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Research Article

The Effects of Structured Outdoor Learning on Students' Attitudes in Environmental Science

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ABSTRACT

This study examined students' learning attitudes before and after the integration of structured outdoor activities into Environmental Science instruction. A quasi-experimental research design was used to assess changes across seven dimensions of attitudes toward outdoor learning: Environmental Interaction, Integration, Student Cohesiveness, Teacher Supportiveness, Open-Endedness, Preparation and Organization, and Material Environment. Mean scores increased across all categories after the intervention, with several dimensions shifting from Neutral to Agree. A paired-samples t test revealed a significant difference between students' pretest and posttest attitude scores toward outdoor learning. The computed t value of -7.65 at the 0.05 significance level supports the effectiveness of integrating structured outdoor learning. Notable improvements were observed in student cohesiveness and open-endedness, indicating enhanced collaboration, engagement, and learner autonomy. Expert evaluation also rated the developed outdoor activities highly in terms of objectives, content alignment, clarity, and cognitive rigor. Overall, the findings provide empirical support for structured outdoor learning as an effective pedagogical strategy in Environmental Science education.

Keywords: *Environmental Science, Outdoor activities, Outdoor education, Outdoor learning*

Introduction

Science teaching and learning can take place in lecture rooms, laboratories, and authentic outdoor environments. In many science classes, concepts are introduced in the classroom, while laboratories provide opportunities for experimentation using specialized apparatus and equipment. Outdoor environments,

however, offer experiential learning opportunities in which students engage directly with real-world settings and learn through inquiry. Learning that takes place outdoors and incorporates the surrounding environment into the instructional process is commonly referred to as outdoor learning. Most forms of outdoor learning draw on experiential approaches

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grounded in constructivist learning theory (Townley et al., 2024). In the Philippines, the most common large-scale outdoor activity is the field trip, which is typically conducted once each academic year and often treated as a requirement rather than as an integral part of the curriculum. Outdoor activities are not commonly integrated into the formal educational system because they are not explicitly embedded in the curriculum at either the basic or higher education levels.

Another concern is that teachers may not be fully aware of how to systematically integrate outdoor activities into the subjects they teach. In some cases, they may already be using related strategies without recognizing them as forms of outdoor learning. Outdoor learning refers to the process of acquiring knowledge outside the traditional classroom (Abdullah et al., 2021). Outdoor activities may enhance students' academic performance by engaging them meaningfully in learning tasks, promoting social interaction with classmates and community members, and helping them appreciate the relevance of what they learn through direct experience in real-world environments.

Abdullah et al. (2021) noted that the use of outdoor spaces for learning can create discomfort when adequate learning tools and facilities are lacking. Teachers, as facilitators of outdoor activities, must therefore be prepared not only during implementation but also before and after each activity. Before the activity, teachers should prepare tasks that align with the course syllabus and consider the specific locations where the activities will be conducted. After each activity, teachers should synthesize students' outputs and integrate the data gathered outdoors into subsequent classroom discussions. Pretest and posttest evaluations should also be administered to measure students' attitudes toward the integration of outdoor activities in the subject.

The aim of this study was to develop enrichment outdoor activities in Environmental Science and to examine their integration into instruction by identifying students' attitudes toward this approach. The outdoor activities included field trips, environmental inventories, simulations, community immersion, and outdoor games.

Students' attitudes toward outdoor learning were measured using the Science Outdoor Learning Environment Inventory (SOLEI). Originally developed by Tamir (1983) and later modified and implemented by Hofstein and Orion (1994), the instrument was further adapted by the researcher to suit the context of the present study.

Objectives of the Study

The general objective of the study was to assess students' attitudes toward outdoor learning before and after the integration of developed outdoor learning activities in Environmental Science.

