

Enhancing Pedagogical Teaching in Forestry and Environmental Science Through Ecopark in Ifugao: A Case Study

Eric D. Bimmoy^{1*}, May Grace O. Ongan², Gemma B. Dumansi³

¹College of Agriculture and Sustainable Development, Ifugao State University, Potia Campus, Alfonso Lista, Ifugao 3608, Philippines

Email: ericbimmoy@ifsu.edu.ph

²College of Education, Ifugao State University Potia Campus, Alfonso Lista, Ifugao 3608, Philippines

Email: Mhayigracia@gmail.com

³College of Education, Ifugao State University Potia Campus, Alfonso Lista, Ifugao 3608, Philippines

Email: gemmaadumansi@gmail.com

ABSTRACT

CORRESPONDING

AUTHOR (*):

Eric D. Bimmoy

(ericbimmoy@ifsu.edu.ph)

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The field-based learning in an ecopark also known as Ecological Trail and Reservation Site of Indigenous Trees (ECOTRIS) located in Ifugao State University, Philippines, plays an essential role in evolving pedagogical teaching, particularly in forestry and environmental science. This case study examines how ECOTRIS serves as a dynamic, hands-on learning environment, fostering experiential education in key areas such as morphology, taxonomy and dendrology, biodiversity conservation, climate change mitigation, and sustainable land use practices. ECOTRIS, with its diverse ecosystem of indigenous trees, wetlands, and endemic species, offers students a real-world setting to apply theoretical knowledge and advance practical skills in sustainable management in forestry and environmental science. One of the most important contributions of ECOTRIS is the integration of real life identification of trees in the field into the teaching curriculum. This allows for a holistic approach to education, where traditional classroom simulation practices and sustainable forest management techniques are explored alongside modern scientific concepts. The site also provides a unique platform for studying the relationship between forest ecosystems and soil health, facilitating lessons on pedology, erosion control, and the role of trees in nutrient cycling and carbon sequestration. ECOTRIS is also instrumental in teaching students about biodiversity conservation, serving as a refuge for various endemic and endangered species. Using quantitative methods (correlation analysis) and qualitative feedback, results reveal that ECOTRIS-based learning significantly improves student performance, engagement, and comprehension of biodiversity and sustainability.

Contribution/Originality: The originality of this study lies in its innovative application of field-based learning through the Ecological Trail and Reservation Site of Indigenous Trees (ECOTRIS). It bridges indigenous knowledge with modern pedagogy,

promoting experiential education in forestry and environmental sciences. This approach enhances student engagement, comprehension, and performance, emphasizing sustainability and biodiversity conservation.

1. Introduction

A growing number of research in field-based learning indicates that high-impact practices, including project-based and experiential learning, play a significant role in enhancing undergraduate student growth and success (Balleisen et al., 2014). This change has been driven by increasing apprehensions that teacher education programs have prioritized knowledge and frameworks over the development of essential complex teaching practices, such as expediting discussions and modelling content. As a result, learners may be inefficiently prepared for the competencies required in everyday classroom settings (Grossman et al., 2018). In the last twenty years, teacher education has gradually embraced practice-based pedagogies aimed at improving the skills of pre-service teachers for employing multifaceted teaching practices. This marks a departure from pedagogies that mainly focus on building the knowledge and theoretical frameworks indispensable for teaching (Ball & Cohen, 1999; Grossman et al., 2018; Lampert, 2010; McDonald et al., 2013).

Field-based knowledge pertains to information tied to a specific area, locality, or geographic region. As Shannon and Galle (2017) explain, field-based education, often referred to as place-based education, emphasizes integrating local communities and environments into the learning process. They highlight the importance of understanding one's starting point as a foundation for meaningful progress. Moreover, place-based education fosters connections between learners, their communities, and ecological surroundings. By addressing the question, "Where are we?" this approach helps students recognize the interplay between education, society, and the environment (Maharjan et al., 2024). However, the movement toward more practice-oriented approaches has not been supported by comprehensive studies assessing their effectiveness, which are critically needed given the strong theoretical foundations of both conceptually-focused and practice-based methods in teacher education (Cochran-Smith et al., 2016; Mancenido, 2023). This approach brings students closer to their surroundings, facilitating a better understanding of relevant issues.

Gras-Velazquez and Fronza (2020) assert that place-based education deepens students' understanding of environmental and social issues by engaging them in reflective, experiential activities within schools and communities, transcending the confines of conventional classroom instruction. Similarly, Shannon and Galle (2017) highlight that disregarding context can result in missed learning opportunities. Consequently, place-based education prioritizes the importance of context and critiques teaching approaches that isolate learners from their environment and meaningful connections to their communities and ecological environments (Maharjan et al., 2024).

Over the past decade, the Philippine education system has faced significant criticism due to the underwhelming performance of Filipino students in global assessments. The Philippine education system is confronted with numerous urgent challenges, with the quality of education being one of the most critical issues. Many schools, especially public institutions, suffer from large class sizes, a lack of adequate instructional materials, and outdated teaching methods (Tracy, 2024). The Ecological Trail and Reservation Site of

Indigenous Trees (ECOTRIS) is an extension project, situated at Ifugao State University, Potia Campus, Alfonso Lista, Ifugao, Philippines, plays a crucial role in enhancing pedagogical teaching, especially in the fields of forestry, environmental science, and sustainability education. This case study explores how ECOTRIS functions as a dynamic, hands-on learning environment that promotes experiential education in essential areas such as soil science, biodiversity conservation, climate change mitigation, and sustainable land use practices.

