VOLUME 11 ISSUE 1
JULY 2026

E-ISSN: 2622-3384
P-ISSN: 2527-9939

JURNAL MEdu Mangifera Edu

Secondary students' perceptions of outdoor Biology learning and gender dynamics in Egor LGA, Edo State, Nigeria

Etinosa Edobor[1]*, Etinosa Edobor[2], Hilda Emmanuel-Akerele[3], Nur Subkhi[4], Lissa[5]
[1]Department of Microbiology, University of Benin, Ugbowo Campus, P.M.B. 1154, Benin City, Edo State, Nigeria
[2]Department of Education, University of Benin, Ugbowo Campus, P.M.B. 1154, Benin City, Edo State, Nigeria
[3]Department of Biological Sciences, Anchor University Lagos, Ayobo/Ipaja Road, Ayobo, Ipaja, Lagos State, Nigeria
[4,5]Department of Biology Education, Universitas Wiralodra, Jl. Ir. H. Juanda Km. 3, Indramayu, West Java, Indonesia

ABSTRACT

Outdoor learning has gained increasing attention as an approach to enrich Biology learning by providing authentic learning experiences beyond the classroom. This study aimed to examine secondary school students' perceptions of outdoor Biology learning, with particular emphasis on conceptual clarity and gender dynamics in Egor Local Government Area, Edo State, Nigeria. A descriptive survey design was employed involving 100 senior secondary school students selected through a multistage sampling procedure. Data were collected using an expert-validated four-point Likert questionnaire (reliability coefficient = 0.75) and analyzed using frequency counts and percentage distributions. The findings indicate that most students expressed positive perceptions of outdoor learning, reporting that outdoor activities supported their understanding of Biology concepts and enhanced their engagement during learning. The results also revealed that many students perceived gender-related differences in outdoor learning experiences, although female students were likewise perceived as demonstrating strong conceptual understanding of Biology. Because the study examined students' perceptions rather than objective learning outcomes, the findings should be interpreted as subjective evaluations of learning experiences rather than evidence of differences in academic achievement or the effectiveness of outdoor learning. The study suggests that Biology teachers and school administrators should design structured and inclusive outdoor learning activities that encourage meaningful participation for all students while supporting contextual learning experiences in Biology education.

ARTICLE INFO

Keywords
Biology education, Conceptual clarity, Descriptive survey, Gender dynamics, Outdoor learning.

Received
February 10, 2026

Revised
July 22, 2026

Accepted
July 23, 2026

Published
July 31, 2026

How to cite
Edobor, E., Edobor, E., Emmanuel-Akerele, H., Subkhi, N., Lissa. (2026). Secondary school students' perceptions of outdoor Biology learning and gender dynamics in Egor LGA, Edo State, Nigeria. *Jurnal Mangifera Edu, 11*(1), 38-54. https://doi.org/10.31943/mangiferaedu.v11i1.257

INTRODUCTION

Biology is a fundamental science that equips students with knowledge and skills to understand living organisms, ecological interactions, biodiversity, and environmental sustainability. However, Biology instruction in many secondary schools remains predominantly classroom-centered, limiting opportunities for students to directly observe biological phenomena and connect theoretical concepts with authentic environmental contexts. Consequently, students may experience difficulties in understanding complex concepts, maintaining motivation, and applying scientific knowledge to real-life situations. These challenges have increased attention toward learner-centered

approaches that promote active participation, contextual understanding, and meaningful learning beyond conventional settings (Becker et al., 2017; Kuo et al., 2019).

Outdoor learning has emerged as an educational approach that facilitates authentic learning through direct interaction with natural and community environments. Grounded in Experiential Learning Theory, outdoor learning enables students to construct knowledge through concrete experiences, reflective observation, conceptualization, and active experimentation (Kolb, 2015). In Biology education, outdoor environments—including school gardens, parks, forests, wetlands, and other natural ecosystems—provide opportunities for students to investigate ecological relationships, biodiversity, and environmental processes that are difficult to visualize in traditional classrooms. Such authentic experiences promote scientific inquiry, critical thinking, conceptual understanding, and engagement with scientific learning (Kolb, 2015; Kuo et al., 2019).

Empirical studies have demonstrated that outdoor learning can provide meaningful experiences in Biology and science education. (Hastika et al., 2024) reported positive student perceptions of Biology learning activities in a botanical garden, while (Ayotte-Beaudet & Potvin, 2020), involving 2,007 students from 71 classes, found that perceptions of outdoor science learning were associated with contextual and instructional factors, including preparation, choice, activity types, grouping, and the outdoor environment. These findings suggest that the value of outdoor learning depends not only on the setting but also on how learning activities are structured and experienced. Recent empirical evidence consistently supports the educational benefits of outdoor learning. A systematic review by (Becker et al., 2017) demonstrated that outdoor education positively influences students' learning experiences, social development, and academic engagement. Similarly, (Kuo et al., 2019) reported converging evidence that experiences with nature enhance attention, motivation, and learning performance. More recently, (Mann et al., 2022) through a systematic review of school-based outdoor learning, concluded that outdoor educational experiences positively influence students' engagement, enjoyment, well-being, and learning development across various educational settings. Collectively, these studies suggest that outdoor learning not only strengthens students' cognitive engagement but also creates meaningful connections between scientific concepts and real-world environmental experiences.

More recent evidence from (Mann et al., 2023) indicates that extended residential and outdoor learning experiences can support students' motivation, engagement, and development of twenty-first-century capabilities, suggesting that outdoor learning may contribute to broader learning experiences beyond conventional academic outcomes. In addition to students' perceptions and engagement, outdoor learning has also been examined in relation to conceptual understanding of biological and ecological concepts. Mernisa & Djukri (2018) investigated the Outdoor Learning Process on ecosystem topics and found it relevant to students' conceptual understanding and environmental concern (Mernisa & Djukri, 2018). These findings support the potential of outdoor learning to connect biological concepts with direct experiences in natural environments, particularly for topics such as ecosystems, biodiversity, and ecological interactions.

