a contributing factor to environmental education's instructional shortcomings. As a result, there is a discrepancy between the approach taken in the classroom and the nature of the actual materials at students' disposal. In order to test the efficacy of field study technique on environmental and resource literacy, students were exposed to environmental and resource-related problems as part of the study's instructional design.

Purpose of the Study

The purpose of this research was to look at the effects of using a field study technique on the environmental and resource literacy of secondary school students in Kafanchan, Nigeria. The goals of this field study are to:

1. Compare the impact of field study strategy on the environmental and resource literacy of participants in the treatment and control groups.
2. Evaluate how the treatment and control groups' literacy of environmental problems improved due to the adoption of the field study strategy.

Research Questions

The following questions served as the basis for our investigation:

1. How does field study strategy impact on the environmental and resource literacy of participants in the treatment and control groups?
2. How does the treatment and control groups' literacy of environmental problems differ due to the adoption of the field study strategy?

Hypotheses

The following hypotheses were evaluated at $p \leq .05$ level of significance

- H₀₁ Literacy of the environment and available resources are not significantly different between the treatment and control groups due to the adoption of field study strategy.
- H₀₂ The adoption of field study strategy did not significantly increase participants' literacy of environmental problems in either the treatment or control group.

Literature Review

Environmental Education

Awareness of environmental issues, as well as the need to protect and conserve environmental resources, is greatly enhanced through environmental education. The basic objective and focus of environmental education should be an environment free of any indications of environmental issues. However, Erhabora and Don (2016) looked into the correlation between students' environmental literacy and their environmental attitudes, and they found no statistically significant correlation ($r. cal. = -0.078$ $r. tab. = 0.380$ at .05 level of significance). Alexandra and Poyyamoli (2014) found a statistically significant difference in pre- and post-test scores on learners' environmental knowledge and skills between experimental and control groups, while Aminrad, et., al., (2011) reported no statistically significant relationship between learners' knowledge of the environment and attitude towards environmental protection and management in Malaysia. However, research by Mashi, Mohammed, Ubom, and Inkani (2021) found that secondary school students in Katsina, Nigeria, have a moderate to high understanding of environmental issues and their causes, effects, and potential remedies. However, a study conducted by Sultana et al. (2017) in Tangail district of Bangladesh found that, on average, secondary school students in that area had an environmental knowledge score of 15.8 (3.07) out of 20.

Ahmad, Noor, and Ismail (2015) studied students' environmental knowledge, attitudes, and behaviours in relation to the efficient dissemination of environmental communication throughout 16 Malaysian Universities. The results showed that students have a solid foundation of environmental knowledge, but only a moderate correlation existed between students' mindsets and environmentally sound behaviours. As a

result, one cannot infer environmental responsibility from one's mindset alone. Mohd et al, (2020) also studied the effects of environmental consciousness on administrative practices in educational institutions. The study's findings showed no statistically significant gap in environmental literacy between racial groups. However, Al-Rabbani and Al-Shuili (2020) discovered that those with a high level of environmental knowledge also held very favourable environmental attitudes and engaged in only moderately beneficial environmental behaviour. Prior research has only aimed to collect data on students' levels of environmental literacy, that is, how much they know about and care about environmental issues, and how they plan to act in response.