According to [Fry \(2019\)](#) a place-based approach could effectively address these complex challenges. These approaches, characterized by their collective, adaptive, and versatile nature, are regarded as effective strategies for addressing localized challenges. Incorporating valuable place-based knowledge into the school curriculum is crucial for addressing environmental concerns. According to [Goodlad and Leonard \(2018\)](#), place-based knowledge serves as a regenerative process, cultivating a deeper engagement and interest in environmental issues in one's local environment.

Consequently, the research question arises: How do the academic performance metrics (e.g., GPA, test scores) of students in ECOTRIS-based learning compare to those who are not involved? Are there specific subjects or areas where ECOTRIS participants perform significantly better or worse than non-participants? This question reflects the necessity to enhance pedagogical approaches to be more context-sensitive and to equip students with the skills to confront this regenerative process supports addressing the global challenge of sustainability. The research question was co-created with collaborators through a process of self-assessment and critical reflection on their existing perspectives and beliefs. The study hypothesized that: Null Hypothesis (H0): There are no significant differences in student learning outcomes between the different teaching methods. Alternative Hypothesis (H1): At least one teaching method results in significantly different student learning outcomes.

1.1. Research Objectives

The primary objective of this research is to examine how the Ecological Trail and Reservation Site of Indigenous Trees (ECOTRIS) at Ifugao State University serves as a dynamic, hands-on learning environment to enhance pedagogical teaching in forestry and environmental science. The study focuses on assessing the effectiveness of ECOTRIS-based field learning in comparison to traditional classroom and non-ECOTRIS field-based methods. Specifically, it aims to evaluate the impact of these methods on student academic performance, engagement, and comprehension of biodiversity, sustainability, and other related subjects.

The research also seeks to explore the integration of indigenous knowledge with modern scientific concepts and assess how ECOTRIS contributes to fostering sustainable environmental stewardship through experiential education

2. Literature Review

2.1. Field-Based and Experiential Learning

Field-based learning, also known as place-based education, emphasizes integrating the local environment into the curriculum. [Shannon and Galle \(2017\)](#) argue that this approach allows students to form stronger connections with their communities and the

ecological environment, enhancing both educational and environmental awareness. Place-based education fosters engagement by connecting learning to real-world ecological challenges. Research suggests that experiential learning methods improve student performance. [Fedesco et al. \(2020\)](#) found that field-based learning in higher education promotes practical knowledge retention, fosters enthusiasm, and enhances student motivation to learn, especially in subjects like forestry and environmental science. These findings align with ECOTRIS-based education's goals, which aim to provide students with practical field experience and a deeper understanding of ecological concepts.

2.2. Comparison of Traditional and Experiential Methods

[Grossman et al. \(2018\)](#) advocate for practice-based teaching approaches over purely theoretical methods, arguing that experiential learning prepares students more effectively for professional challenges. This is especially relevant in fields like forestry, where hands-on learning is critical for understanding complex ecological relationships. The ECOTRIS study compares such experiential methods with traditional classroom settings, demonstrating significant performance benefits in field-based learning. Incorporating indigenous knowledge into modern education is emphasized as a way to bridge traditional and scientific knowledge, enhancing cultural relevance in the curriculum. [Goodlad and Leonard \(2018\)](#) highlight that integrating local, place-based knowledge enriches students' understanding of their environment and fosters sustainable stewardship. ECOTRIS's role in including indigenous perspectives aligns with this approach, as it exposes students to sustainable land use practices and biodiversity conservation.

2.3. The Role of Demographics and Prior Knowledge

Research indicates that demographic factors, such as age, gender, and prior knowledge, may impact student engagement in different educational settings. For example, [Bednall et al. \(2014\)](#) found that informal learning environments, like field sites, encourage active learning across diverse student backgrounds. Similarly, the ECOTRIS study found no significant differences in demographic engagement, suggesting that field-based learning is accessible and beneficial for all students. Field-based experiential learning can foster long-term academic and professional benefits by enhancing critical thinking, practical skills, and retention of complex concepts. [Roberts \(2016\)](#) argues that outdoor learning environments support holistic educational approaches that can enrich traditional curricula. This aligns with the ECOTRIS project's objective of creating lasting educational impacts through hands-on engagement in environmental science and forestry.

3. Research Methods

3.1. Research Method

Quantitative approach was employed, this was implemented through statistical analysis to compare academic performance metrics between the experimental and control groups. A qualitative approach was also conducted such as interviews and focus groups with students and educators to gather insights on their experiences and perceptions regarding academic performance related to ECOTRIS participation. This combine quantitative and qualitative approaches provided a holistic understanding of the impact of ECOTRIS-based learning, Non-ECOTRIS and Traditional teaching method. Ethical

consideration was given priority, permission was obtained from the student participants, they were required to read to consent letter and attached their signature if they are willing to participate in the research, all data obtained were considered confidential, name of students were not revealed.

3.2. Sample Groups

Experimental group was identified, students of Bachelor of Science in Forestry second year participated in ECOTRIS Field-based, Traditional classroom and Non-Ecotris field base in learning programs. A selected comparable group of students not involved in ECOTRIS was also prepared. The researchers matched groups on key demographics such as age, gender, and prior academic performance to control for confounding variables. 60 students subdivided into 3 groups were performed as an appropriate sample size using power analysis to ensure statistical validity.

