Fronteiras: Journal of Social, Technological, and Environmental Science
http://periodicos.unievangelica.edu.br/fronteiras/
ISSN 2238-8869

Article

Integration between Environmental Education and Botany Teaching: Students' Perceptions during a Visit to Taboão Ecological Park in the Municipality of Lorena - São Paulo, Brazil

Carine Palmeira de Lima[1] , **Luiz Fernando de Sousa Antunes**[2] , **Célia Regina Tomachuk**[3]

[1] Master's Degree in Science Education Projects. University of São Paulo. ORCID: 0000-0003-4410-2415. E-mail: carinepalmeira@hotmail.com

[2] PhD in Plant Science. Federal Rural University of Rio de Janeiro. ORCID: 0000-0001-8315-4213. E-mail: fernando.ufrrj.agro@gmail.com

[3] PhD in Engineering. University of São Paulo. ORCID: 0000-0002-3771-5945. E-mail: celiatomachuk@usp.br

ABSTRACT

This study explores the potential of Taboão Ecological Park, located in the municipality of Lorena, São Paulo, as a pedagogical tool in teaching botany and environmental education to 7th-grade elementary school students. The research included a theoretical class, followed by a visit to the park, where initial and final assessments were conducted to measure the impact of the experience on student learning. During the visit, students produced reports expressing their perceptions of the experience. The results indicated that the visit to the park was extremely beneficial, providing students with direct contact with plants, which enriched their understanding of botanical characteristics and increased their motivation to study. In addition, this article seeks to promote the park as an effective educational resource, encouraging other educators to use this space in their teaching practices. Observing plants in their natural environment was fundamental to consolidating knowledge, reinforcing the importance of educational methods that involve practical and visual contact.
Keywords: field trip; ecological park; science teaching.

ABSTRACT

This study explores the potential of the Taboão Ecological Park, located in the municipality of Lorena, São Paulo, as a pedagogical tool in teaching botany and environmental education to 7th-grade students. The research included a theoretical lesson followed by a visit to the park, where initial and final assessments were conducted to measure the impact of the experience on students' learning. During the visit, students produced reports expressing their perceptions of the experience. The results indicated that the visit to the park was highly beneficial, providing students with direct contact with plants, which enriched their understanding of botanical characteristics and increased their motivation to study. Furthermore, this article aims to promote the park as an effective pedagogical resource, encouraging other educators to incorporate this space into their teaching practices. Observing plants in their natural environment was essential in consolidating knowledge, emphasizing the importance of educational methods that involve practical and visual engagement.
Keywords: field trip; ecological park; science education.

Submission: 02/06/2025 Accepted: 28/07/2025 Publication: 09/04/2025

v.14, n.3, 2025 • p. 1-15. • DOI http://dx.doi.org/10.21664/2238-8869.2025v14i3.8025

Introduction

According to Cairus(2020) , practical activities are those that favor the student's role as the protagonist of their learning, as they lead to different attitudes where the student actually puts into practice what was taught in theory. It refers to pedagogical actions that aid in understanding.

The performance of a practical activity goes hand in hand with the concepts that must be explained in theory, that is, practice will complement and aid in a better understanding of subjects addressed theoretically. In addition to contributing to the construction of knowledge, these activities also promote unity among students, teamwork, division of roles, and understanding of rules and procedures (L. C. dos Santos 2022) . This contact can lead to greater student motivation, in addition to enabling students to work in groups and develop skills that would not be achieved through theoretical classes alone, such as better classroom interaction and the development of student confidence (Aragão and Alves-Filho 2016) .

This statement is in line with the thinking on education of biologist and psychologist Jean Piaget, who developed a theory on the construction of knowledge called Genetic Epistemology. For Piaget, knowledge is constructed from the interaction of the subject with the environment. He recommends a break with education based on the transmission of knowledge and memorization, and the teacher seen as unique in the process of construction and learning. To this end, he recommends an education based on the student involved in an active process, where they construct and give meaning to their knowledge through the stimulation of experimental activities (Piaget 2010) .