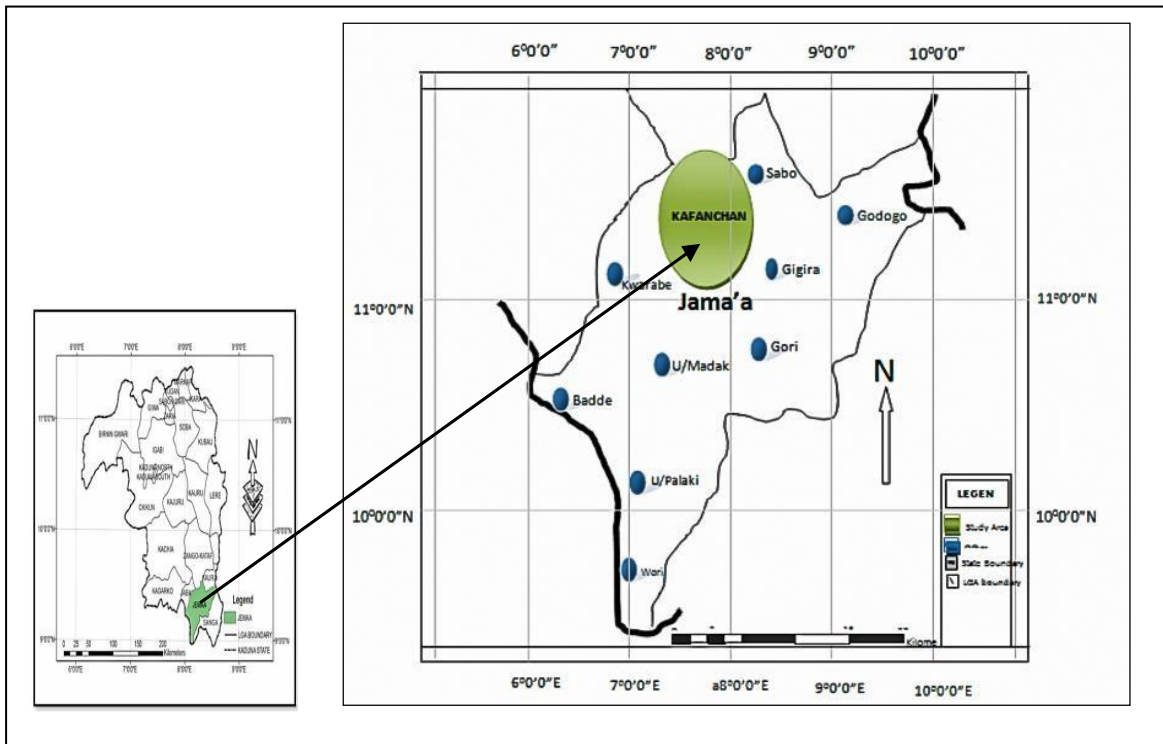
Field Study Strategy

There are pros and cons to using field studies as a learning tool. Some of the advantages of exposing students to new ways of learning and thinking are increased creativity in their thinking, increased productivity in their inquiries, enhanced exploratory skills, accelerated integration, and strengthened conceptual understanding. Learning capacity is boosted by field study methods, which also reveal facts in the field, motivate students to learn, foster physical and social skill development, and give their education a sense of purpose. Nonetheless, field research is often difficult, unpleasant, and expensive (Sundayana, 2016). Subject studies are used as a learning approach to help students acquire the information they need to succeed in their courses and build their expertise in the subject of environmental inquiry (Esteves et al., 2015). Wafula (2015) found that 83 percent of geography teachers in Kenya do not use a field study strategy when instructing students on environmental education content and that 74 percent of students had no exposure to field study in their classrooms. However, Lee (2020) found that students who took part in an inquiry-based fieldwork project that made use of mobile technology learned more about the topic they were researching than they would have otherwise. In addition, 88% exhibit more inquiry-driven behaviours, such as engaging in greater risk-taking and conversation. Field instructional methods can increase environmental knowledge and evoke awareness of the environment because it is faced directly with the real situation of the local environment, resources, and problems that occur around it, as found by Latipah et al. (2019) in Indonesia, who found a statistically significant difference in experimental ecological intelligence compared to control groups using visual media.

Study Area

Kafanchan, Nigeria, occupies 1,661 km² at latitude 9°33' 30" to 9° 36' 30" North and longitude 8° 16' 0" to 8° 20' 0" East in WAT (+). According to Koppen's classification, the region under study has a tropical continental climate, which is denoted by the letter AW and is characterized by alternating wet and dry seasons (Koppen, 1846). Maximum temperature in April is 28.9°C, while minimum temperature in December is 22.9°C. During the wet season, the humidity can reach up to 90%, whereas during the dry season it only reaches 25% to 30%. The annual rainfall is approximately 1800mm with seasonal variation: the wet season is controlled by warm and moist tropical maritime air mass coming from the Atlantic Ocean, while the dry season is influenced by dry, cool, and dusty tropical continental air mass coming from the Sahara Desert, responsible for a condition called Harmattan (Abaje, et. al., 2016). Figure 1 shows the study area.

Fig 1: Map of Kaduna Showing the Study Area



Source: Kaduna State Ministry of Land and Survey 2016

The population is estimated at 79,522 (Mindat, 2016) the climate encourage population mobility, which in turn leads to an increase in the amount of pressure that is placed on the environment as a result of the growth in population. A Precambrian migmatite-gneiss complex, as well as meta-sediments, Pan African granitites, Calc-alkaline granites, and volcanic rocks that date back to the Jurassic period cover the area. These rocks have been altered over the course of time by orogenic movements, which has resulted in an uneven distribution of land surface features such as highland, plateau, lowland, plains, valley, depressions, waterfalls, undulating hills and tectonic ridges, rivers, rich alluvial soil, and weathered rocks (Abaje et al. 2016; Edivie & Olaniyan, 2013).