3.3. Sampling Process

Participants were matched across demographics such as age, gender, and prior academic performance to minimize confounding variables. A power analysis was performed to determine that 60 participants (distributed across the three groups) would ensure statistical validity.

3.4. Data Collection

Academic performance metrics was determined through collection of quantitative data on standardized test scores, and specific assessment scores (FBS 211: Taxonomy, Morphology and Dendrology tests) relevant to the curriculum. A field test wherein student will identify the sample live specimen of tree leave using phylotaxy was prepared, 5 leaves specimen were predetermined by the instructor for them to identify, they were asked to write the common name, scientific name and family name of the trees. Gathering of data was done over a one semester within academic year to measure performance changes. Demographic information was collected such as data on (age, gender, prior knowledge) using surveys to account for potential confounding variables.

3.5. Data Analysis

The statistical software SPSS was employed to analyze academic performance data. ANOVA and Chi square was used to compare performance metrics between the two groups, focusing on mean differences and statistical significance ($p < 0.05$). Correlation analysis was performed to examine relationships between participation in ECOTRIS and academic performance outcomes. Then we transcribed and analyzed qualitative data from interviews or focus groups using thematic analysis to identify key themes, insights, and potential influences on academic performance.

4. Results

4.1. Demographic profile of the students

Figure 1 presents the entrance to the Ecological Trail and Reservation Site of Indigenous Trees (ECOTRIS), established in 2019 as a dedicated field laboratory for Bachelor of Science in Forestry students, specifically for courses in Morphology, Taxonomy, and

Dendrology. This site, funded by the University Extension Office, has supported several research and extension projects, enhancing experiential learning opportunities. [Figure 2](#) illustrates students engaged in three distinct experiential learning modes: (A) ECOTRIS field-based learning, offering hands-on experience with native species; (B) traditional classroom simulation instruction and (C) non-ECOTRIS field-based learning. This study offers the first causal evidence demonstrating that three experiential teaching methods in teacher education improve teaching performance compared to more traditional, theory-centered approaches. Unlike earlier studies, such as [Kavanagh and Rainey \(2017\)](#), this research employs an experimental design to validate these findings.

Figure 1: The entrance of the Ecological Trail and Reservation Site of Indigenous Trees (ECOTRIS)



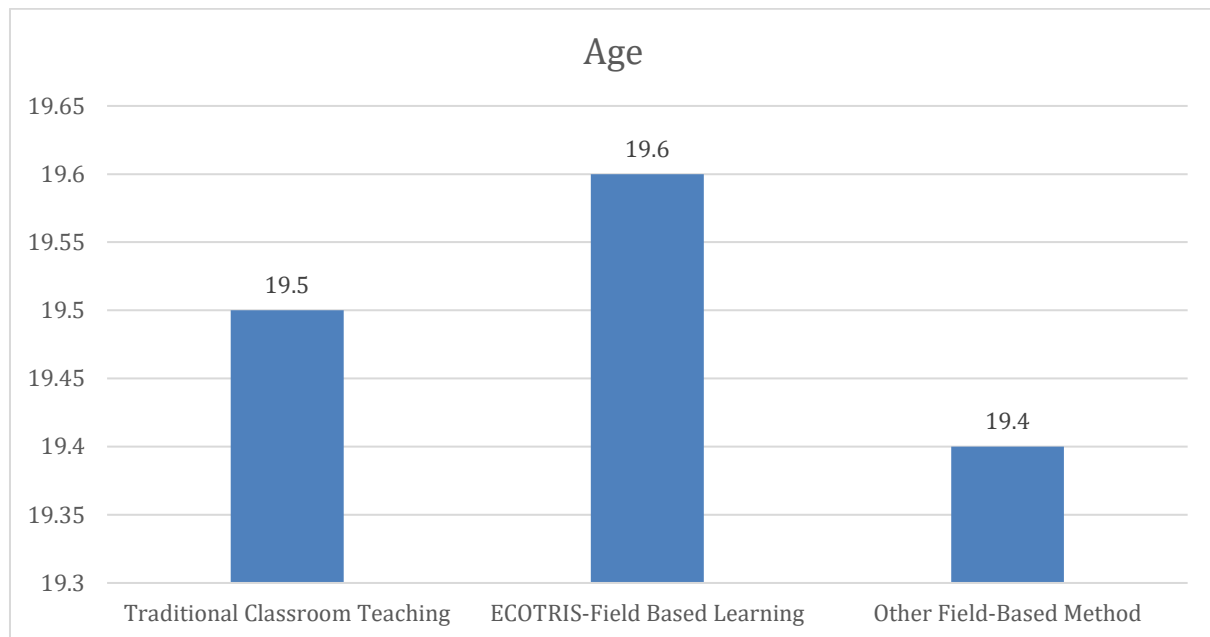
Figure 2: The student learning across three experiential teaching method (A) ECOTRIS Field-based (B) Traditional classroom (C) Non ECOTRIS field-based



4.2. Ages of students

The demographic variable of age reveals a minor variation among different experiential teaching methods as shown in [Figure 3](#). In traditional classroom teaching, the average age of participants is 19.5 years, closely aligning with 19.6 years for ECOTRIS-field based learning and 19.4 years for other field-based methods. This minor dissimilarity suggests that students across these learning environs are of similar age, which may affect their engagement levels and learning inclinations.