Recent research has explored outdoor-based learning in Biology education, particularly for ecosystem and biodiversity topics. Examined outdoor-based discovery learning and its influence on students' critical thinking in ecosystem learning (Agustini et al., 2025); on the other hand,

environment-based guided inquiry and its relevance to students' science process skills in biodiversity learning were investigated (Siregar et al., 2025). Together, these findings support the use of authentic environmental contexts to engage students with biological phenomena and develop higher-order thinking and science process skills. This line of research has also examined contextualized outdoor science education. (Ayotte-Beaudet et al., 2021) demonstrated that contextualized outdoor learning can support students' understanding of ecosystem relationships and biological phenomena. Such evidence highlights the potential of outdoor learning to make Biology concepts more meaningful through direct observation and investigation in authentic environments.

Besides improving engagement and conceptual understanding, outdoor learning promotes collaborative inquiry, scientific reasoning, communication, and problem-solving through authentic field experiences. These characteristics make it particularly relevant to Biology, where many concepts require direct observation of living organisms and ecological processes. Nevertheless, previous studies have largely evaluated outdoor learning through objective indicators such as academic achievement, instructional effectiveness, environmental awareness, and science process skills (Becker et al., 2017; Mann et al., 2022). Comparatively fewer studies have explored students' own perceptions regarding how outdoor learning contributes to their conceptual understanding or how gender dynamics may influence their learning experiences during outdoor Biology activities.

Although previous studies have established the educational benefits of outdoor learning, several research gaps remain. First, limited attention has been given to students' subjective perceptions compared with learning outcomes and intervention effectiveness. Second, studies examining perceived conceptual clarity and gender dynamics together in outdoor Biology learning remain scarce. Third, empirical evidence from Nigerian secondary schools, particularly in Egor Local Government Area of Edo State, is limited. Addressing these gaps may provide complementary insights into students' outdoor learning experiences and inform the development of more engaging, inclusive, and contextually relevant Biology learning environments.

Recent studies indicate that students' perceptions remain an important but developing area of outdoor learning research. A sample of 980 secondary students highlighted the importance of understanding learners' perspectives (Tağrikulu et al., 2021). The perceptions of outdoor science learning were found to be associated with instructional and contextual factors (Ayotte-Beaudet & Potvin, 2020). However, these studies did not examine the combined dimensions of perceived conceptual clarity and gender dynamics in outdoor Biology learning, indicating a need to explore students' perceptions of Biology concepts and gender-related experiences in outdoor learning contexts.

Further evidence from Biology education has also examined students' perceptions of outdoor learning activities; it investigated students' perceptions of outdoor Biology learning activities conducted in a botanical garden and reported generally positive perceptions of learning Biology in an outdoor environment (Hastika et al., 2024). This study provides particularly relevant evidence for the present research because it demonstrates the importance of examining students' own perceptions when evaluating outdoor Biology learning experiences.

Gender is another contextual dimension that may shape how students experience and perceive outdoor science learning. (Lee Sang et al., 2026) found that a multiday STEM-focused outdoor

learning experience was associated with reduced stereotypical perceptions of scientists and more realistic views of scientists working in outdoor and field-based settings. However, research on gender-related experiences and perceptions in outdoor Biology learning remains limited, particularly regarding conceptual clarity and gender dynamics. This gap highlights the importance of considering gender when examining students' perceptions of outdoor Biology learning.

Similarly, (Stevenson et al., 2021) reported that outdoor science education can provide meaningful experiences that support girls' continued engagement with science. Their findings suggest that the design and context of science learning experiences may play an important role in shaping students' engagement with science, particularly among female learners. These findings are relevant to the present study because they emphasize the importance of considering gender-related experiences when examining participation and perceptions in outdoor Biology learning.

Unlike previous studies that primarily examined outdoor learning through academic achievement, instructional interventions, environmental awareness, or science process skills (Becker et al., 2017; Kuo et al., 2019; Mann et al., 2022), the present study focuses on students' subjective perceptions of outdoor Biology learning. Specifically, it investigates how secondary school students perceive the contribution of outdoor learning resources to their conceptual clarity and how they perceive gender dynamics during outdoor Biology learning activities. Students' perceptions constitute an important source of educational evidence because they provide insights into learners' cognitive engagement, confidence, and self-efficacy that may not be fully captured through standardized achievement tests alone (Pintrich, 2003; Kolb, 2015). By emphasizing students' perspectives, this study complements previous outcome-oriented research and provides a broader understanding of outdoor learning experiences.

The present study contributes to the literature on outdoor Biology education by providing contextual evidence from Nigerian secondary schools, particularly in Egor Local Government Area, Edo State, where empirical research on outdoor learning remains limited. To the best of the authors' knowledge, few studies have simultaneously examined students' perceptions of outdoor Biology learning, conceptual clarity, and gender dynamics in this context. The findings therefore extend current knowledge by highlighting learners' subjective evaluations of outdoor learning experiences rather than focusing exclusively on objective academic performance (Mann et al., 2022; UNESCO, 2024).

The findings are expected to contribute both theoretically and practically. From a theoretical perspective, this study enriches the literature on experiential learning by describing students' perceived conceptual clarity and gender dynamics within outdoor Biology education (Kolb, 2015). From a practical perspective, the findings may assist Biology teachers in designing outdoor learning activities that promote active participation, contextual understanding, and inclusive learning environments. In addition, school administrators and educational policymakers may use the findings as supporting evidence when developing learning environments that encourage authentic scientific inquiry and greater student engagement with Biology (Becker et al., 2017; Kuo et al., 2019).

Based on these considerations, this study aims to examine secondary school students' perceptions of outdoor Biology learning resources, focusing on conceptual clarity and gender dynamics in Egor Local Government Area, Edo State, Nigeria. Specifically, it describes students'

perceptions of how outdoor learning resources contribute to their understanding of Biology concepts and their perceptions of gender dynamics during outdoor Biology learning activities. As a descriptive survey, the study describes students' perceptions rather than establishing causal relationships or determining the effectiveness of outdoor learning on academic achievement.