Specifically, it aims to:

1. Determine students' attitudes toward the integration of outdoor activities in terms of:
 - a. Environmental interaction.
 - b. Integration.
 - c. Student cohesiveness.
 - d. Teacher supportiveness.
 - e. Open-endedness.
 - f. Preparation and Organization.
 - g. Material Environment.
2. Identify Environmental Science topics suitable for the integration of outdoor activities and develop corresponding instructional materials.
3. Determine whether there is a significant difference between students' pretest and posttest attitude scores.
4. Evaluate the developed outdoor activities in terms of objectives, content, language and format, and activities.

Methodology

The study employed a quasi-experimental research design. Quasi-experimental designs examine the effects of an intervention on purposively selected participants (Capili & Anastasi, 2024). In this study, the intervention consisted of structured outdoor activities, and the aim was to determine their effect on students' attitudes toward learning outdoors.

The participants were 85 Bachelor of Industrial Technology students majoring in Automotive Technology who were enrolled at Bulacan State University–Bustos Campus during the first semester of Academic Year 2025–2026

and were taking Environmental Science. Purposive sampling is commonly used across research paradigms because it helps ensure that an appropriate sample is selected in relation to the purpose of the study, thereby strengthening the relevance and trustworthiness of the findings (Nyimbili et al., 2024). In the present study, only two sections of BIT students were taking Environmental Science; therefore, the participants were purposively selected by the researcher.

The instrument used was the validated Science Outdoor Learning Environment Inventory (SOLEI) developed by Hofstein and Orion (1996) to assess students' attitudes toward outdoor learning. The instrument consists of seven dimensions: Environmental Interaction, Integration, Student Interaction, Student Cohesiveness, Teacher Supportiveness, and Open-Endedness. The original 55-item instrument was modified by the researcher to 45 items and administered as both a pretest and a posttest.

Permission to conduct the study was secured from the program chair of the College of Industrial Technology of Bulacan State University – Bustos Campus.

The researcher revised the Environmental Science syllabus and developed enrichment outdoor activities. Students were grouped into seven outdoor learning groups based on their academic background and previous Science, Technology, and Society grades. The SOLEI was administered before and after the implementation of the outdoor activities. A weighted mean was used to determine the average responses for each SOLEI item using a five-point Likert scale.

Results and Discussion

A. Learning Attitudes of students towards learning Environmental Science before and after the integration of outdoor activities

Table 1 presents the general average of students' responses in each category. The seven SOLEI categories include Environmental Interaction, Integration, Student Cohesiveness, Teacher Supportiveness, Open-Endedness, Preparation and Organization, and Material Environment.

The table below presents students' pretest and posttest attitudes before and after the integration of outdoor activities.

Table 1. Pretest and Posttest Students' Attitudes Toward Outdoor Learning Activities

CATEGORIES	PRE ATTITUDE	POST ATTITUDE
Environmental Interaction	3.51 (Agree)	4.22 (Agree)
Integration	3.31 (Neutral)	4.38 (Agree)
Student Cohesiveness	3.31 (Neutral)	4.60 (Agree)
Teacher Supportiveness	3.20 (Neutral)	4.50 (Agree)
Open Endedness	3.14 (Neutral)	4.53 (Agree)
Preparation and Organization	3.53 (Agree)	4.30 (Agree)
Material Environment	3.78 (Agree)	4.45 (Agree)
	3.39 (Agree)	4.42 (Agree)

The Environmental Interaction category offers students the opportunity to pursue their own science interests through outdoor activities. Students are allowed to go beyond regular outdoor assignments and conduct their own studies, and they are involved in investigating outdoor phenomena. Before the integration of outdoor activities, the students' agreement with the statements under the environment interaction category was evident, as their average response was 3.51, interpreted as agree.

After the integration of outdoor activities, their responses increased to 4.42, also interpreted as agree. In the study by Abdullah et al. (2021), in tertiary education, knowledge is not the only thing enhanced when students engage in outdoor activities; it also allows students to engage in social, economic, and cultural activities. In the formal learning setting at the college level, there is minimal exposure to outdoor learning activities because they use exam-related educational programs (Abdullah et al., 2021). The

integration of outdoor activities in the current study paved the way for greater student exposure to activities best done outside the classroom.