Figure 3: Ages of students in the different teaching method



Field-based learning in higher education is diminished both in its implementation at colleges and in the academic literature (Fedesco et al., 2020). Field-based learning, particularly in the ECOTRIS context, may deal distinctive advantages, such as practical experience and direct interaction with the environment, which could enrich understanding and remembering compared to traditional methods. However, the comparable average age specifies that the potential benefits of field-based learning might be available to all participants, regardless of their age. Therefore, informative approaches should be tailored to influence these gains while compliant to the education needs and inclinations of students in different demographic groupings.

4.3. Gender of students

Figure 4 shows the study analyzing gender distribution across different experiential teaching methods highlights a consistent representation of males and females across traditional classroom, ECOTRIS field-based learning, and other field-based methods. Males constituted 48% in traditional classrooms, 50% in ECOTRIS-based learning, and 49% in alternative field-based approaches, while females represented 52%, 50%, and 51%, respectively.

These findings indicate a balanced gender distribution across all teaching methods, suggesting that neither approach is more favorable for a specific gender in terms of engagement. The close percentages may reflect the inclusive nature of these educational environments, which could encourage participation from all students regardless of gender. Bednall et al. (2014), Berg and Chyung (2008) found that women were more likely to engage in informal learning, whereas Wolfson et al. (2018) observed either the opposite effect or no significant difference. This lack of significant variation in gender engagement suggests that teaching methods, whether traditional or field-based, can effectively cater to diverse student populations. Consequently, educators should focus on enhancing instructional strategies to foster engagement and active learning for all genders.

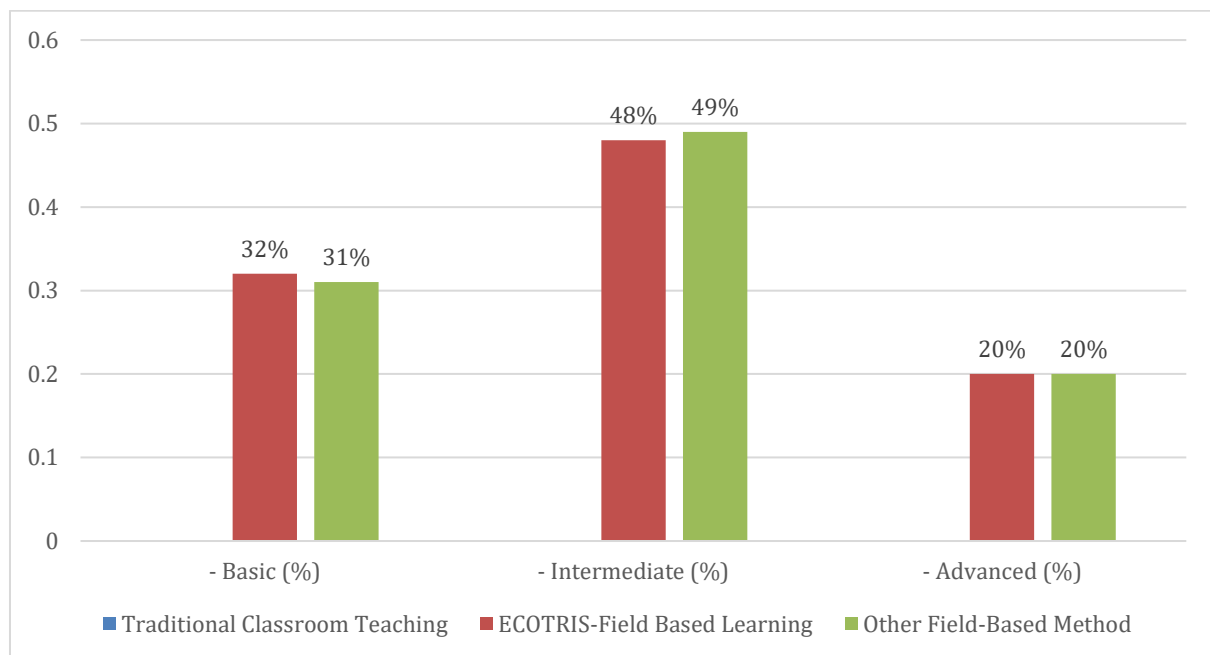
Figure 4: Student gender in the different teaching method



4.4. Prior knowledge of student on the subject

In Figure 5 it shows the study examining the impact of prior knowledge on student participation across three experiential teaching approaches traditional classroom teaching, ECOTRIS field-based learning, and other field-based methods reveals comparable distributions of prior knowledge levels among students.

Figure 5: Students prior knowledge in the subject



Basic-level students represented 30% in traditional classrooms, 32% in ECOTRIS learning, and 31% in other field-based methods. Intermediate-level students accounted

for 50%, 48%, and 49% across the methods, while Advanced-level students consistently made up 20% in all three teaching approaches. The student feedback is overwhelming they said that in the field inside ECOTRIS, they were able to retained knowledge with ease.

These findings suggest that prior knowledge levels are similarly distributed, indicating that each teaching method attracts a diverse range of student backgrounds. The slight variations in basic and intermediate categories imply that while some methods may appeal slightly more to students with different prior knowledge, all approaches effectively engage a balanced mix of learners. This diversity offers educators the opportunity to design tailored instructional strategies that accommodate varying knowledge levels, enhancing overall participation and learning outcomes for all students.