METHOD

This study employed a descriptive survey research design to examine secondary school students' perceptions of outdoor Biology learning resources, with particular emphasis on conceptual clarity and gender dynamics. A descriptive survey design was considered appropriate because the study sought to describe students' opinions, perceptions, and learning experiences within their natural educational setting rather than to determine causal relationships or evaluate the effectiveness of an instructional intervention (Creswell & Creswell, 2018; Fraenkel et al., 2019). This design also enables researchers to describe characteristics of a target population systematically and to draw general descriptions from representative samples (Cohen et al., 2018).

The study was conducted in Egor Local Government Area (ELGA), Edo State, Nigeria. The target population consisted of approximately 400 senior secondary school students enrolled in Biology across four public secondary schools. Outdoor learning activities implemented during Biology lessons focused on ecological concepts, ecosystems, and biodiversity using the school environment and nearby natural settings as learning resources. Through structured field observations, students explored ecological interactions, biotic and abiotic relationships, biodiversity, and other environmental phenomena directly within authentic learning contexts.

A sample of 100 students was selected from the accessible population using a multistage sampling procedure. In the first stage, four secondary schools were selected through simple random sampling to provide equal opportunities for school participation. In the second stage, 25 senior secondary Biology students were purposively selected from each participating school based on their enrollment in Biology classes and their participation in the outdoor learning activities. The sample represented approximately 25% of the accessible population, which is considered adequate for descriptive survey research intended to describe population characteristics rather than estimate causal effects or treatment outcomes (Cohen et al., 2018). The multistage sampling procedure was adopted to enhance the representativeness of the sample while ensuring that all respondents possessed relevant learning experiences related to the objectives of the study.

Data were collected using a researcher-developed structured questionnaire entitled Secondary Students' Perceptions of Outdoor Biology Learning and Gender Dynamics in Egor LGA, Edo State. The questionnaire was specifically designed to measure students' perceptions rather than objective academic achievement because the present study adopted a descriptive survey approach. The instrument consisted of four major constructs derived from the literature on outdoor learning and experiential learning: (1) perceived cognitive engagement during outdoor Biology learning, (2) perceived conceptual clarity, (3) perceived academic self-efficacy, and (4) students' perceptions regarding gender dynamics during outdoor learning activities (Kolb, 2015; Pintrich, 2003). Responses were measured using a four-point Likert scale comprising Strongly Agree, Agree, Disagree, and Strongly Disagree. The exclusion of a neutral response category was intended to

encourage respondents to express a definite perception regarding each statement, thereby facilitating clearer interpretation of students' viewpoints (Cohen et al., 2018).

It is important to note that the study did not statistically compare male and female students' academic performance. Instead, the questionnaire explored students' perceptions of gender dynamics during outdoor Biology learning. Accordingly, gender was treated as a perceived dimension of students' learning experiences rather than as an independent variable for inferential comparison. This methodological approach is consistent with the descriptive objectives of the study, which sought to document students' subjective evaluations of outdoor learning experiences rather than to test hypotheses concerning gender differences in academic achievement.

The questionnaire was subjected to face and content validity through expert judgment to ensure that each item adequately represented the intended constructs and aligned with the objectives of the study (Cohen et al., 2018). The preliminary instrument was reviewed by the research supervisor and two experts in Biology education and educational measurement. They evaluated the relevance, clarity, wording, and content coverage of each item. Suggestions provided during the validation process were incorporated into the final version of the questionnaire before data collection.

The reliability of the instrument was established using a test–retest procedure. Thirty copies of the questionnaire were administered to 30 senior secondary Biology students from schools outside the study sample but with characteristics comparable to those of the target population. After an interval of two weeks, the same questionnaire was re-administered to the same respondents. The two sets of responses were analyzed using the Pearson Product Moment Correlation coefficient, yielding a reliability coefficient of 0.75. According to (DeVellis & Thorpe, 2021), a reliability coefficient of 0.70 or higher indicates acceptable consistency for educational survey instruments. Therefore, the questionnaire was considered sufficiently reliable for measuring students' perceptions of outdoor Biology learning.

Before data collection, permission was obtained from the participating secondary schools. The questionnaires were administered personally by the researcher with the assistance of four trained research assistants, who received orientation on the study objectives, ethical considerations, and standardized administration procedures. Students were informed that participation was voluntary, responses would remain confidential, and the data collected would be used solely for research purposes. Respondents completed the questionnaires independently after participating in outdoor Biology learning activities to ensure that their responses reflected their actual learning experiences.

The quantitative data obtained from the completed questionnaires were analyzed using descriptive statistics, specifically frequency counts, percentages, means, and standard deviations. Frequency counts and percentages summarized the distribution of students' responses for each questionnaire item, while means and standard deviations described the overall tendency and variability of students' perceptions across the measured constructs.

The selection of descriptive statistics was consistent with the objectives of the study, which aimed to describe students' perceptions regarding outdoor Biology learning, conceptual clarity, and gender dynamics rather than to examine causal relationships or determine statistically significant differences between groups (Creswell & Creswell, 2018). Although the questionnaire included items

concerning gender dynamics, these items were designed to capture students' perceptions of gender-related learning experiences rather than to compare the academic performance or perceptions of male and female students using inferential statistics. Consequently, no hypothesis testing or inferential statistical analyses were conducted because such analyses were beyond the scope of the descriptive survey design.

Accordingly, the findings should be interpreted as descriptive representations of students' subjective perceptions of outdoor Biology learning experiences rather than as evidence of causal effects or statistically significant gender differences in academic achievement.

RESULTS AND DISCUSSION

A total of one hundred (100) questionnaires were administered to respondents and validated for the analysis. The responses presented in Table 1 indicate that students generally reported positive perceptions regarding the use of outdoor learning resources in Biology.