These features have provided learners with a wide range of areas of environmental interest to study through fieldwork. However, upland areas are rich in red clay and sand but poor in organic matter (Oluyori & Lazarus, 2016). Over cultivation, pollution caused by the careless dumping of trash, and the addition of inorganic compounds to the soil in an effort to restore its lost fertility all contribute to a decline in the soil's overall quality. Despite the fact that substantial practices have been implemented, this has had a negative impact on agricultural yield. However, the vegetation has been greatly modified by human activities such as bush burning, wood fuel logging, farming, timber extraction, mining, and animal grazing which has led to floods, desertification, pollution, and climate change (Zankan, et., al., 2019). The vegetation is guinea savanna and is characterized by tall trees of about 20-40m high, shrubs, and tall grasses up to 3m tall. The region is abundant in both metallic and nonmetallic mineral resources such as tin, iron ore, tantalite, columbite, gemstones, and garnet (David, 2020).

The fertile and well-drained soil enables all types of crops to flourish and be produced in subsistence and commercial numbers (David, 2020). The most common types of crops that are grown for commercial purposes include maize, yam, guinea corn, millet, ginger, groundnut, bean, rice, soya bean and buttered bean, amongst others. Commercial activities depend on these products. The tropical grassland is used for activities such as animal husbandry and lumbering; however, because there is a lack of understanding regarding the most effective methods for protecting the environment, these activities have led to pollution, desertification, deforestation, flooding, waste, and climate change. Fishing, even when done in very modest quantities with pesticides and cactus fluid, contributes to the polluting of water, lowers the quality of

products used in households, and results in the loss of biodiversity. According to Oluyori and Lazarus (2016), the majority of commercial operations consist of the buying and selling of agricultural produce and minerals obtained from mining sites. As a result, the majority of places within the research region are left with heaps of rubbish that contribute to environmental contamination. The transportation system is responsible for an increase in carbon dioxide emissions caused by vehicular congestion (Kim, 2016). These emissions contribute significantly to climate change and pollution.

Method and Procedure

The research employed a quasi-experimental design known as the nonequivalent control group pretest-posttest design. This design involves measuring a dependent variable in one group of participants both before (pretest) and after (posttest) the implementation of a treatment. Additionally, the same dependent variable is measured at pretest and posttest in another group that does not receive the treatment, serving as a nonequivalent control group (Creswell, 2009).

Equation 1: Nonequivalent Control group pre-test post-test Quasi-Experimental Design

$$\beta x_1 \quad X \quad \beta x_3$$

$$\beta x_2 \approx x \beta x_4$$

Where; $\beta x_{1\&2}$ = Pretest, $\beta x_{3\&4}$ = Posttest, X = Treatment (FSS), $\approx x$ = (No treatment)

The educational landscape in the region includes 108 senior secondary schools, consisting of 52 public schools and 56 private schools. These schools offer both mixed-gender and single-gender education, catering to students within specific age ranges. Specifically, students in SS I fall within the age limit of 15-16 years, those in SS II range from 16-17 years, and students in SS III are between 17-18 years old. It is worth noting that some of these schools include boarding facilities, the study participants consist of individuals from households with varying income levels, including low, moderate, and high-income earners. The enrollment numbers of these learners are diverse and are categorized based on school type, educational levels, and gender. A summary of these figures is provided in Table 1.

Table 1: Study Population

Population Enrolment: School Type, Level/Gender							Study Population			
Public Schools			Private Schools				Public (52)		Private (56)	
Level	M	F	Total	M	F	Total	M	850	M	217
SS I	739	646	1,385	204	192	396	F	658	F	187
SS II	850	658	1,503	217	187	404	Total	1,503	Total	404
SS III	945	593	1,538	160	161	321				

Sources: Kaduna State Ministry of Education Annual School Census 2019

The study population consisted of a total of 1,503 male and female learners in public SS II, and 404 learners in private SSS, resulting in a combined 1,907 learners.

The study employed the proportionate stratified random sampling technique to ascertain the appropriate sample size. This method was chosen due to the fact that the strata of interest is a relatively tiny part of the overall population, and relying solely on random processes could potentially result in the inadvertent exclusion of the stratum (Neuman, 2014). The determination of the sample size (n) was conducted by applying the mathematical expression of the Hayes model of a stratified sampling method.

$$\frac{n}{\partial} \times e$$

Where; n= Sample size

∂ = Population size

e = Stratum size

Thus; n = 4, ∂ = 108, e1 = 52, e2 = 56

The researchers employed the basic random sampling technique, utilizing a hat and draw procedure, to choose four mixed boarding public and private schools as the sample schools. The intact classes of SS II were then divided into control and treatment groups based on their pretest results. The study utilized the Creswell 2009 Placement Index (CPI) to allocate intact classes to either the treatment group or the control

group. Classes with lower average scores were assigned to the treatment group, while groups with better average scores were assigned to the control group. The study was predicated on the underlying assumptions that individuals who are part of the intact class with a lower average score will experience an increase in their average score following the implementation of the treatment. The distribution of the sample is displayed in Table 2.