The [Table 1](#) present the demographic variables age, gender, and prior knowledge level across three teaching approaches (traditional classroom, ECOTRIS field-based learning, and other field-based methods) found no statistically significant differences that could influence the choice of teaching method. For age, the averages were nearly identical: 19.5 years in traditional classrooms, 19.6 in ECOTRIS, and 19.4 in other field-based methods. An ANOVA test confirmed this uniformity, yielding a p-value greater than 0.05, indicating no significant age differences.

Table 1: Statistical result in the demographic profile across different experiential teaching method

Demographic Variable	Traditional Classroom Teaching	ECOTRIS-Field Based Learning	Other Field-Based Method	Statistical Test	p-value
Age	19.5	19.6	19.4	ANOVA	> 0.05 *ns
Gender (%)				Chi-square	> 0.05 *ns
- Male	48%	50%	49%		
- Female	52%	50%	51%		
Prior Knowledge Level				Chi-square	> 0.05 *ns
- Basic (%)	30%	32%	31%		
- Intermediate (%)	50%	48%	49%		
- Advanced (%)	20%	20%	20%		

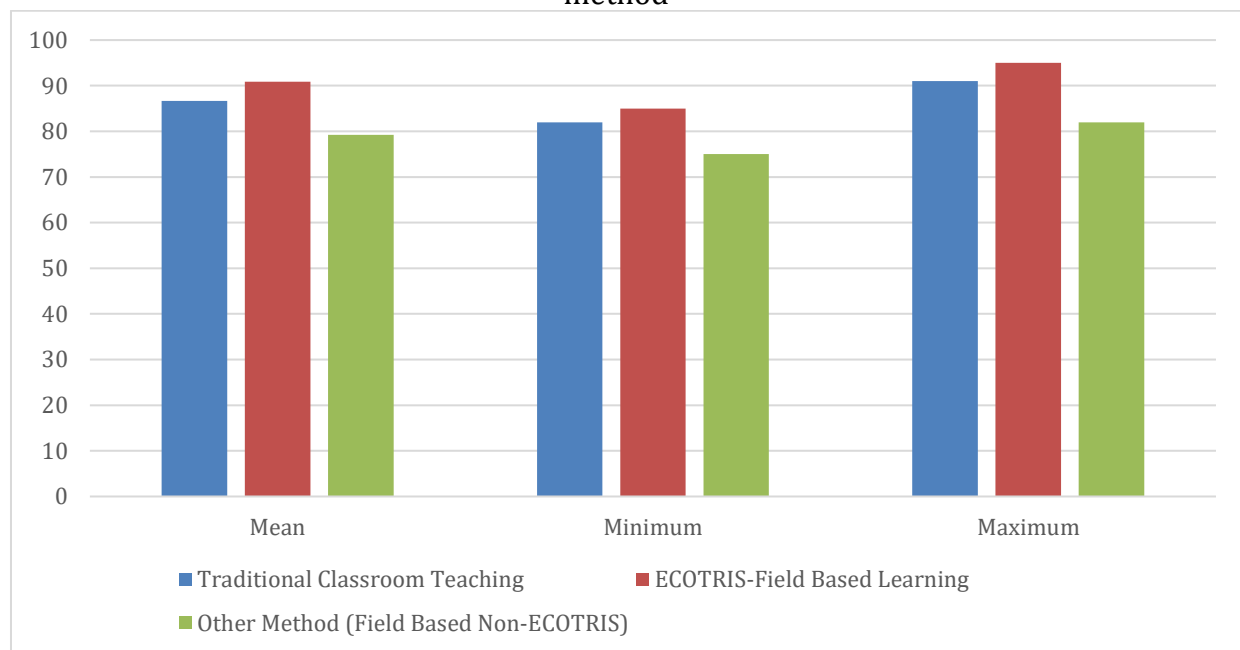
ns: no statistically significant differences among the demographic variables of participants across the three teaching methods

Gender distribution was similarly balanced, with males comprising 48% in traditional, 50% in ECOTRIS, and 49% in other field-based methods, while females represented 52%, 50%, and 51%, respectively. A Chi-square test supported the lack of significance with a p-value greater than 0.05. Regarding prior knowledge levels, the study reported evenly distributed categories of Basic, Intermediate, and Advanced across all methods, with no significant differences confirmed through Chi-square tests ($p > 0.05$). These results indicate that demographic factors did not significantly impact student engagement or the effectiveness of the teaching methods evaluated. The student shared their though after the field in various site that the ECOTRIS were the best site where they can easily familiarize with the phyllotaxy of plants.

4.5. Average score of students in different experiential teaching method

The descriptive statistics for each experiential teaching method provide a clear comparison of their effectiveness in enhancing student performance is shown in [Figure 6](#). For Traditional Classroom Teaching, the mean score is 86.67, with a minimum score of 82 and a maximum score of 91, indicating a relatively consistent performance among students using this method. In compare, the ECOTRIS-Field Based Learning method establishes a higher average score of 90.87, with a minimum of 85 and a maximum of 95. This suggests not only greater overall performance but also a tapered range of scores, which indicates a higher level of regularity among students engaged in this experiential learning environment. Lastly, the Other Method (Field-Based Non-ECOTRIS) yields a mean score of 79.20, with a minimum score of 75 and a maximum of 82, reflecting significantly lower performance levels and less variability than the other methods. [Murphy's \(2001\)](#) study on the social interactions of field backpackers supports the notion that ordinary shared experiences can help foster deeper connections. Although the student said that they can feel safer inside the room specially against wild animals or organism such as parasite in the field, their feedback in term of field work are positive.