The observed increase in Environmental Interaction indicates that students became more actively involved in the exploration and understanding of environmental phenomena through direct experience. Rather than studying real-world problems only through textbooks, outdoor learning offers authentic situations in which students can examine these issues firsthand. This finding is consistent with experiential learning theory, which emphasizes that knowledge is constructed through direct engagement with the environment. Similarly, Townley et al. (2024) reported that outdoor learning activities in higher education improve student involvement, environmental awareness, and the ability to relate abstract ideas to real-world environmental contexts.

According to Polley et al. (2025), nature-specific outdoor learning is vital for students' psychological, cognitive, and general well-being and should be integrated into each student's education within their particular setting. The next category is integration, and it shows how outdoor activities are closely connected to what students learn in their regular science classes. The lessons discussed inside the classroom are continued and deepened through hands-on experiences outdoors. Students apply what they have learned, gather and analyze data, and bring their observations back to the classroom for further discussion. Teachers also use these outdoor experiences to explain concepts more clearly. In this way, outdoor activities are not separate from classroom learning but are an extension of it, helping students better understand and solve problems related to their lessons. During the pretest, the students' average score was 3.31, which is interpreted as neutral, as they have not yet experienced the real integration of outdoor activities into learning Environmental Science. The posttest average is 4.38 and interpreted as agree, this showed that the students' attitudes towards the category integration have been improved right after experiencing the actual outdoor activities.

Students reported stronger links between classroom instruction and real-world environmental experiences, as evidenced by the improvement in the Integration category. The abstract ideas covered in Environmental Science became more tangible and meaningful through outdoor activities. This result is consistent with the findings of Townley et al. (2024), who highlighted how outdoor learning facilitates the transfer of knowledge from classroom settings to real-world situations. Similarly, Abdullah et al. (2021) found that experiential outdoor activities promote deeper understanding by allowing students to apply scientific ideas in authentic contexts.

The next category is student cohesiveness. This category highlights how outdoor activities encourage teamwork and meaningful interaction among students. During these activities, students depend on one another for help, share ideas, and work together to accomplish tasks, especially when challenges arise. Outdoor learning provides opportunities for students to get to know each other better and allows quieter classmates to become more confident and participative. Group discussions and collaborative problem-solving are common, promoting active engagement in learning rather than purely social interaction. Overall, outdoor activities foster cooperation, communication, and share responsibility among students. The pretest score is 3.31 and is interpreted as Neutral and the post test score is 4.60 and is interpreted as Agree. After the integration of outdoor activities, the student cohesiveness or students' dependence on each member of the group has increased.

The collaborative nature of outdoor learning assignments may explain the increase in student cohesiveness. Many activities required students to share responsibilities, work in groups, and identify solutions to environmental issues. These interactions help students develop cooperation, communication skills, and mutual support. Mann et al. (2022) found that outdoor learning environments promote the development of social competence and cooperative learning behavior. Support from both teachers and classmates also plays an important role in students' cognitive engagement (Neville et al., 2023).

The fourth category is Teacher supportiveness. This category focuses on the role of the teacher in facilitating outdoor activities. The teacher pays attention to what the pupils say and ask during outside activities. During the activities, the teacher helps learners who fail with their assignments and pays close attention to any further questions. During outdoor activities, the instructor behaves nicely toward the pupils and refrains from discussing personal things with them.

During the preassessment on students' attitudes towards learning outdoors, the weighted mean of the responses in this category is 3.20 and is interpreted as Neutral and right after the integration of outdoor activities, the weighted mean turned out to 4.50 and is interpreted as Agree. This showed that the students appreciated the teachers' supportiveness while the students are doing some outdoor activities.