Paulo Freire, Brazilian educator and philosopher, proposes discussions on teaching and education in the formation of reflective individuals through experiences that connect students' lives and raise social issues. According to the author, banking education, seen as that in which the teacher transmits knowledge to the student, does not promote assimilation and reflection on what is studied. To this end, in his book Pedagogy of Autonomy: Knowledge Necessary for Educational Practice, the author highlights actions for teachers to improve their pedagogical practice in search of better contact and assimilation of the content by students, defending the need for student interaction with the object of study (Freire 1996) .

Practical activities in botany teaching become meaningful for students when they are related to real experiences and are implemented through a contextualized and planned methodology. In this context, students play an active role in knowledge construction, under the supervision of the teacher. This methodological approach not only makes teaching more motivating, creative, and dynamic, but also contributes to a more enjoyable learning environment. Consequently, the use of these practices more effectively stimulates students and promotes improvement in the discipline, since the application of diversified methods can result in more meaningful engagement and more positive behaviors in the school environment (M .

Silva et al(2024) defend the relevance of implementing field classes in the teaching of botany, highlighting that these experiences provide an educational approach that integrates human, social, and environmental aspects, enriching the socio-educational process. The authors note that, historically, field classes have faced significant challenges, including devaluation and a lack of resources, investments, and public policies that encourage their adoption. To overcome these barriers, they argue that it is crucial to establish a collaborative environment and carry out careful planning, which should include adequate financial investments, clear pedagogical objectives, and well-defined actions. In addition, they highlight the importance of continuous negotiation and monitoring of activities before, during, and after field classes to ensure their effectiveness and integration into the teaching process.

This study proposes the implementation of the Taboão Ecological Park as a pedagogical strategy in the teaching of botany, with the aim of providing 7th-grade elementary school students with a practical and direct immersion in the study of plants. The goal is to create activities that actively engage students, promoting contact

with the natural environment and integrating field experiences with botanical theory. The approach includes visits to the park, where students can make direct observations and participate in practical activities, facilitating their understanding of botanical characteristics and the application of the knowledge acquired. The research seeks not only to reinforce the importance of plants in the ecosystem, but also to increase student motivation and improve their understanding through practical experience. The study aims to demonstrate the value of Taboão Ecological Park as an effective educational resource and encourage other educators to adopt similar methods in their teaching practices.

The importance of natural environments in education, especially in the teaching of botany, is recognized, as evidenced by the researcher's experience. Upon entering university, the researcher observed a significant gap in her previous education regarding the morphological knowledge of plants. This recognition led to the development of a pedagogical approach that aims to provide students with a more immersive and meaningful learning experience. During the visit to Taboão Ecological Park, it was possible to observe a notable increase in student motivation, highlighting how direct interaction with the natural environment can enrich the learning process. The practical experience allowed students to better understand the vital function of plants in our ecosystem and the importance of their role in sustaining life on Earth. Thus, the study reaffirms the need to integrate natural environments as educational resources to promote a more complete understanding and reduce inequalities in access to knowledge.

The research conducted by Santos(2022) reveals that students performed poorly in assessments conducted before exposure to practical activities in botany teaching, indicating that the knowledge acquired was limited in the absence of methods that brought students closer to the subject matter. However, after the implementation of practical activities, a significant improvement in knowledge assimilation was observed, evidenced by a sharp growth curve in student performance. These results suggest that students' lack of mastery of the content is directly related to the teaching methodologies employed. Thus, the research underscores the importance of integrating practical activities into the educational process, highlighting their effectiveness in facilitating knowledge acquisition and promoting a more robust understanding of the content covered.