Figure 6: Student average score in the field across different experiential teaching method

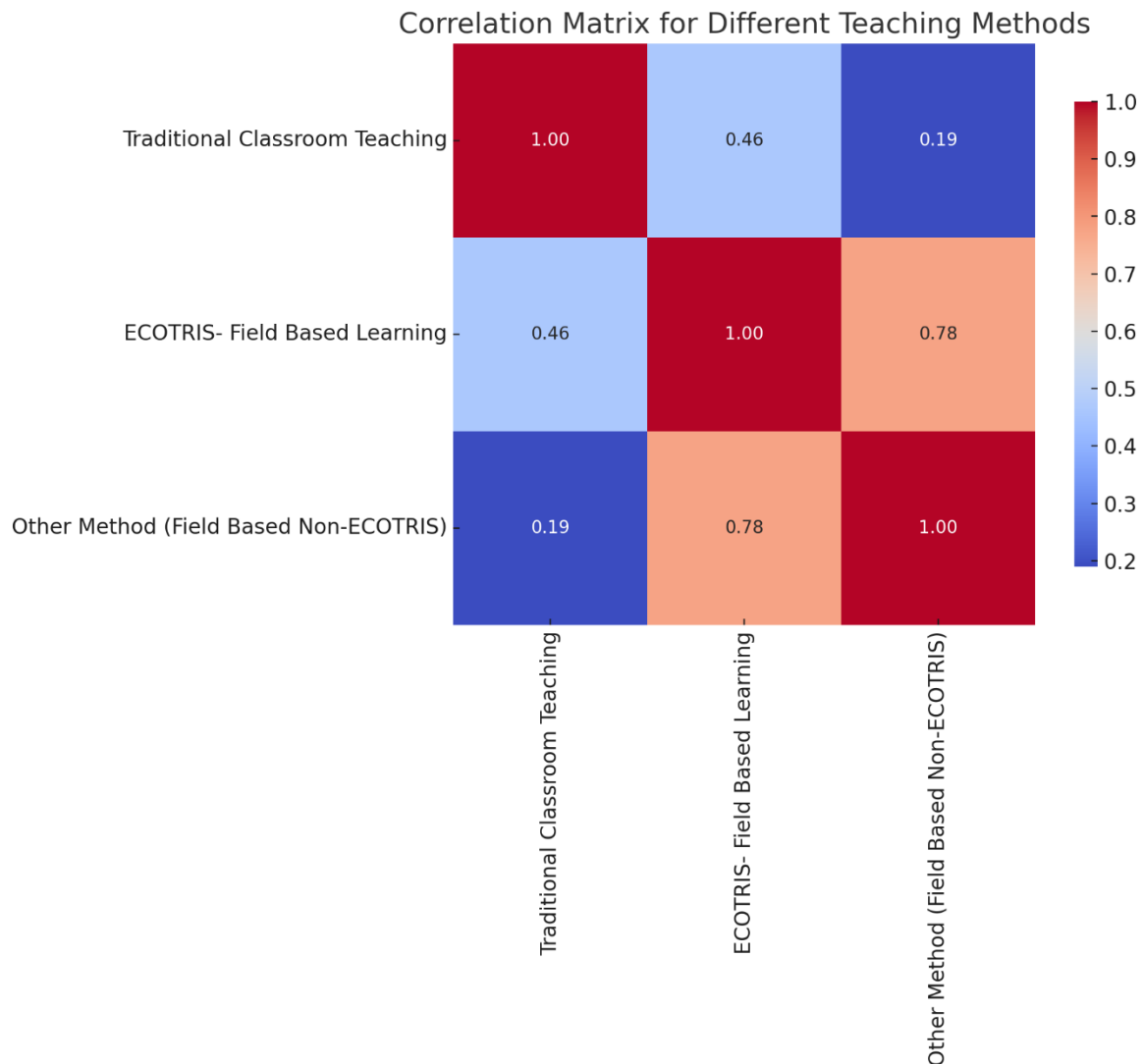


The study reveals clearly that the ECOTRIS-Field Based Learning method leave behind both Traditional Classroom Teaching and the Other Method, underscoring its effectiveness in stimulating student achievement and signifying its potential as a favoured teaching strategy in educational settings. Field-based learning study experiences also boost motivation by fulfilling the other fundamental psychological needs of autonomy and competence ([Ryan & Deci, 2017](#)). For instance, vivid and unique classroom settings make moments more memorable, enabling students to later use these experiences to enhance information recall—a phenomenon supported by everyday memory research conducted by neuroscientists ([Takeuchi et al., 2016](#)).

The correlation analysis and visualization present in [Figure 7](#) expose interesting relationships among the three experiential teaching methods: Traditional Classroom, ECOTRIS-based Field Learning, and Other Field-Based Non-ECOTRIS methods. The

strongest correlation (0.78) exists between ECOTRIS and the Other Field-Based Non-ECOTRIS method, indicating that student performance in field-based environments tends to be consistent, even across varying structures or methodologies. This suggests that field-based learning, regardless of its specific approach, may foster similar levels of student engagement and outcomes, likely due to the immersive and experiential nature of field learning itself. This aligns with the findings of [Trenshaw, Revelo, Earl, and Herman \(2016\)](#), who identified relatedness as the most significant of the three basic needs in fostering intrinsic motivation to learn. Student are very enthusiastic to learn live specimen rather that collected leaf brought into the classrooms.