Table 1. Distribution of students' self-perceived cognitive engagement and perceived utility of biology outdoor learning resources

Statement	SA %	A %	SD %	D %
Did you feel that your understanding of Biology concepts improved after using outdoor learning resources?	60 60%	20 20%	10 10%	10 10%
Do you believe that outdoor learning resources helped you achieve better results in Biology?	79 79%	7 7%	10 10%	4 0%
After using outdoor learning resources, do you think you performed better in Biology assessments?	75 75%	13 13%	7 7%	5 5%
Did outdoor learning activities make you more interested in Biology concepts?	60 60%	20 20%	15 15%	5 5%
Do you think that learning outdoors helped you remember Biology concepts more effectively?	80 80%	10 10%	6 6%	4 4%

A majority of respondents (60%) strongly agreed that outdoor learning resources improved their understanding of Biology concepts, while 20% agreed with this statement. Similarly, 79% of the respondents strongly agreed that outdoor learning resources helped them achieve better results in Biology, and 80% strongly agreed that learning outdoors enabled them to remember Biology concepts more effectively. In addition, 75% of the respondents strongly agreed that they performed better in Biology assessments after participating in outdoor learning activities, whereas 60% strongly agreed that these activities increased their interest in learning Biology. Overall, the descriptive findings suggest that respondents perceived outdoor learning resources as beneficial for supporting their Biology learning experiences.

These positive perceptions may be attributed to the experiential characteristics of outdoor learning. Unlike conventional classroom instruction, outdoor learning provides opportunities for students to interact directly with authentic biological objects and phenomena, enabling them to connect theoretical concepts with real-life experiences. According to Kolb (Kolb, 2015), experiential learning occurs through concrete experiences followed by observation, reflection, and conceptualization, which may contribute to students' perceptions of improved understanding and engagement. Similarly, (Beames et al., 2016) argued that learning in natural environments

encourages curiosity, exploration, and meaningful learning by situating scientific concepts within authentic contexts.

The present findings are consistent with previous empirical studies reporting positive student perceptions of outdoor learning. (Kuo et al., 2019) found that outdoor learning environments enhance students' interest, motivation, and engagement in science learning by providing multisensory learning experiences. Likewise, (Becker et al., 2017) reported that students participating in outdoor educational activities expressed more positive learning experiences and greater enthusiasm for science than those learning exclusively in conventional classrooms. Although these studies were conducted in different educational settings, they similarly indicate that students generally perceive outdoor learning as an engaging instructional approach.

This finding is consistent with (Mann et al., 2023), who reported that extended outdoor learning experiences can support students' motivation, engagement, and development of broader learning capabilities. Their findings suggest that learning experiences situated in outdoor environments may provide opportunities for students to become more actively involved in learning and develop competencies beyond conventional classroom settings. In the context of the present study, students' positive perceptions of outdoor learning resources may therefore reflect the potential of outdoor environments to create more engaging and meaningful learning experiences.

Nevertheless, the findings should be interpreted with caution. Because this study employed a descriptive survey design, the reported results represent students' subjective perceptions rather than objectively measured improvements in Biology achievement or academic performance. Consequently, the findings cannot be interpreted as evidence that outdoor learning directly improves students' learning outcomes; rather, they indicate how students perceive their learning experiences during outdoor Biology activities.

From a practical perspective, these findings suggest that students positively perceive outdoor learning resources and that these resources may serve as valuable complementary learning experiences in Biology education. Biology teachers may therefore consider integrating structured outdoor learning activities into classroom instruction to enrich students' learning experiences while maintaining clear instructional objectives and ensuring active participation among all learners.

Table 2. Students' perceptions regarding their conceptual clarity and academic self-efficacy

Statements	SA %	A%	SD %	D %
Did you notice an increase in your understanding of Biology concepts after participating in outdoor learning activities?	75 75%	12 12%	8 8%	5 5%
Do you think that outdoor learning resources made it easier for you to grasp Biology concepts?	60 60%	20 20%	10 10%	10 10%
After using outdoor learning resources, do you feel more confident in your understanding of Biology?	70 70%	10 10%	7 7%	13 13%
Did outdoor learning experiences help clarify any confusing Biology topics for you?	50 50%	30 30%	15 15%	5 5%
Do you believe that hands-on outdoor activities improved your comprehension of Biology concepts?	75 75%	13 13%	7 7%	5 5%

The descriptive findings presented in Table 2 indicate that respondents generally expressed positive perceptions regarding the contribution of outdoor learning activities to their conceptual understanding and academic self-confidence in Biology. A substantial proportion of respondents

(75%) strongly agreed that participating in outdoor learning activities improved their understanding of Biology concepts. In comparison, 60% strongly agreed that outdoor learning resources made Biology concepts easier to understand. Likewise, 70% of the respondents strongly agreed that they felt more confident in their understanding of Biology after participating in outdoor learning activities. Furthermore, half of the respondents (50%) strongly agreed that outdoor learning helped clarify previously confusing Biology topics, whereas 75% strongly agreed that hands-on outdoor activities improved their comprehension of Biology concepts. Overall, these descriptive findings indicate that respondents perceived outdoor learning as an approach that supported conceptual clarity and strengthened their confidence in Biology.

The positive perceptions reported by the respondents may be associated with the experiential and contextual characteristics of outdoor learning. Biology concepts such as ecology, ecosystems, and biodiversity are often more meaningful when students observe biological phenomena directly rather than relying solely on textbook explanations. Learning experiences situated in authentic environments enable students to connect abstract concepts with real-life observations, thereby facilitating meaningful learning experiences. According to Kolb's Experiential Learning Theory, knowledge is constructed through concrete experiences followed by reflection and conceptualization, allowing learners to develop a deeper personal understanding of scientific concepts. Likewise, (Beames et al., 2016) emphasized that outdoor learning environments encourage exploration, inquiry, and active participation, which are fundamental characteristics of meaningful science learning.