Materials and Methods

A visit to Taboão Ecological Park (Figure 1) was conducted with 27 seventh-grade students during one morning. Taboão Ecological Park is located in the municipality of Lorena, São Paulo, and covers approximately 80 hectares of an area dedicated to environmental protection and preservation, leisure, and the dissemination of regional culture.

The site has a room dedicated to environmental education, a library with an environmental collection, a museum on the history of the park, trails, and recreation areas. The park also has a biologist who, with prior scheduling, is available to receive students, giving lectures and leading discussions. Prior to the visit to the Ecological Park, a diagnostic assessment of the students was carried out. There was a theoretical class and a report was completed during the visit. Afterwards, the students took a final assessment to verify their learning.

Prior to the visit to the park, an initial diagnostic assessment was applied, a questionnaire containing seven questions, two open-ended and five multiple-choice, on the main groups of plants in botany and their ecological relevance, which the students answered individually and anonymously.

Figure 1- Taboão Ecological Park located in f Lorena, São Paulo. Source: authors (2023)

Results and Discussion

The survey was conducted with a total of 180 students, 28 (15.59%) from the municipality of Olaria-MG, 106 from Lima Duarte-MG (58.89%), and 46 from Bom Jardim de Minas-MG (25.14%). In the three municipalities surveyed, more than 70% of students are familiar with PANC, and at least half of them reported having PANC at home. Students are knowledgeable about the nutrients provided by PANC, ranging from 64% to 82% among the municipalities studied. In the city of Olaria-MG, 100% of students agree that the school should offer PANC on the menu, while in the other municipalities, this intention ranged from 79 to 83%. Regarding home gardens, more than 50% have them, and the percentage of students who have PANC at home ranged from 43 to 50%. Regarding the consumption of PANC at school, the percentage in each municipality ranged from 29 to 39%. Below, as presented in Table 1, there is information about the species listed by the students, as well as word clouds by municipality (Figure 1) of the PANC that were most highlighted by students from public schools in Olaria-MG, Lima Duarte-MG, and Bom Jardim de Minas-MG.

The first question (Figure 2) investigated the presence of botanical imperceptibility in students, that is, in an image where there was a bird, flowers, and a tree, which living being would be most easily identified and highlighted. A total of 30 students responded to the questionnaire, but although the question asked students to respond with only one word, some students responded with two, so 34 responses were counted. It can be seen that most of the students (22), approximately 65%, were able to immediately observe the animal in the image. This information is in line with the study by Balas and Momsen(2014) , which found that people are less sensitive to observing plants in the environment, i.e., the image captured at the initial moment is usually of an animal in relation to plants, which is information that confirms botanical imperceptibility. This phenomenon affects the teaching of botany, which must increasingly seek resources to combat students' distancing from plants (Amatuzzi 2023) .

As long as society fails to see the minimum amount of plant life present around them, they will not be able to care for flora and realize the importance of these beings for the environment. This means that botanical imperceptibility can have negative consequences for the environment. Thus, it is emphasized that knowledge about plants is indispensable for the human species, and it is necessary for students in their educational process to have frequent contact with these living beings, in order to develop a positive view of the plant world and rebuild a positive bond with nature in humans (Gonçalves 2023) .