The results imply that teacher facilitation is critical to the success of outdoor learning experiences. Before, during, and after outdoor activities, students need effective guidance to remain engaged and achieve the intended learning objectives. Neville et al. (2023) emphasized that educators play a crucial role as outdoor learning facilitators by designing engaging activities that encourage students to think critically, discuss their findings, and actively participate in the learning process.

Teachers in preservice and in-service education need training on how natural or out-of-the-classroom settings can be used effectively to support student learning (Polley et al., 2025). According to Imana (2025), learner-centered teaching strategies are more effective than teacher-centered methods in supporting students' psychological needs.

The fifth category is Open-Endedness. This category reflects the extent to which students are encouraged to learn independently. It includes whether students understand what they are doing during outdoor activities, whether they invest effort in learning, and whether they are able to express themselves freely while performing the activities. The weighted mean during the pretest was 3.14, interpreted as Neutral, and it increased to 4.53, interpreted as Agree, after the intervention. This suggests that students were able to express themselves more

freely and use their time more effectively while completing outdoor activities.

Additionally, the higher posttest score suggests that outdoor learning promoted learner autonomy and inquiry-based thinking. Students were given opportunities to investigate environmental issues independently, formulate explanations, and make observations. These experiences foster critical thinking and self-directed learning, both of which are important goals of modern science education. According to Mann et al. (2022), outdoor learning environments are well suited to fostering creativity, problem-solving skills, and learner autonomy.

Student motivation and engagement are essential prerequisites for classroom instruction, and 21st Century skills are becoming increasingly accepted as significant educational goals alongside academic knowledge. Environmental outdoor learning settings may be a perfect setting for fostering students' interest in acquiring and enhancing their 21st century skills (Mann et al., 2022).

The next category is Preparation and Organization. This category includes the preparation undertaken before, during, and after the integration of outdoor activities. It also includes teachers' instructional strategies in implementing the activities and the materials they provide, such as worksheets that guide students in completing the tasks. The pretest weighted mean was 3.53, interpreted as Agree, while the posttest score was 4.30, also interpreted as Agree.

The positive assessment of Preparation and Organization suggests that the outdoor activities were supported by careful planning, structured worksheets, and clear instructions. Neville et al. (2023) emphasized the importance of effective planning and preparation in the development of high-quality outdoor learning programs because these practices support both student safety and meaningful learning outcomes. Their study also highlighted the importance of aligning the environment, the learner, and the educator in creating immersive outdoor experiences that promote learning.

The last category is the material environment. The category includes the readiness of the material and equipment needed for

outdoor activity. This also confirms if the outdoor activity focuses on the phenomena that cannot be investigated in the classroom.

The improvement in perceptions of the Material Environment emphasizes the importance of providing suitable instructional materials and authentic environments for environmental education. Outdoor locations expose students to natural phenomena that cannot be fully recreated in the classroom, thereby enriching their learning experiences. According to Townley et al. (2024), authentic environmental settings promote higher levels of student engagement, curiosity, and ownership of learning, which in turn contribute to improved educational outcomes.

The weighted mean of the pretest was 3.78, interpreted as Agree, while the posttest score was 4.45, also interpreted as Agree. This confirms that the activities assigned to students were appropriate and involved phenomena that are better understood outside the classroom. Reported benefits of learning in natural outdoor settings include increased student engagement and ownership of learning, some evidence of academic improvement, the development of social and collaborative skills, and improved self-concept factors (Polley et al., 2025). Mann et al. (2022) likewise reported that connecting students with natural spaces can support both physical and mental well-being.

B. Topics in Environmental Science in which outdoor activities are integrated

The topics in Environmental Science in which the outdoor activities were integrated were based on the revised course syllabus. The

topics covered in the developed outdoor activities manual were suggested by the faculty members teaching Environmental Science across courses. These topics are scientific method, scientific naming, population ecology, population distribution, herbal medicines, energy consumption, environmental degradation, environmental restoration and waste management.