Table 2: Sample Size Distribution

s/n	School	School Type	Number of Participants n=129
1	A	Public	35
2	B	Private	39
3	C	Private	29
4	D	Public	26

Source: *Field Data, 2022*

The intact classes of schools A and D were assigned to the treatment group, whereas schools B and C were assigned to the control group based on their pretest scores, as explained above. The research employed a primary data source, specifically the Environment and Resource Literacy Test, to gather data. Supplementary data was acquired from secondary sources, including journals, maps, and textbooks, among other resources. The assessment tool comprised two distinct components, namely Section A and Section B. Section A was designed to collect information about the demographic characteristics of the participants. On the other hand, Section B was divided into two sub-sections, namely: Sub-section B1 encompassed seven items pertaining to the notion of environment and resources, whilst sub-section B2 consisted of seven items specifically addressing the topic of environmental problems. All of the multiple-choice items were designed with three alternatives, where one option accurately characterized the object while the remaining two options were inaccurate. The study achieved a content validity ratio (CVR) of 0.99 using Lawshe's template, indicating a high level of content validity. Additionally, a reliability index of 0.81 was reached by the application of Cronbach's alpha method, suggesting good internal consistency of the measurements. A pretest was administered to assess the initial abilities of the participants and to assign them to either the treatment or control groups. This was done by delivering a set of 14 test items to all intact classes. Following the assessment, the invigilators collected, assessed, assigned scores to, and documented the test scripts before delivering them to the researchers.

Permission and notification were duly organized and dispatched to the respective communities in which the places of interest are situated. Adequate arrangements were made to ensure the provision of logistics, including transportation, refreshments, and security measures. The school calendar underwent modifications, and the learners were provided with a comprehensive explanation of the goal of the treatment known as FSS. Subsequently, a classroom discussion was conducted to explore the topic being studied prior to engaging in field observation. During the course, students were provided with opportunities to identify various environmental components and resources, along with their associated elements of environmental concerns. This task was completed over the course of two contact periods, each lasting two hours, across a two-week timeframe. Upon their return, participants were granted permission to analyze the data gathered from the field in order to offer facts pertaining to the environment and resources. The treatment group exclusively got the field study strategy intervention, whereas the control group received no treatment and were instructed on the same issues within the classroom setting. The research was carried out simultaneously in four boarding schools with the aim of allocating extra time during study hours for students to analyse field data, engage in discussions, and receive feedback. This approach was adopted to mitigate the potential influence of students' interactions on the data, given that the schools were approximately 3km apart.

Following the administration of treatment, participants in both the treatment and control groups had post-testing. The post-test was conducted independently but simultaneously in both schools. This approach was implemented to mitigate potential interaction effects on the data between learners from both groups, as elucidated in the treatment administration. The duration of the posttest was 60 minutes. The scripts were compiled, annotated, evaluated, and afterwards learner's proficiency and knowledge rating scale were administered, gathered, organized, and recorded for the purpose of data analysis. The analysis of test score data involved the utilization of descriptive statistics, specifically percentages and mean scores, in order to

provide a comprehensive description of participants' knowledge pertaining to the environment and resources. Percentages were employed to ascertain the proportions of learners who achieved pass and fail grades across several sample groups, each with distinct percentage benchmarks. Meanwhile, the mean was utilized to assess the level of knowledge pertaining to learners' environments and resources across the participants. The statistical significance of the descriptive results obtained was determined using a two-sample t-test, with a significance level of .05. The data analysis was conducted using StataMP14 and Excel version 11, with the aim of simplifying the process.