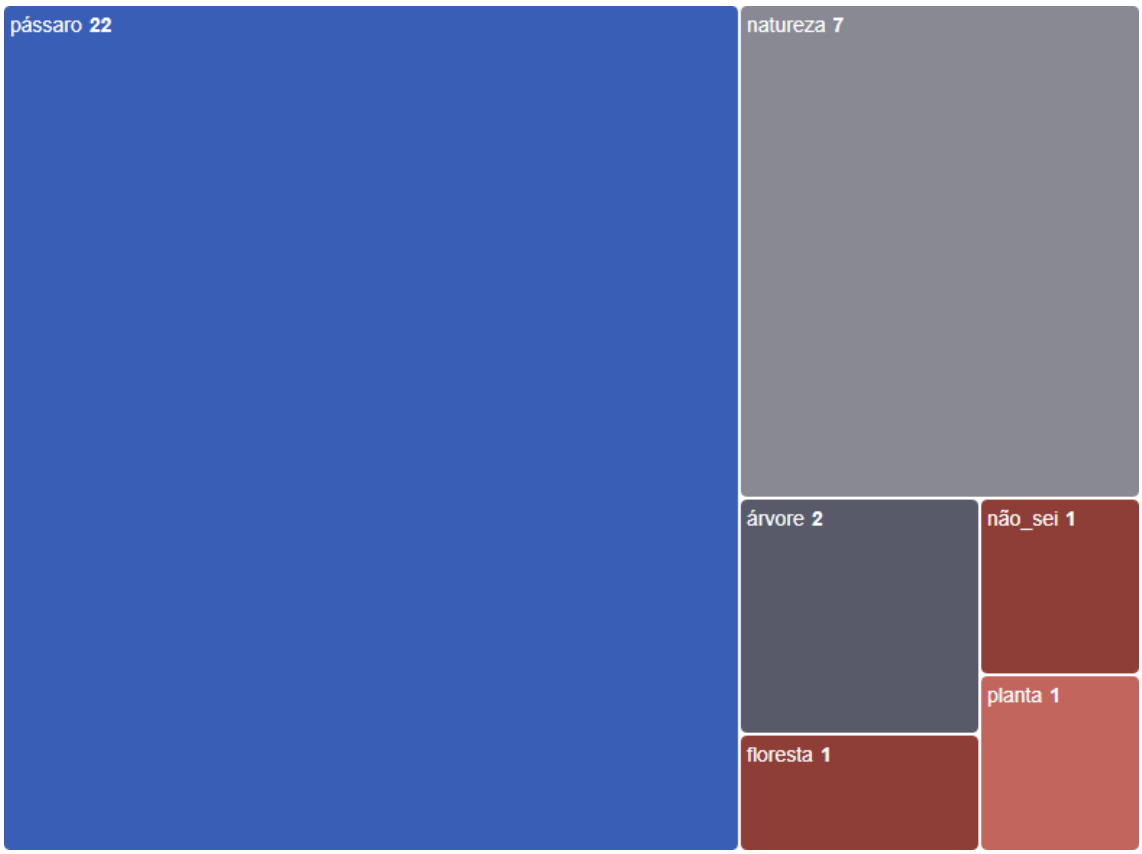

Figure 2- Analysis of responses to question no. 1 “Describe in one word the first thing you identify in this image.” Prepared using Atlas.ti software. Source: authors (2023).

Question 2 aimed to assess students’ knowledge of the scientific field dedicated to the study of plants and showed that only 50% of students knew the meaning of the term botany (Figure 3).