Most of the activities were conducted for three (3) hours, except for one (1), which is the activity 10 (Are you managing it well?) because the students need to ask permission from the industry they choose to visit prior to the actual day of visitation. The activity also required research papers that they needed to relate to the actual practices of the chosen visited industry.

The outdoor activities were based on the suggested topics included in the revised syllabus. Almost all chapters in the syllabus include outdoor activities except for the chapter entitled Community Ecology. The researcher created activities based on the availability of the area that is only confined within the school vicinity and nearby community. The learning topic Population Ecology includes two (2) outdoor activities because two of its sub topics were applicable for the integration of outdoor activities. Activity 8 (*Stop Your Contribution in Any Type of Degradation*) was made out of integration to two topics namely Environmental Degradation and Environmental Issues.

Table 2 shows the outdoor activity number, time allotment for each activity and title of the activity based on the topics in Environmental Science.

Table 2. Selected Topics with the Integrated Outdoor Activities in Environmental Science

Activity no./ Time Allotment	Topics	Title of the Outdoor Activity
1 (3 hrs)	Scientific Method	<i>"Ecological Problems... Let us solve it!"</i>
2 (3 hrs)	Scientific Naming	<i>"Knowing the Hidden Identity"</i>
3 (3 hrs)	Ecosystems	<i>"Go Beyond Normal Surveying"</i>
4 (3 hrs)	Population Ecology	<i>"Carrying Capacity"</i>
5 (3 hrs)	Population Ecology	<i>"Pattern Matters"</i>
6 (3 hrs)	Human Health	<i>"Phytoremediation"</i>
7 (3 hrs)	Energy	<i>"How much do you consume? How much can you conserve?"</i>

Activity no./ Time Allotment	Topics	Title of the Outdoor Activity
8 (3 hrs)	Environmental Degradation Environmental issues	"Stop Your Contribution in Any Type of Degradation"
9 (3 hrs)	Environmental Restoration	"Project Restoration"
10 (6 hrs)	Waste Management	"Are You Managing It Well?"

The outdoor activities developed were based on the selected topics in Environmental Science where the titles and brief discussion are the following:

Ecological Problems...Let us solve it! The outdoor activity focuses on the ecological problems that can be encountered inside the vicinity of BSU Bustos. This includes the identification of the problem and solving of each problem by the application of the step by step procedure of the scientific method.

Knowing the Hidden Identity. This allows the students to roam around the vicinity of the university to look for plants wherein they will identify the common and scientific names of each plant. The scientific and common names will be written on a wooden board and will then be attached to the identified trees or be placed near the small plants.

Go Beyond Normal Surveying. The activity focuses on the study of the relations of the biotic and abiotic components of a certain area. The students will examine the abiotic factors such as the pH level of soil, temperature in the area, salinity and will relate these to the living organisms occupying the area.

Carrying Capacity. This center on the population density of each class rooms in BSU – Bustos. The students will identify the area of the designated classrooms, will count the number of occupants and will compute for its population density. They will identify if the class rooms have a healthy or unhealthy carrying capacity based on the computed population density.

Pattern Matters. This is about the different distribution patterns of populations. The students will look for different populations of organisms and will identify the pattern where each belongs. They will also identify the advantage and disadvantages of each distribution pattern in the given population.

Phytoremediation. This activity is all about the development of herbarium or herbal

garden inside the vicinity of the university. The students will provide herbal plants and will then identify the uses of each plant. The students will be responsible in the maintenance of the garden for the entire semester.

How much do you consume? How much can you conserve? The activity focuses on the consumption of electricity of each student at home and the ways they can do to conserve their electrical consumption.

Stop the Contribution in Any Type of Degradation. In this activity, the students will identify environmental issues in a specific community and investigation also of its effects and contribution to the degradation of the environment.

Environmental Restoration. This is all about the identification of specific area inside the vicinity of the university or in their homes that needs a simple restoration. After the identification, the students will restore the specific degraded area.