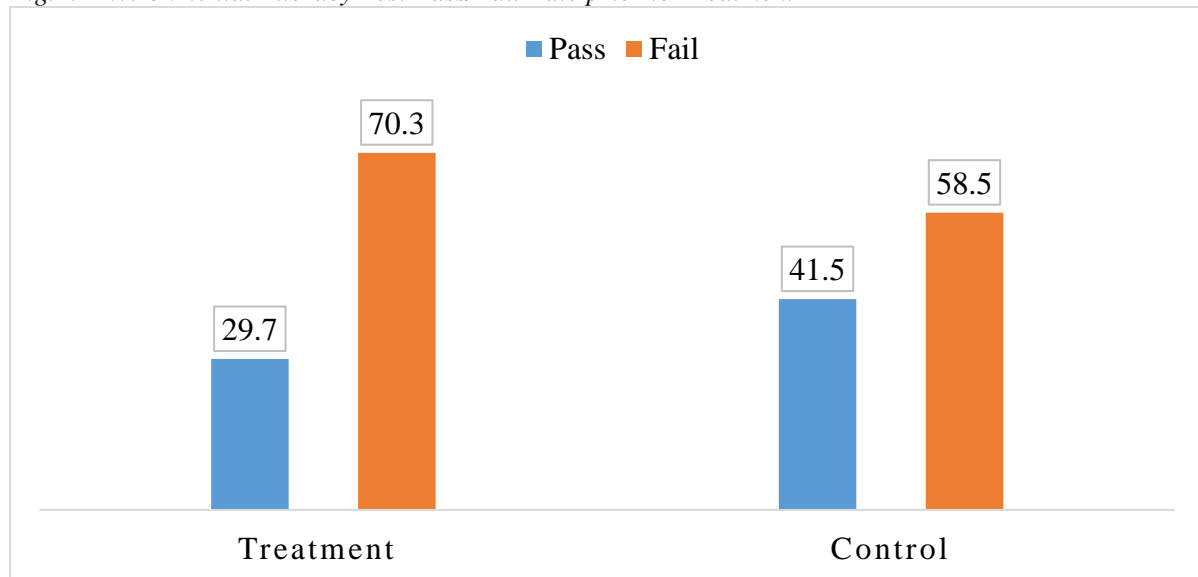
Results and Discussion

The research conducted in the study aimed to determine the impact of field study on the enhancement of participants' literacy of the environment, its resources, and associated problems. The study compared the literacy levels of individuals in both the treatment and control groups. The participants had a pretest to determine their initial understanding of topics related to the environment, resources, and environmental challenges. Additionally, a post-test was conducted to assess the effectiveness of the field study strategy on the treatment group. The findings are succinctly summarized and presented in the subsequent manner.

Literacy of Environment and Resource

A criterion was employed wherein a baseline score of 16, with a maximum attainable score of 28, served as the threshold for pass, while scores below 16 were considered fail. This criterion was utilized to ascertain the number of participants that passed or failed. The findings have been condensed and displayed in Figure 3.

Fig.2: Environmental Literacy Test Pass/Fail Rate prior to Treatment



The findings indicated that among the 64 participants in the treatment group who underwent an environmental literacy test focusing on the concepts of environment and resources, 29.7% achieved a pass score, while 70.3% did not meet the passing criteria. In contrast, the pass rate for the control group was 41.5% while the failure rate was 58.5%. The mean score was utilized to determine the overall scores of the two groups in order to compare them and draw conclusions based on the research questions. Additionally, a two-sample t-test with a significance level of $\leq .05$ was employed to determine if there was a statistically significant difference between the scores of learners from the treatment and control groups. The findings have been summarized and are shown in Table 3.

Table 3: Environmental and Resources Literacy prior to Treatment

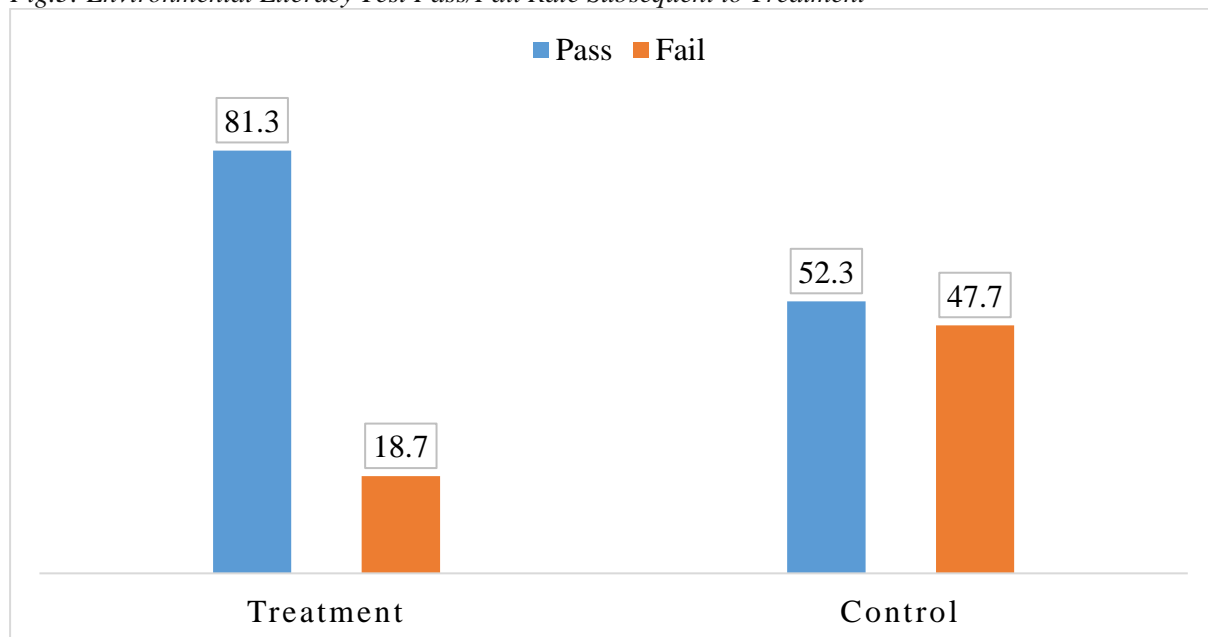
Sample Group	Sample Size (n)	Total Scores (x)	Mean (\bar{x})	Mean Difference
Treatment	64	652	10.2	2.7
Control	65	838	12.9	