The present findings are consistent with previous empirical research on outdoor learning. A recent systematic review conducted by (Mann et al., 2022) concluded that nature-based outdoor learning is consistently associated with higher student engagement, stronger ownership of learning, improved self-concept, and more positive learning experiences across various educational contexts. Similarly, (Kuo et al., 2019) reported that learning in natural environments promotes students' motivation, attention, and engagement by providing multisensory experiences that facilitate meaningful learning. These studies support the present findings by suggesting that students generally perceive outdoor learning environments as beneficial for understanding scientific concepts. However, the magnitude of these perceptions may vary across educational settings.

Further support for the present findings, examining contextualized outdoor science education and finding that learning activities conducted in authentic outdoor environments could contribute to students' conceptual understanding of relationships among living organisms(Ayotte-Beaudet et al., 2021). Their findings suggest that connecting scientific concepts with direct observations and investigations in students' immediate surroundings can help learners develop a more meaningful understanding of biological phenomena. This evidence is particularly relevant to the present study, in which respondents perceived outdoor learning activities as supporting greater conceptual clarity and improved comprehension of Biology concepts.

Nevertheless, the findings should be interpreted carefully. The present study employed a descriptive survey design and measured students' perceptions rather than objectively assessing conceptual understanding or academic achievement. Consequently, the positive responses reported in Table 2 should not be interpreted as direct evidence that outdoor learning improves students'

Biology performance. Instead, they reflect respondents' subjective evaluations of how outdoor learning influenced their understanding, confidence, and learning experiences.

From a practical perspective, these findings suggest that outdoor learning may provide meaningful learning experiences that students perceive positively, particularly when teaching Biology topics closely related to natural environments, such as ecology and biodiversity. Therefore, Biology teachers may consider incorporating structured outdoor learning activities as complementary instructional strategies to promote active participation, conceptual understanding, and students' confidence while ensuring that learning activities remain inclusive and aligned with the intended curriculum.

Table 3. Students' perceptions of gender differences in outdoor biology learning

Statements	SA %	A %	SD %	D %
Do you think there is a difference in how male and female students achieve in Biology when using outdoor learning resources?	55 55%	20 20%	15 15%	10 10%
In your opinion, do male students perform better than female students when engaged with outdoor learning resources in Biology?	78 78%	12 12%	5 5%	5 5%
Do you believe that male students benefit more from outdoor learning resources than female students in Biology?	90 90%	5 5%	3 3%	2 2%
Have you observed any differences in achievement between male and female students during outdoor Biology lessons?	60 60%	20 20%	10 10%	10 10%
Do you think gender plays a role in the academic performance of students using outdoor learning resources for Biology?	78 78%	10 10%	7 7%	5 5%

The descriptive findings presented in Table 3 summarize respondents' perceptions regarding gender-related differences in outdoor Biology learning. Overall, the responses indicate that many students perceived differences in how male and female students engage with outdoor learning activities. Specifically, 55% of the respondents strongly agreed that there were differences in how male and female students experienced Biology learning through outdoor learning resources. In addition, 78% strongly agreed that male students appeared to perform better during outdoor Biology activities, while 90% strongly agreed that male students benefited more from outdoor learning resources. Furthermore, 60% strongly agreed that they had observed differences between male and female students during outdoor Biology lessons, and 78% strongly agreed that gender played a role in students' learning experiences during outdoor instruction.

These findings suggest that respondents perceived gender-related differences in outdoor learning experiences. One possible explanation is that outdoor learning environments involve collaborative fieldwork, movement, observation, and interaction with authentic learning contexts, all of which may shape students' perceptions of participation and engagement differently. Experiential learning settings encourage learners to interact directly with natural environments, and students may therefore perceive variations in confidence, participation, or classroom interaction rather than differences in actual academic ability. Kolb's Experiential Learning Theory emphasizes that learning occurs through concrete experiences, reflective observation, and active experimentation. In contrast, outdoor learning provides authentic contexts in which learners construct meaning through direct engagement with their environment (Kolb, 2015; Beames et al., 2016).

This interpretation is supported by (Stevenson et al., 2021), who found that outdoor science education can provide meaningful learning experiences that help girls remain engaged with science.

Their findings suggest that the context and design of outdoor science learning may influence students' participation and engagement, particularly by creating opportunities for learners to interact with science in authentic and supportive environments. In relation to these findings, students' perceptions of gender differences during outdoor Biology learning may therefore be influenced by how students participate, interact, and engage in outdoor activities rather than by inherent differences in academic ability. This perspective highlights the importance of considering the learning environment and instructional practices when interpreting perceived gender differences in outdoor Biology education.

The present findings are partially consistent with previous studies examining gender issues in science education. Hyde's Gender Similarities Hypothesis argues that males and females are generally more similar than different across most psychological and cognitive characteristics, suggesting that observed differences are often influenced by contextual and social factors rather than inherent cognitive ability (Hyde, 2014). Likewise, (UNESCO, 2020) emphasized that learning environments should be intentionally designed to provide equitable opportunities for both male and female learners, particularly in STEM education. More recent educational research also indicates that students' participation in outdoor learning may be influenced by instructional design, classroom culture, and opportunities for active engagement rather than gender alone (Mann et al., 2022). Therefore, the perceptions identified in the present study should be interpreted within the broader educational context rather than viewed as evidence of actual differences in academic performance.

The present findings can also be considered in relation to (Mapulanga & Bwalya, 2025), who examined gender differences in secondary school students' perceptions of teaching practices used in Biology classrooms. Their study highlights that students' perceptions of Biology learning environments may vary according to gender, suggesting that gender can be an important contextual dimension when examining how students experience and interpret Biology instruction. In the context of the present study, the perceived gender-related differences reported by respondents may therefore reflect differences in students' experiences, participation, and perceptions of learning activities rather than inherent differences in Biology learning ability. This perspective supports the need to interpret gender dynamics within outdoor Biology learning as a contextual and experiential phenomenon that requires inclusive instructional practices.