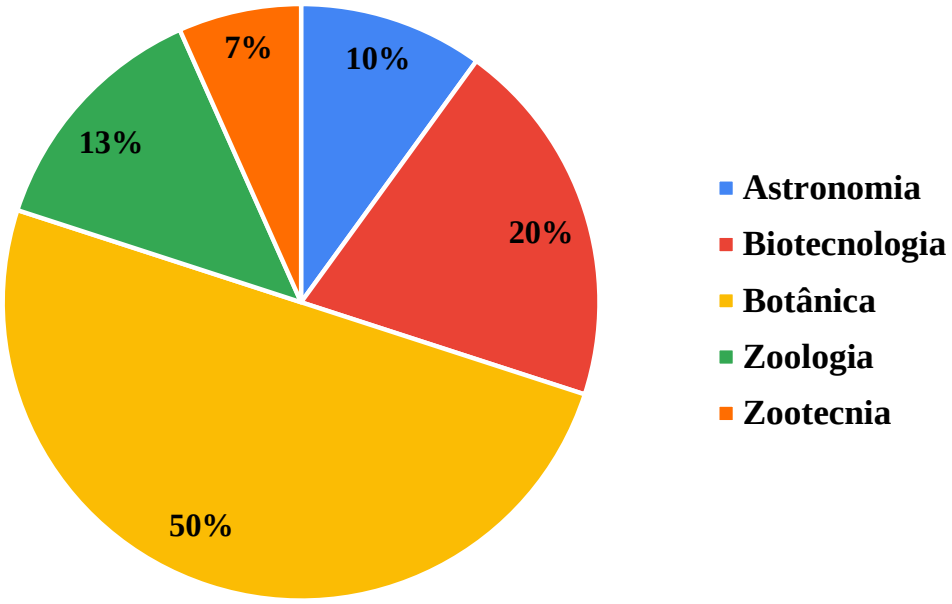

Figure 3 - Question 2: "Plants are studied in an area of science called...". Source: authors (2023).

Learning does not occur when a student has had mechanical contact with botany, that is, when the student memorizes a term instead of attributing meaning to it. When learning is based solely on memorization, without experience with the object of study, the term in question can easily be forgotten (Moreira 2002) .

Question 3 sought to discover the students' prior knowledge regarding the Bryophyta group (Figure 4-A). It can be seen that no student was able to identify the group. Question 4 sought to discover the students' prior knowledge regarding the Pteridophyta group (Figure 4-B). It can be seen that none of the students had any knowledge about the group. Question 5 sought to discover the students' prior knowledge regarding the Gymnospermae group (Figure 4-C). It can be seen that only 3% of students were able to identify the group. Question 6 sought to discover the students' prior knowledge of the Angiosperms group (Figure 4-D). It can be seen that only 3% of students were able to identify the group.