Are You Managing it Well? This activity focuses on the waste management measures in each discipline: Food Service and Management, Electrical Technology, Electronics Technology, Automotive Technology and Computer Technology. The students will visit field that is related to their course and will examine waste management in that particular area. They will examine if the chosen area they visited is practicing proper waste management.

C. Level of significance on Students' attitude toward outdoor learning before and after the integration of outdoor activities

The computed difference of the pre and post attitude of students towards learning outdoor shows that there is a significant difference in its value as revealed by the computed t value of -7.65, which is greater than the critical value of ± 2.447 at the 0.05 level of significance (two tailed). The result indicates that there is a significant change in students' attitudes toward

outdoor learning using the enrichment integrated outdoor activities in Environmental Science.

Based on the observations made by the researcher, the students were attentive and performed well in the outdoor assignments given to them. The performance of the students in accomplishing the tasks contributed to their high-performance scores and also to their written exams. The students had a higher retention because of outdoor activities where they learn by themselves and by the actual involvement in the environment.

The result showed the effectiveness of the integration of outdoor activities in teaching Environmental Science confirmed by the difference in the students' attitude towards outdoor learning before and after the integration of the strategy.

The significant shift in the students' view after the intervention backs up earlier study showed how useful outdoor learning is for learning. Outdoor classrooms let students learn through hands on activities, guided questions and group projects that keep them interested and motivated. According to the results of Mann et al. (2002), students who have planned outdoor activities are more likely to be engaged, have better social interactions, and have a good outlook on learning. Also, Townley et al.

(2004) said that outdoor learning in higher education helps students make links between what they are learning in school and the real world, which makes their learning experiences better. The students' environmental interaction helped in their ability to do the given tasks. The integration of outdoor activities in the subject was carefully made and enhanced the students' understanding in the selected topics in Environmental Science. The teacher's supportiveness contributed to the students' achievement in doing the tasks. The students' social abilities have been developed upon doing the learning activities because they were able to interact with their classmates and other members of society.

D. Expert's evaluation on the developed outdoor activities.

As shown in Table, the item that got the highest mean of 5 and interpreted as Very Great Extent are from the item that states "The objectives give the idea of what is expected at and five (5) with a mean of 4.4 which is interpreted as Very Great Extent. This means that the objectives stated in the activity enable to develop scientific attitude and skills and he set of objectives' area aimed in the development of the three educational domains. The overall weighted mean for Objectives is 2.92 which is of Moderately Extent.

Table 3. Experts' Evaluation on the Developed Outdoor Activities

	ITEMS	Mean	Interpretation
	OBJECTIVES		
1	The objectives give the idea of what is expected at the end of the activity.	5	Very Great Extent
2	The objectives are stated in measurable/ behavioural terms.	4.6	Very Great Extent
3	The objectives stated in the activity enable to develop scientific attitude and skills.	4.4	Great Extent
4	The objectives are attainable after the performance of the activity.	4.8	Very Great Extent
5	The set of objectives' area aimed in the development of the three educational domains: cognitive, affective and psychomotor.	4.4	Great Extent
	AVERAGE MEAN	4.64	Very Great Extent
	CONTENT		
1	The activity performed is relevant and in accordance with the existing course syllabus. (see attached syllabus)	4.8	Very Great Extent
2	The activity provides an insight and understanding of the importance of performing it.	5	Very Great Extent
3	The information presented in the activity is up to date.	4.4	Great Extent
4	The activity is substantiated with enough concepts and principles in Environmental Science	4.4	Great Extent
	AVERAGE MEAN	4.65	Very Great Extent
	LANGUAGE AND FORMAT		
1	There is logical relationship and smooth flow of ideas to the previous activity performed.	4.8	Very Great Extent
2	The instructions, questions and activities are clear.	5	Very Great Extent
3	The format organizations (i.e. font size and style) enable to easily identify the activity presented.	4.4	Great Extent
	AVERAGE MEAN	4.73	Very Great Extent
	ACTIVITIES		
1	The activity serves to facilitate better understanding of the topics discussed.	4.8	Very Great Extent
2	The activity stimulates critical thinking.	4.6	Very Great Extent
3	The instructions in the activity are clearly stated.	4	Great Extent
4	The activity facilitates the achievement of the description.	4.4	Great Extent
5	There are provisions for the development of higher cognitive skills such as critical thinking, learning by doing and inquiry.	5	Very Great Extent
	AVERAGE MEAN	4.56	Very Great Extent