Nevertheless, several important limitations should be considered when interpreting these findings. The present study employed a descriptive survey design and collected students' perceptions rather than objective measures of learning outcomes or observed behavioral differences. Furthermore, no inferential statistical analyses were conducted to determine whether actual gender differences existed. Consequently, the findings reported in Table 3 should not be interpreted as evidence that one gender performs better than the other during outdoor Biology learning. Instead, they represent respondents' subjective perceptions of gender dynamics within their learning experiences.

From a practical perspective, these findings highlight the importance of designing inclusive outdoor learning activities that encourage equitable participation among all students. Biology teachers may consider organizing collaborative field investigations, rotating leadership roles during outdoor activities, and providing equal opportunities for participation so that both male and female

students can engage meaningfully in outdoor Biology learning. Such approaches are consistent with current recommendations for inclusive STEM education and may help foster positive learning experiences for diverse groups of learners.

Table 4. Gender dynamics in students' perceptions toward subjective grasp and understanding of biological concepts

Statements	SA	A	SD	D
Do you think there is a difference in understanding Biology concepts between male and female students who use outdoor learning resources?	90 90%	5 5%	3 3%	2 2%
In your experience, do female students understand Biology concepts better than male students when taught with outdoor learning resources?	70 70%	10 10%	10 10%	10 10%
Do you believe that male students grasp Biology concepts less effectively than female students when using outdoor activities?	75 75%	13 13%	7 7%	5 5%
Have you noticed any differences in how male and female classmates respond to outdoor Biology lessons regarding understanding?	80 80%	10 10%	5 5%	5 5%
Do you think gender influences how well students understand Biology concepts learned through outdoor activities?	60 60%	20 20%	10 10%	10 10%

The descriptive findings presented in Table 4 summarize respondents' perceptions regarding gender dynamics in conceptual understanding during outdoor Biology learning. Overall, the responses indicate that many students perceived differences in how male and female students understood Biology concepts when learning through outdoor activities. Specifically, 90% of the respondents strongly agreed that differences existed in conceptual understanding between male and female students using outdoor learning resources. Furthermore, 70% strongly agreed that female students demonstrated a good understanding of Biology concepts during outdoor learning. In comparison, 75% strongly agreed that male students were perceived to grasp Biology concepts less effectively than female students in outdoor activities. In addition, 80% strongly agreed that they had observed differences in how male and female classmates responded to outdoor Biology lessons, and 60% strongly agreed that gender influenced students' understanding of Biology concepts during outdoor learning. Collectively, these responses indicate that respondents perceived gender-related differences in conceptual understanding during outdoor Biology activities.

These perceptions may reflect differences in learning experiences rather than actual differences in cognitive ability. Outdoor learning requires students to engage actively in observation, discussion, exploration, and collaborative problem-solving within authentic environments. Such learning contexts may influence how students perceive participation, confidence, and interaction during learning activities. Experiential Learning Theory suggests that knowledge develops through concrete experiences followed by reflection and conceptualization (Kolb, 2015). Consequently, students who participate differently in outdoor activities may also develop different perceptions regarding conceptual understanding, even though these perceptions do not necessarily represent measurable differences in learning achievement. Similarly (Beames et al., 2016) argued that well-designed outdoor learning environments encourage active participation and collaborative inquiry, both of which may shape students' perceptions of their own and their peers' learning experiences.

The present findings are generally consistent with previous educational research emphasizing that gender-related differences observed in learning environments should be interpreted cautiously. Hyde's Gender Similarities Hypothesis proposes that males and females are more alike than different

in most cognitive abilities, and that perceived differences are frequently associated with social, cultural, and instructional contexts rather than inherent intellectual capacity (Hyde, 2014). Likewise, (UNESCO, 2020) emphasized that equitable learning environments should provide equal opportunities for participation regardless of gender, particularly in science education. More recently, (Mann et al., 2022) reported that the effectiveness of outdoor learning depends largely on the quality of instructional design, student participation, and opportunities for meaningful engagement rather than on learners' demographic characteristics. Therefore, the perceptions reported in the present study should be understood within the context of students' learning experiences rather than interpreted as evidence of objective gender differences in conceptual understanding.

The present findings can also be interpreted in relation to the study by (Waluyo & Rahardjanto, 2022), which examined the understanding of male and female students in relation to biological concepts. Their findings indicated that gender did not have a significant effect on students' knowledge across the measured aspects of evolutionary biology. This evidence provides an important perspective for interpreting the present findings because students' perceptions of differences in conceptual understanding between male and female learners may not necessarily correspond to objectively measured differences in biological knowledge. In the context of the present study, the relatively high levels of agreement regarding perceived gender differences in conceptual understanding may therefore reflect students' subjective experiences, classroom interactions, or perceptions of participation during outdoor learning rather than actual differences in cognitive ability. Thus, the findings reinforce the importance of distinguishing between perceived gender differences and objectively demonstrated differences in Biology learning outcomes.

Nevertheless, these findings should be interpreted within the limitations of the present research design. The study employed a descriptive survey approach and examined students' perceptions using self-reported questionnaire responses. No objective assessment of conceptual understanding or inferential statistical analysis was conducted to determine whether actual gender differences existed. Consequently, the findings presented in Table 4 should not be interpreted as evidence that either male or female students possess superior conceptual understanding in Biology. Instead, they represent respondents' subjective perceptions regarding gender dynamics during outdoor learning experiences.

From an educational perspective, the findings highlight the importance of implementing inclusive outdoor Biology instruction that promotes equitable participation among all learners. Teachers may consider designing collaborative field investigations, assigning balanced group responsibilities, and ensuring equal opportunities for observation, discussion, and scientific inquiry during outdoor activities. Such instructional strategies may help create learning environments in which all students perceive themselves as actively involved and supported, regardless of gender. These recommendations are consistent with current perspectives on inclusive science education and learner-centered outdoor pedagogy.