The t -value = -1.86259, p -value = 0.64831, $df = 127$. The result is not significant at $p \leq .05$

In contrast, the control group demonstrated superior performance, as evidenced by their higher total score of 838 and mean score of 12.9, in comparison to the treatment group. The treatment group, on the other hand, achieved a total score of 652 and a mean score of 10.2, resulting in a mean difference of 2.7 between the two groups. The statistical analysis produced the following results: $t(127) = -1.86259$, $p = .64831$, indicating that there was no significant difference at the $p \leq .05$ level. The study's findings did not provide sufficient evidence to reject the null hypothesis. Consequently, it can be concluded that there is no statistically significant distinction between the literacy of environmental concepts and resources among the treatment and control groups prior to the implementation of the field study strategy for learning environmental ideas. The findings align with the study conducted by Mashi et al. (2021) which examined the environmental knowledge and perception of secondary school students in Katsina, Nigeria. The study revealed that students in the town possess a moderate level of environmental knowledge pertaining to various aspects such as concepts, resources, causes, consequences, and solutions related to environmental issues. In contrast, Sultana et al. (2017) found that the degree of environmental awareness among secondary level students in Bangladesh was very high, with an average score of 15.83 (± 3.07) out of 20.

The present study conducted a comprehensive investigation into the participants' understanding of the environment and resources subsequent to their exposure to the field study approach. The findings are succinctly summarized and presented in the subsequent manner.

Fig.3: Environmental Literacy Test Pass/Fail Rate Subsequent to Treatment



The findings demonstrated a significant enhancement in the pass rates of learners in the treatment group following their exposure to learning environmental concepts through the implementation of field study strategy. For example, it was seen that 81.3% of the participants in the treatment group successfully completed the literacy test pertaining to the concepts of environment and resources subsequent to their exposure to the field study strategy. Conversely, 18.7% of the participants in the treatment group did not achieve a passing score on the test. Furthermore, it was observed that 52.3% of the learners belonging to the control group successfully passed the literacy test pertaining to the subject matter of environment and resources subsequent to the implementation of the treatment. Conversely, 47.7% of the learners from the same group were unable to achieve a passing score on the aforementioned test. The mean score was utilized

to determine the overall scores of the two groups in order to facilitate comparison and draw conclusions based on the research questions. Additionally, a two-sample t-test with a significance level of $\leq .05$ was employed to determine if there was a statistically significant difference between the scores of learners in the treatment and control groups. The findings have been condensed and displayed in Table 4.

Table 4: Environment and Resources Literacy Subsequent to Treatment

Sample Group	Sample Size (n)	Total Scores (x)	Mean (\bar{x})	Mean Difference
Treatment	64	1490	23.3	8.9
Control	65	964	14.4	

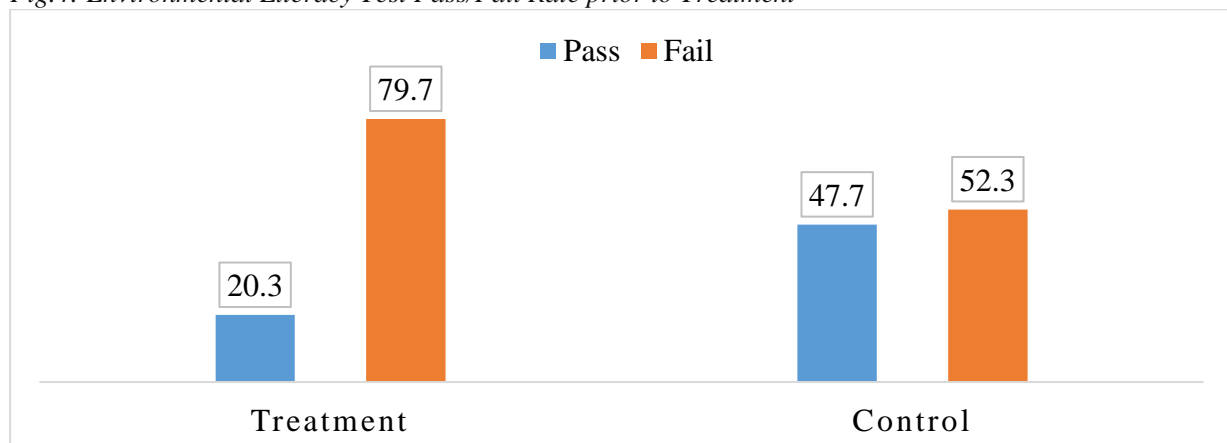
The t-value is 5.4949, p-value $< .00001$, $df = 127$. The result is significant at $p \leq .05$