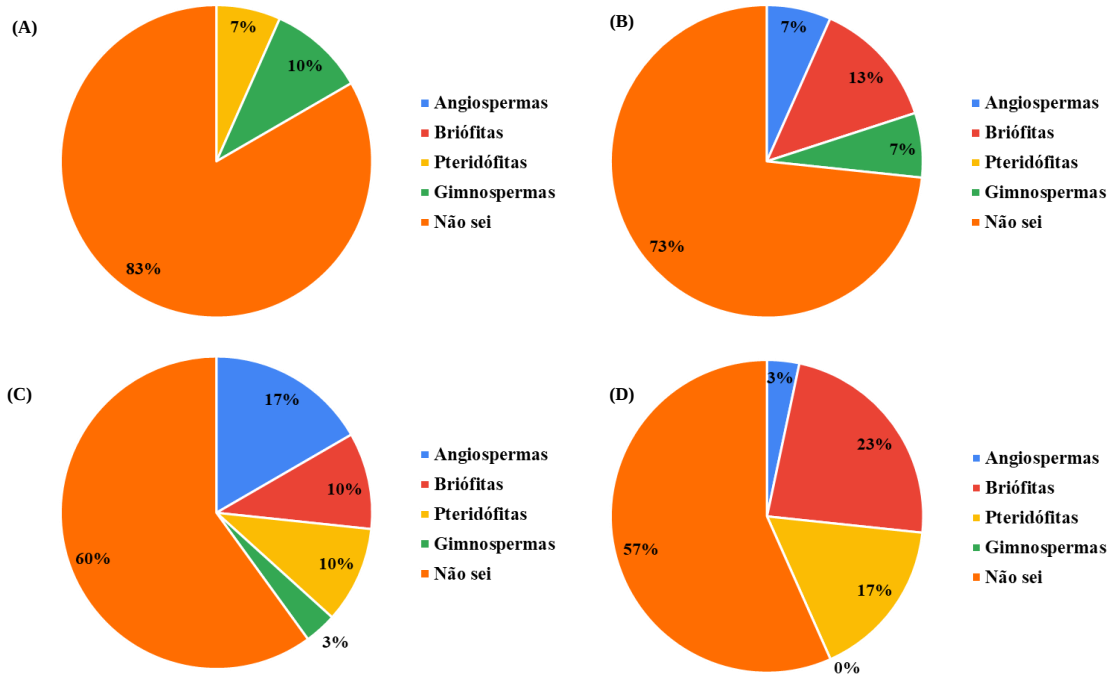

Figure 4 - Question 3: "During a science class, a student noticed something green on a damp wall. When asked, the teacher said it was a small plant that was extremely dependent on water, as it had no conducting vessels. Do you know which group the teacher was talking about?" (B) Question 4: "Maria told her class that her mother had several plants to decorate the house and that her favorite were ferns. These plants belong to the group..." (C) Question 5: "Pine trees are plants that are widely used during the Christmas season and produce pine nuts as seeds. These trees do not bear fruit or flowers, which means they belong to the group of..." (D) Question 6: "In a botany class, a student brought a flower to the classroom. When the teacher asked the class to identify which group this plant belonged to, everyone answered calmly, because only..." Source: authors (2023).

The data presented are concerning, as students do not demonstrate knowledge about the main plant groups. When there is no interest in or knowledge about plants, it is unlikely that they will be cared for. Barbosa et al.(2020) identified gaps in knowledge about bryophytes and pteridophytes, attributed to the lack of coverage of these groups in textbooks, which limits students' familiarity with the subject. However, it is crucial to address these groups due to their essential functions for life. Oliveira(2022) highlights the need to work on this content to make students aware of the importance and characteristics of these plants. In the study of angiosperm and gymnosperm groups, Carvalho, Silva, and Mendonça(2018) observed difficulties in students' prior knowledge, attributed to factors such as lack of interest, inadequate classroom coverage, or little emphasis on the plant kingdom compared to the animal kingdom. This imbalance in the curriculum may contribute to students' lesser familiarity with plant characteristics.

In relation to question no. 7, "What is the role of plants on our planet?", 53% of students answered "I don't know," 27% of students attributed the role of plants to their importance for the air, 10% attributed importance to the environment, 7% attributed the importance of plants to food, and 3% to shade. It is essential to reflect when more than 50% of students lack knowledge about the importance of plants.

After the diagnostic assessment, it was found that students lacked solid scientific knowledge about the main groups of plants. Based on these results, a theoretical class and a field trip to Taboão Ecological Park were planned, using specific pedagogical strategies to raise students' awareness and bring them closer to the content of botany. Through activities that integrate theoretical knowledge with practical observation of plants, the aim is to consolidate scientific knowledge and establish a solid foundation for continuous learning in the field of botany.

Theoretical class for understanding concepts

The theoretical class was organized according to the principles of Krasilchik (2004) , which highlights the importance of lectures for conveying concepts, emphasizing relevant aspects, and stimulating students. To capture the students' attention, resources such as interactive discussions, voice variation, and audiovisual resources were used, including a *PowerPoint* presentation® . The visual presentation contained representative images of plants, promoting reflection on the students' prior knowledge. Each group of plants was addressed separately, focusing on identifying and understanding their environmental importance.

Visit to Taboão Ecological Park

A field trip was made to Taboão Ecological Park with 27 seventh-grade students. The biologist responsible for the Ecological Park welcomed the students and gave a lecture on "The importance of plants" (Figure 5). During the visit, the groups of plants and their ecological importance were discussed with the students.

Figure 5- Biologist responsible for the Ecological Park giving a lecture emphasizing the importance of plants to students. Source: authors (2023).

The biologist conducted a rain simulation in a degraded area and in a forest area. This practical activity highlighted the importance of plants in soil conservation and water cycle regulation, emphasizing their essential role in maintaining the balance of ecosystems. The students were able to understand in a concrete

way how the preservation of green areas is fundamental for environmental sustainability and the quality of life of future generations (Figure 6).