The findings of this study collectively indicate that respondents generally held positive perceptions of outdoor learning resources in Biology. Across all four dimensions examined — perceived cognitive engagement, conceptual clarity, academic self-efficacy, and gender-related learning experiences—the majority of respondents expressed favorable views toward learning

Biology through outdoor activities. These findings suggest that students perceived outdoor learning environments as supportive contexts for understanding biological concepts and engaging more actively in the learning process. However, because the study employed a descriptive survey design, these findings should be interpreted as respondents' subjective evaluations rather than objective evidence of improved academic achievement or cognitive performance.

One possible explanation for these positive perceptions lies in the experiential nature of outdoor learning. Biology is inherently connected to natural phenomena, making authentic environments particularly suitable for observing ecological interactions, biodiversity, and ecosystem processes. Direct interaction with real-world biological contexts may help learners connect theoretical knowledge with practical experiences, thereby promoting meaningful learning. This interpretation is consistent with Experiential Learning Theory, which proposes that knowledge develops through concrete experiences, reflective observation, conceptualization, and active experimentation (Kolb, 2015). Likewise, (Beames et al., 2016) argued that outdoor learning encourages inquiry, collaboration, and authentic engagement with scientific phenomena, thereby creating learning experiences that students perceive as meaningful and relevant.

The present findings are also consistent with recent empirical evidence reported in international literature. (Mann et al., 2022), in a systematic review of outdoor learning research, concluded that nature-based learning is commonly associated with higher student engagement, increased motivation, stronger self-concept, and more positive learning experiences across different educational settings. Similarly, Kuo et al. (2019) reported that natural learning environments enhance students' attention, motivation, and active participation by providing multisensory experiences that facilitate meaningful learning. Although these previous studies investigated various educational contexts, their findings support the present study by demonstrating that students generally perceive outdoor learning as an engaging instructional approach that facilitates science learning.

An important finding emerging from this study concerns students' perceptions of gender dynamics during outdoor Biology learning. Many respondents perceived differences in participation, confidence, and conceptual understanding between male and female students. However, these perceptions should not be interpreted as evidence of actual gender differences in academic ability. Previous educational research consistently indicates that observed differences in classroom participation are often influenced by contextual, social, and instructional factors rather than inherent cognitive differences. Hyde's Gender Similarities Hypothesis emphasizes that males and females are substantially more alike than different in most cognitive abilities (Hyde, 2014). Likewise, (UNESCO, 2020) recommends that science learning environments be intentionally designed to promote equitable participation and inclusive learning opportunities for all students regardless of gender. Therefore, the gender-related findings reported in this study should be understood as respondents' perceptions of their learning experiences rather than objective measures of academic performance.

The educational implications of the present findings should likewise be interpreted within the scope of the research design. Since respondents generally perceived outdoor learning positively, Biology teachers may consider incorporating structured outdoor learning activities, particularly when teaching topics closely related to ecological systems, biodiversity, and environmental

processes. Outdoor learning may provide opportunities for active observation, collaborative investigation, and contextual exploration that students perceive as beneficial for understanding scientific concepts. Nevertheless, instructional activities should be carefully planned to ensure equal participation, clear learning objectives, and inclusive classroom practices for all learners.

Despite these contributions, several limitations should be acknowledged. The study relied exclusively on self-reported questionnaire data collected from students within one Local Government Area and employed descriptive statistical analysis. Consequently, the findings cannot establish causal relationships or determine whether outdoor learning objectively improves students' academic achievement or whether actual gender differences exist in Biology learning outcomes. Future studies are therefore encouraged to employ experimental or quasi-experimental designs, include objective measures of conceptual understanding and academic performance, and utilize inferential statistical analyses to examine possible differences among student groups. Such investigations would provide stronger empirical evidence regarding the effectiveness of outdoor learning in Biology education.

CONCLUSION

This descriptive survey indicates that secondary school students in Egor Local Government Area, Edo State, generally hold positive perceptions of outdoor learning resources in Biology. Most respondents perceived that outdoor learning activities supported their conceptual understanding, encouraged active engagement during learning, and increased their confidence in studying Biology. Respondents also perceived gender-related differences in outdoor learning experiences. However, these findings reflect students' subjective perceptions. They should not be interpreted as evidence that outdoor learning objectively improves academic achievement or that actual differences exist between male and female students' learning performance.

The findings suggest that well-planned outdoor learning activities may provide meaningful learning experiences for Biology students, particularly when teaching topics related to ecology, biodiversity, and environmental processes. Therefore, Biology teachers and school administrators may consider incorporating structured outdoor learning activities as complementary instructional strategies while ensuring equitable participation for all learners.

Because this study relied on self-reported perceptions and descriptive statistical analysis, its findings cannot establish causal relationships or determine the effectiveness of outdoor learning. Future studies are therefore recommended to employ experimental or quasi-experimental designs, include objective measures of students' learning outcomes, and apply inferential statistical analyses to examine further the effectiveness of outdoor learning and gender-related learning experiences.