The treatment group exhibited a cumulative score of 1490 and an average score of 23.3. In contrast, the control group had a cumulative score of 964 and an average score of 14.4, resulting in a mean difference of 8.9. The study confirmed the statistical significance of the data obtained from both the treatment and control groups by conducting a two-sample t-test with a significance level of $p \leq .05$. The results of the statistical analysis, specifically $t(127) = 5.4949$, $p = .00001$ at $p \leq .05$, suggest that there is a significant difference between the two groups being compared. The study provides evidence to reject the null hypothesis, indicating a statistically significant difference in the literacy of environment and resources between the treatment and control group learners. Specifically, the treatment group demonstrated a greater acquisition of knowledge in this area compared to the control group. This difference is attributed to the implementation of a field study strategy for learning environmental concepts, as suggested by the study. The implementation of field study strategy has proven to be a valuable instructional approach that enhances the acquisition of knowledge and the performance of learners in the realm of environmental ideas. The results are consistent with the findings of Latipah et al. (2019), which demonstrated a statistically significant distinction in experimental ecological intelligence when comparing groups exposed to visual media with control groups. The authors' conclusion suggests that employing field educational methods might enhance individuals' environmental knowledge and foster a heightened awareness of the environment. This is attributed to the direct exposure to real-life local environmental situations and resources.

Literacy of Environmental Problems

The research commences by doing an analysis of environmental and resource literacy followed by an investigation into environmental problem literacy. The findings are presented and summarized in the following sub-section. Figure 5 illustrates the distribution of participants who successfully pass or fail the knowledge test prior to receiving any form of treatment.

Fig.4: Environmental Literacy Test Pass/Fail Rate prior to Treatment



The findings depicted in Figure 5 indicate that 20.3% of the participants from the treatment group successfully passed the literacy test pertaining to environmental problems, whilst the remaining 79.7% did not get pass scores. Furthermore, the control group had a pass rate of 47.7%, whereas 52.3% of participants in the same group were unable to achieve pass grade. The mean score was utilized to determine the overall scores of the two groups in order to compare them and draw conclusions based on the research questions.

Additionally, a two-sample t-test with a significance level of $\leq .05$ was employed to determine if there was a statistically significant difference between the scores of learners from the treatment and control groups. The findings have been succinctly summarized and are visually depicted in Table 5.

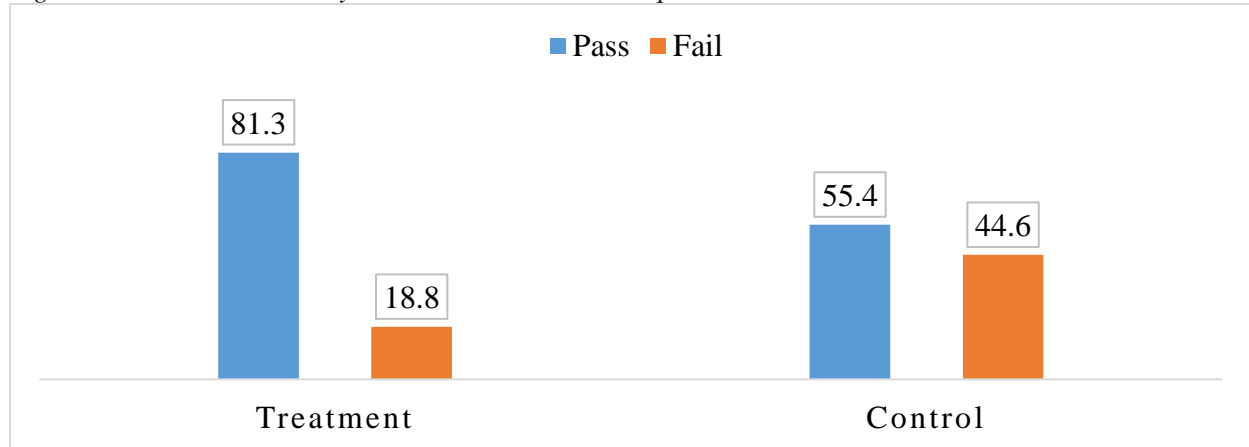
Table 5: Literacy of Environmental Problems prior to Treatment