Figure 7: Correlation across different learning method

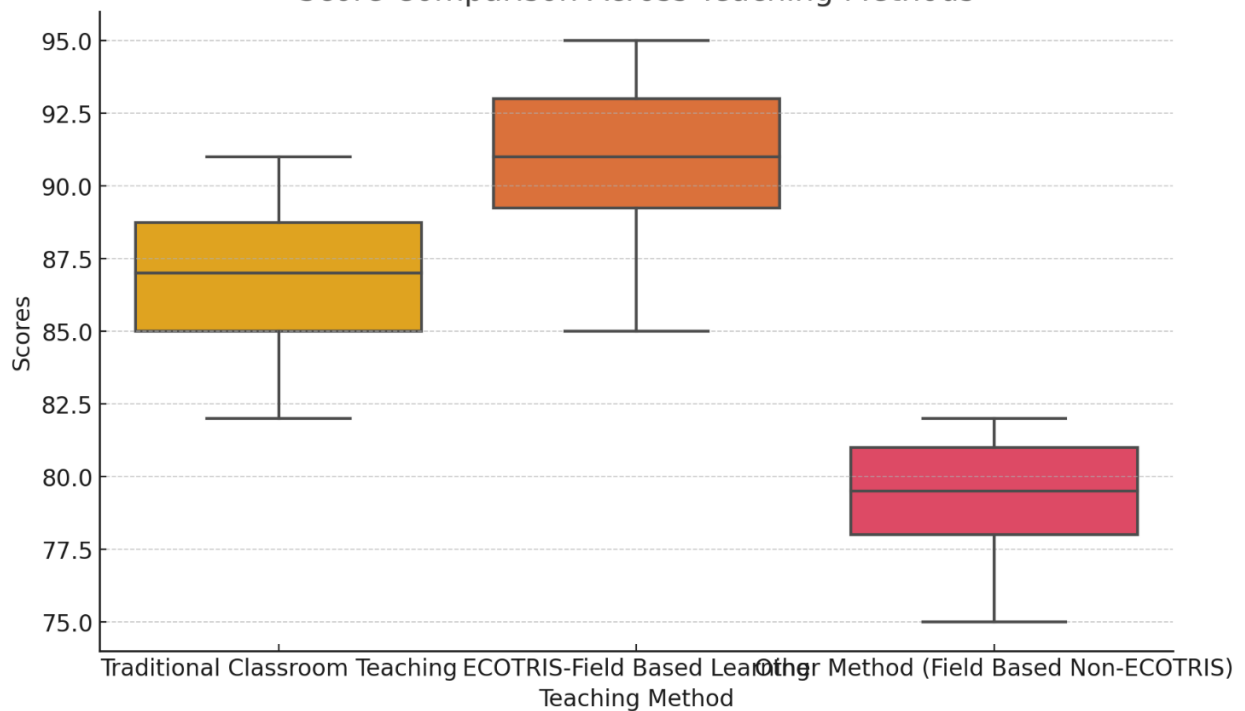


In contrast, the correlation between Traditional Classroom and ECOTRIS (0.46) is moderate, suggesting that while some students perform well in both, these methods foster different skills or appeal to varied learning styles. The weakest relationship is between Traditional Classroom and the Other Field-Based Non-ECOTRIS method (0.19), implying minimal overlap in the factors contributing to success in these two approaches. [Rai and Acharya \(2020\)](#) argued that the development and advancement of education have largely centered on systematic, teacher-driven, and conventional pedagogical approaches that overlook students' prior knowledge and beliefs, leading to learning practices that are completely decontextualized. This differentiation supports the value of diverse teaching methods to cater to varied student learning preferences and strengths.

Performance of student during recitation is better in the field compared to classrooms. Roberts (2016) recommends that this should not be treated as a one-time activity but rather as an ongoing, dynamic document that actively contributes to every class. Hence, Field-based learning also enhanced student engagement by incorporating a variety of instructional practices to maintain the course's freshness, a recommended teaching approach, especially in K-12 education (Ripp, 2016).

Figure 8 shows the box plot visually compares score distributions across different teaching methods, highlighting significant variations in performance and consistency. ECOTRIS-Field Based Learning demonstrates the highest median score, accompanied by a relatively narrow interquartile range (IQR), indicating consistently strong outcomes among students who used this method. In contrast, Traditional Classroom Teaching shows a high median as well but with a broader spread of scores, suggesting some variability in performance within this approach. The "Other Method" (a non-ECOTRIS field-based approach) presents the lowest median score and a narrow range, indicating generally lower performance with minimal score variation. This innovative approach greatly contributed to the simultaneous development of knowledge, higher-order thinking, positive attitudes, perseverance, and students' ability to adapt in unexpected situations (Chan & Ho, 2014).

Figure 8: Result of test comparing score across experiential teaching method
Score Comparison Across Teaching Methods



To determine if these observed differences are statistically significant, a repeated measures ANOVA test was conducted. The results ($F = 181.20$, $p < 0.001$) reveal that there is a statistically significant difference in the mean scores across the three teaching methods. This finding implies that the variations in average scores among Traditional Classroom Teaching, ECOTRIS-Field Based Learning, and the other field-based method are unlikely to be due to random chance. Consequently, ECOTRIS-Field Based Learning appears to be the most effective method for enhancing student performance in this context, providing a strong case for its adoption in pedagogical settings. Field-based

learning has long been regarded as a cornerstone of geographical education by both educators and researchers (Das & Chatterjea, 2018).