The data revealed that the item in Content that gained the highest mean is the item one (1) with a mean of 4.8 with an interpretation of Very Great Extent. This reveals that the activity performed is relevant and in accordance with the existing course syllabus. However, the item that got the lowest mean is the item four (4) with a mean of 2.8 with an interpretation of Moderately Extent. Meaning, information presented in the activity is moderately up to date. The overall weighted mean is 4.64 which is Extremely Great Extent.

The Language and Format got the average weighted mean of 4.73 which is Very Great Extent. The item “The instructions, questions and activities are clear” received the highest mean score of 5, indicating a Very Great Extent. The item that gained the lowest mean of 4.4 which is Great Extent is “The format organizations (i.e. font size and style) enable to easily identify the activity presented”.

Further analysis of data showed that the overall mean of Activities is 4.56 which is of Very Great Extent. The item that gained the highest mean of 5 is from the item five (5). This means that there are provisions for the development of higher cognitive skills such as critical thinking, learning by doing and inquiry. However, the item that got the lowest mean of 4 was from item three (3) which is interpreted as Great Extent. This means that the instructions in the activity are clearly stated.

Conclusion

The findings of the study indicate that students' attitudes toward learning Environmental Science improved significantly after the integration of structured outdoor activities. Across the seven categories of the Student Outdoor Learning Environment Inventory (SO-LEI)—Environmental Interaction, Integration, Student Cohesiveness, Teacher Supportiveness, Open-Endedness, Preparation and Organization, and Material Environment—scores increased from the pretest to the posttest. The computed *t* value of -7.65 exceeded the critical value at the 0.05 level, confirming that the observed differences were statistically significant.

The outdoor activities improved learners' autonomy and engagement and strengthened

collaboration among group members. The developed outdoor activities were also positively evaluated by experts, indicating that the objectives, content, format, and activity design were appropriate for effective instruction.

Overall, the findings confirm the pedagogical value of structured outdoor learning as an effective strategy for enhancing engagement, collaboration, and positive learning attitudes in Environmental Science.

Limitations

The current study has several limitations that should be considered when interpreting the findings. First, the study involved only 85 Bachelor of Industrial Technology students at Bulacan State University–Bustos Campus enrolled in Environmental Science, which limits the generalizability of the findings to other academic programs or institutions. Second, the study did not include a comparison group and focused on only one group of participants, making it difficult to attribute observed changes solely to the intervention. Third, the study primarily examined students' self-reported attitudes toward outdoor learning and did not assess other outcomes such as academic performance, environmental literacy, retention of learning, or long-term behavioral change. Future studies may address these limitations by using more rigorous experimental approaches, larger and more diverse samples, and additional outcome measures.

Recommendations

It is recommended that Environmental Science educators integrate structured outdoor learning activities into their teaching practices to promote positive learning attitudes, student engagement, and collaborative learning. Educational institutions may also provide professional development opportunities that equip teachers with the knowledge and skills needed to design and implement effective outdoor learning programs. Future researchers may replicate this study using larger and more diverse samples, including control groups, to strengthen causal inferences. They may also examine how outdoor learning influences academic performance, environmental literacy,

critical thinking, and pro-environmental behavior. In addition, the integration of outdoor learning strategies into other subject areas and educational levels may be explored in future research.

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