Sample Group	Sample Size (n)	Total Scores (x)	Mean (\bar{x})	Mean Difference
Treatment	64	390	6.1	0.4
Control	65	424	6.5	

The t-value = -1.6906, p-value = .093362, df = 127. The result is not significant at $p \leq .05$

According to the findings of the study, the control group demonstrated a higher total score of 424 and a mean score of 6.5, in contrast to the treatment group, which exhibited a total score of 390, and a mean score of 6.1. The mean difference between the two groups was calculated to be 0.4. The results of the significance test indicated that there was a statistically non-significant relationship between the variables. The t-value ($t = -1.69062$, $df = 127$) did not reach the critical value at the alpha level of .05, with a p-value of .09336. The study did not find sufficient evidence to reject the null hypothesis, indicating that there is no statistically significant difference between the literacy of the concepts of environmental problems in the treatment and control groups prior to the implementation of the field study learning strategy. The findings align with the study conducted by Mashi et al. (2021), which examined the environmental knowledge and perception of secondary school students in Katsina, Nigeria. The study revealed that pupils in the town possess a moderate degree of understanding regarding environmental problems, including their causes, repercussions, and potential remedies. In contrast, Sultana et al. (2017) found that the degree of environmental awareness among secondary school students in Bangladesh was very high, with an average score of 15.83 (± 3.07) out of 20. The study conducted a further investigation into the participants' understanding of environmental problems subsequent to their exposure to the field study approach. The findings are succinctly summarized and presented in the subsequent manner.

Fig.5: Environmental Literacy Test Pass/Fail Rate Subsequent to Treatment



The results from the implementation of the field study strategy revealed significant outcomes, with 81.3% of participants in the treatment group successfully passing the literacy test on environmental issues, while 18.8% of participants in the same group did not attain a passing score. The control group achieved a pass rate of 55.4% and a failure rate of 44.6% on the environmental problem literacy test. The mean score was employed to assess the overall performance of the two groups, facilitating comparison and enabling conclusions to be drawn in relation to the research questions. Additionally, a two-sample t-test was conducted with a significance level of $\leq .05$ to determine any statistically significant differences between the scores of learners in the treatment and control groups. The results are clearly summarized and visually displayed in Table 6.

Table 6: Literacy of Environmental Problems Subsequent to Treatment

Sample Group	Sample Size (n)	Total Scores (x)	Mean (\bar{x})	Mean Difference
Treatment	64	1392	21.8	6.3
Control	65	1004	15.4	

The t -value = 4.67158, p -value <.00001, $df = 127$. The result is significant at $p <.05$

The participants in the treatment group demonstrated an enhancement in their understanding of environmental issues, reflected by a total score of 1392 and an average score of 21.8. The increase can be credited to the efficacy of the field study strategy utilized in the research. The control group achieved a cumulative score of 1004 and an average score of 15.4, demonstrating a difference of 6.3. The improvement noted in the control group can be linked to the repetition of concepts, given that the same concepts were presented during the baseline assessment before the treatment commenced.

The significance test produced the following results: $t(127) = 4.67158$, $p = .00001$, with a significance threshold of $p \leq .05$. The study found sufficient evidence to reject the null hypothesis, demonstrating a statistically significant difference in the understanding of environmental problem concepts between the treatment group and the control group after the application of the field study learning strategy. The results are consistent with Lee's (2020) research on the implementation of an inquiry-based fieldwork project that incorporates mobile technologies. Lee noted that students involved in the field project demonstrated improved knowledge acquisition related to the specific subject of study. Moreover, a substantial majority of individuals, specifically 88 percent, demonstrate increased levels of inquiry-driven behaviours. The behaviours observed include heightened engagement, curiosity, and verbal expression, especially concerning the concepts that are presently being examined or studied.

Conclusion

The findings of the study demonstrate that the application of the field study technique yielded positive outcomes in enhancing participants' environmental literacy, which includes knowledge pertaining to environmental resources and issues.

Recommendations

The following recommendations have been presented.

1. To enhance the acquisition of environmental concepts and foster active participation in the educational process, it is essential for educators to efficiently organize field studies. This will enhance the learners' engagement and support their overall knowledge acquisition and performance enhancement.
2. It is essential for education policy makers to swiftly implement the field study strategy as a required and strongly endorsed method for gaining insights into environmental concepts. This measure would facilitate an enhanced understanding of the environment among learners.

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