Figure 6- Test simulating the effect of rain on degraded and non-degraded soil to observe water infiltration. Source: Author (2023).

During the visit to Taboão Ecological Park, the biologist in charge presented a detailed analysis of the phenomenon of silting, emphasizing the crucial role of plants in preserving soil and water quality. The biologist explained how vegetation contributes to soil stabilization, preventing erosion and silting of water bodies, while improving water infiltration and the health of aquatic ecosystems. He highlighted the importance of plants in maintaining ecological balance, emphasizing how they sustain a variety of species of living beings that inhabit these environments. The biologist also demonstrated the relevance of plant seeds and the role of animals in dispersing these seeds. He explained how different animal species contribute to seed dispersal, facilitating plant regeneration and, consequently, the continuity of ecosystems. In addition, he discussed the purpose of ecological parks, elucidating their function as spaces dedicated to biodiversity conservation and environmental education. The biologist also addressed the main groups of plants, providing information about their characteristics and ecological functions, and how each group contributes to the complexity and stability of ecosystems.

At the end of the visit, the students completed a report on the experiences and lessons learned during the visit. The report included observations, reflections, and analyses of what they experienced, highlighting the positive and negative aspects of the experience.

The first question in the report sought to make students reflect on and respond to the importance of having an ecological park. There were various responses, such as: plants, nature, knowledge, learning, trees, environment, learning, animals, air, natural, preservation, and vegetation (Figure 7). The information provided by the students was considered relevant as it showed that they were able to identify the importance of environments, such as ecological parks, that preserve vegetation. The existence of an ecological park is extremely important for promoting environmental education and raising awareness among students, proposing practices that aim to improve society's relationship with the environment (Silva 2023) .

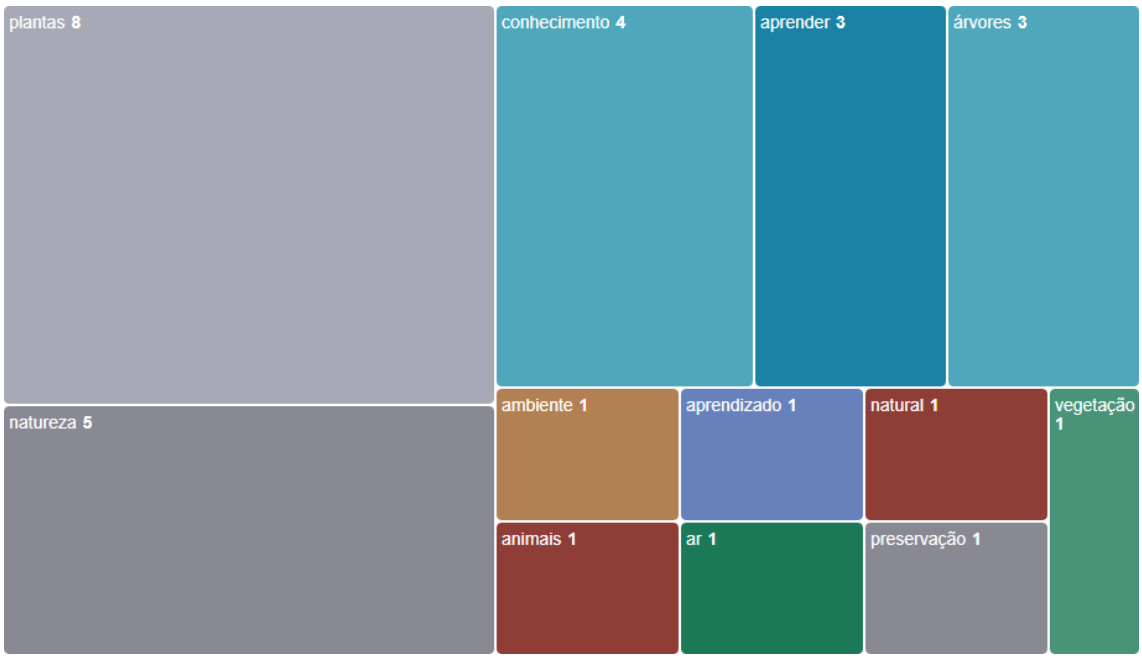

Figure 7- Analysis of responses to question no. 1 "Describe in one word the importance of the existence of a park." Prepared by the Atlas.ti program.