REFERENCES

Agustini, T., Anggraini, N., & Nazip, K. (2025). The influence of outdoor-based discovery learning model on critical thinking skill in ecosystem material. *JPBI (Jurnal Pendidikan Biologi Indonesia)*, *11*(1), 136–144. https://doi.org/10.22219/jpbi.v11i1.35867

Ayotte-Beaudet, J.-P., Chastenay, P., Beaudry, M.-C., & L'Heureux, K. (2021). Exploring the impacts of contextualised outdoor science education on learning: The case of primary school students learning about ecosystem relationships. *Journal of Biological Education*, *56*(4), 428–442. https://doi.org/10.1080/00219266.2021.1909634

Ayotte-Beaudet & Potvin. (2020). Factors related to students' perception of learning during outdoor

science Llessons in schools' immediate surroundings. *Interdisciplinary Journal of Environmental and Science Education*, *16*(2), e2212. https://doi.org/10.29333/ijese/7815

Beames, S., Higgins, P., & Nicol, R. (2016). *Learning outside the classroom: Theory and guidelines for practice*. Routledge. https://doi.org/10.4324/9780203816011

Becker, C., Lauterbach, G., Spengler, S., Dettweiler, U., & Mess, F. (2017). Effects of regular classes in outdoor education settings: A systematic review. *International Journal of Environmental Research and Public Health*, *14*(5), 485. https://doi.org/10.3390/ijerph14050485

Cohen, L., Manion, L., & Morrison, K. (2018). *Research methods in education (8th ed.)*. Routledge. https://www.routledge.com/Research-Methods-in-Education/Cohen-Manion-Morrison/p/book/9781138209886

Creswell, J. W., & Creswell, J. D. (2018). *Research design: Qualitative, quantitative, and mixed methods approaches (5th ed.)*. SAGE Publications.

DeVellis, R. F., & Thorpe, C. T. (2021). *Scale development: Theory and applications (5th ed.)*. SAGE Publications. https://books.google.co.id/books?id=QddDEAAAQBAJ

Fraenkel, J. R., Wallen, N. E., & Hyun, H. H. (2019). *How to design and evaluate research in education (10th ed.)*. https://www.mheducation.com/unitas/highered/changes/fraenkel-how-to-design-and-evaluate-research-in-education-10e.pdf

Hastika, A. D., Saefudin, & Supriatno, B. (2024). Exploring students' perceptions of outdoor biology learning activities in botanical garden. *Jurnal Penelitian Pendidikan IPA*, *10*(5), 2379–2387. https://doi.org/10.29303/jppipa.v10i5.6718

Hyde, J. S. (2014). Gender similarities and differences. *Annual Review of Psychology*, *65*, 373–398. https://doi.org/10.1146/annurev-psych-010213-115057

Kolb, D. A. (2015). *Experiential learning: Experience as the source of learning and development (2nd ed.)*. FT Press. https://books.google.co.id/books?id=jpbeBQAAQBAJ

Kuo, M., Barnes, M., & Jordan, C. (2019a). Do experiences with nature promote learning? Converging evidence. *Frontiers in Psychology*, *30*, 305. https://doi.org/10.3389/fpsyg.2019.00305

Kuo, M., Barnes, M., & Jordan, C. (2019b). Do experiences with nature promote learning? Converging evidence of a cause-and-effect relationship. *Frontiers in Psychology*, *10*, 305. https://doi.org/10.3389/fpsyg.2019.00305

Lee Sang, C. A., Childers, G., Hite, R., Matteson, S., Whitworth, C., Darwin, T., Mosley, B., & Mack, C. (2026). DAST: Exploring middle school-aged girls' perceptions of scientists upon participating in an outdoor learning experience. *Journal of Outdoor and Environmental Education*. https://doi.org/10.1007/s42322-026-00250-x

Mann, J., Gray, T., & Truong, S. (2023). Does growth in the outdoors stay in the outdoors? The impact of an extended residential and outdoor learning experience on student motivation, engagement and 21st century capabilities. *Frontiers in Psychology*, *14*, 1102610. https://doi.org/10.3389/fpsyg.2023.1102610

Mann, J., Gray, T., Truong, S., Brymer, E., Passy, R., Ho, S., Sahlberg, P., Ward, K., & Bentsen, P. (2022). Getting out of the classroom and into nature: A systematic review of nature-specific outdoor learning on school children's learning and development. *Frontiers in Public Health*, *10*, 877058. https://doi.org/10.3389/fpubh.2022.877058

Mapulanga, T., & Bwalya, A. (2025). Gender differences in secondary school students' perceptions of teaching practices used in Biology classrooms. *African Journal of Research in Mathematics, Science and Technology Education*, *29*(1), 1–12. https://doi.org/10.1080/18117295.2024.2444793

Mernisa, M., & Djukri, D. (2018). The influences of outdoor learning process (OLP) on conceptual understanding and environmental concern: Implementations on the ecosystem subject. *Journal of Physics: Conference Series*, *1097*, 012043. https://doi.org/10.1088/1742-6596/1097/1/012043

Pintrich, P. R. (2003). A motivational science perspective on the role of student motivation in learning and teaching research. *Journal of Educational Psychology*, *95*(4), 667–686. https://doi.org/10.1037/0022-0663.95.4.667

Siregar, S. D., Saefudin, S., & Riandi, R. (2025). Improving student's science process skills through environment-based guided inquiry on biodiversity in outdoor learning. *JPBI (Jurnal Pendidikan Biologi Indonesia)*, *11*(3), 841–847. https://doi.org/10.22219/jpbi.v11i3.41236

Stevenson, K. T., Szczytko, R. E., Carrier, S. J., & Peterson, M. N. (2021). How outdoor science education can help girls stay engaged with science. *International Journal of Science Education*, *43*(7), 1090–1111. https://doi.org/10.1080/09500693.2021.1900948

Tağrikulu, P., Cirit Gül, A., & Çobanoğlu, E. O. (2021). Examining of perception levels of secondary education students regarding outdoor learning. *E-Kafkas Journal of Educational Research*, *8*(3), 499–513. https://doi.org/10.30900/kafkasegt.953811

UNESCO. (2020). *Global education monitoring report 2020: Inclusion and education: All means all*. https://unesdoc.unesco.org/ark:/48223/pf0000373724

UNESCO. (2024). Global education monitoring report 2024: Gender report. In *Paris: United Nations Educational, Scientific and Cultural Organization*. https://unesdoc.unesco.org/ark:/48223/pf0000391998

Waluyo, L., & Rahardjanto, A. (2022). The understanding of male and female students on the basic concepts of evolution. *JPBI (Jurnal Pendidikan Biologi Indonesia)*, *8*(1), 51–57. https://doi.org/10.22219/jpbi.v8i1.18636