The results of the ANOVA test highlight a statistically significant difference in mean scores across the teaching methods, underscoring the distinct advantage of ECOTRIS-Field Based Learning in enhancing student performance (Table 2). With the highest median and a narrow interquartile range, ECOTRIS-Field Based Learning demonstrates consistent, high-scoring outcomes, setting it apart from Traditional Classroom Teaching and other field-based methods. The significance level ($p < 0.001$) in the ANOVA analysis suggests that the observed differences in mean scores are unlikely to have occurred by chance. Students shared their thought during the focus group discussion, they imparted to the class that they are abler to retain knowledge when they see the plant in the field compared to picture and live specimen. The standing trees gives them more lasting memory of the phyllotaxy.

Table 2: Statistical result of student scores across different teaching method

Teaching Method	Mean Score	Standard Deviation	Minimum Score	Maximum Score	Observations from Box Plot Analysis
Traditional Classroom Teaching	86.67	2.54	82	91	High median, moderate variability
ECOTRIS-Field Based Learning	90.87	2.62	85	95	Highest median, narrow interquartile range (IQR) indicating consistently high performance
Other Field-Based Method	79.20	2.01	75	82	Lowest median, narrow range, indicating lower and less variable performance

ANOVA Test Result: $F = 181.20$, $p < 0.001$

This outcome points to ECOTRIS-Field Based Learning as a particularly effective approach for educational engagement and achievement, potentially due to its interactive, experiential learning environment that fosters better understanding and retention. The implementation of field-based knowledge fosters students' connection to their predecessors' understanding (Caretta et al., 2022). In contrast, the broader score variability in Traditional Classroom Teaching and the lower, less variable scores in other field-based methods indicate that these approaches may not deliver the same level of consistent high performance. Thus, this statistical evidence strengthens the case for integrating ECOTRIS-Field Based Learning into educational curricula where high engagement and improved academic outcomes are prioritized. This confirms various study in erm of field-based learning that elucidates field-based learning can enhance work engagement (Susomrith & Coetzer, 2019; Uhunoma et al., 2021). From a performance perspective, have generally shown positive correlations with performance improvements (Wolfson et al., 2018, 2019).

To explore further the effectiveness of the different teaching methods, a post-hoc analysis using Tukey's HSD test was performed, revealing significant pairwise differences. The comparison between Traditional Classroom Teaching and ECOTRIS Field-Based Learning indicated a statistically significant difference in mean scores, with ECOTRIS showing higher performance. This result highlights the greater effectiveness of

ECOTRIS, signifying that experiential learning may improve engagement among students and enrich their understanding. In contrast of Traditional Classroom Teaching to the Other Method (Field-Based Non-ECOTRIS), results also showed a statistically significant difference, with Traditional Classroom Teaching yielding higher scores. Strategically, if field-based learning reinforces attitudes, knowledge, and performance, it can contribute to building a strong talent channel and a pool of competent learners (Brymer et al., 2019; Ployhart et al., 2011).

Nevertheless, the result of the study suggests that traditional methodologies may be added helpful than non-ECOTRIS field-based methods for student achievement. Finally, when linking ECOTRIS Field-Based Learning to the Other Method, the results were again significant, indicating that ECOTRIS consistently outperformed the non-ECOTRIS field-based approach. These findings mutually strengthen the belief that ECOTRIS Field-Based Learning is not only effective but stands out as the greatest positive teaching method among those analysed. The confirmation from the Tukey's HSD test supports the assimilation of ECOTRIS into educational curricula to foster higher student performance and engagement in learning activities. Therefore, field-based learning across various disciplines may promote perceived relatedness, and potentially other basic psychological needs, which can positively influence student motivation, resulting in a range of favorable academic outcomes e.g., academic performance (Ryan & Deci, 2017).

5. Conclusion

The results of this research emphasise the effectiveness of the experiential teaching method conducted in the Ecological Trail and Reservation Site of Indigenous Trees (ECOTRIS) as a powerful tool for pedagogical enhancement, particularly in forestry and environmental science education. ECOTRIS-based field learning not only yielded higher student performance compared to traditional classroom and non-ECOTRIS field-based methods, but it also demonstrated a unique ability to engage students through hands-on, experiential learning. This supports with broader educational theories suggesting that place-based and experiential approaches foster deeper understanding and retention. The study further highlights that ECOTRIS provides a valuable platform for integrating indigenous knowledge with modern scientific methods, thereby enriching the curriculum with cultural relevance and promoting sustainable environmental stewardship. The statistically significant differences in student performance strengthen the potential of ECOTRIS as a preferred teaching strategy, encouraging educational institutions to adopt similar field-based models.

In implication, ECOTRIS exemplifies how field-based learning sites can play a transformative role in student engagement and achievement. This model supports a holistic educational approach, preparing students with practical skills and a profound appreciation for biodiversity conservation and sustainable land management practices. Future research should explore broader applications of ECOTRIS to other academic disciplines and assess long-term impacts on student learning and environmental awareness.

Ethics Approval and Consent to Participate

The researchers used the research ethics provided by the Research Development Extension and Training (RDET) of the Ifugao State University Philippines. All procedures

performed in this study involving human participants were conducted in accordance with the ethical standards of the institutional research committee. Informed consent was obtained from all participants according to the Declaration of Helsinki.

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Conflict of Interest

The authors declare no conflict of Interest.

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