Source: authors (2023).

In the second question, students were asked to answer two questions: where bryophytes are found and their ecological importance (Table 1). Of the 27 students participating in the survey, 26 answered where bryophytes are found, with 21 correctly identifying that bryophytes are only found in humid places. one student demonstrated that they were near the river, which is also a humid location, and two students observed bryophytes on trees, one on the ground, and one on rocks. The other answers are also correct, as bryophytes were also present on the ground, trees, and rocks in the park. One student did not answer where the bryophytes were found, responding only to their importance. It is believed that questions where students need to provide two pieces of information may have caused some misinterpretation for this student.

Silva and Barros (2017a) , when conducting an assessment, realized that initially the students did not perceive the ecological importance of plants, relating their relevance only to their utilitarian aspect for humans. However, after participating in an activity with discussion and observation of plants, there was a change in thinking. The students came to understand that plants play a fundamental role in oxygen production, soil conservation, and biodiversity maintenance. In addition, they began to see plants as living beings that we must care for and preserve, and not just as resources to be used utilitarianly. Thus, it is clear that the workshop and field activities are capable of promoting a significant transformation in students' thinking and awareness regarding plants and the environment.

In question 3 of the report, students were asked to answer which group of plants has the greatest advantage in reproducing their species. Thus, 89% of students were able to correctly answer "Angiosperms." It is important that students are able to understand and relate to the evolutionary issue and the adaptive advantages of plants. Stimulating phylogenetic thinking in groups is important for a critical understanding of biodiversity. In other words, for a real understanding of biodiversity, there must be discussions about the modification of beings and the implications of these modifications for the species (Mendes et al. 2023) .

Table 1- Analysis of the answers provided by students in Question 2: "Regarding bryophytes, in what type of environment in the park did you observe them? Explain their importance in the environment.

Occurrence	Quantity	Importance	Quantity
Trees	2	Environment	2
Soil	1	Air quality	4
Humid places	21	Cool environment	2
On rocks	1	Bioindicators	6
Near rivers	1	Moisture conservation	1
		Flood prevention	1
		Soil formation and retention	6
		Flood prevention	2
		Prevents silting of rivers	1
		Reproduction	1
		Air humidity	1
		Preservation	1
Total	26	Total	28

Source: authors (2023).

Regarding Question 4, "In the park, there was a rain simulation in two areas: one with vegetation and one that was degraded. Were you able to see the importance of plants for the soil, water, and the entire ecosystem?", all students answered yes. The experiment with the rain simulation in the areas with vegetation and degraded areas was very visual for the students, as the experiment clearly showed the difference in the color of the water coming out of a place with vegetation and a degraded place. For this reason, it is believed that all students were able to visualize the importance of vegetation for the soil and the prevention of river silting. This type of visualization is essential and has been confirmed to provide students with greater interest and motivation, helping them achieve satisfactory results. In addition, field activities should be valued as they provide students with direct contact with nature (Santos 2015) .

Questions 5 and 6 of the report sought to verify student satisfaction with the visit to the Ecological Park and the acquisition of new knowledge, where no students were dissatisfied or unsatisfied with the visit to the Park and the acquisition of new knowledge. This result contributes to our assessment that the visit to Taboão Ecological Park was satisfactory for the students, as they were very satisfied with the contribution of the visit to the acquisition of new knowledge.

The visualization of plants carried out during this stage of the sequence is essential and provides students with greater interest and motivation, helping students achieve satisfactory results and favoring direct contact with nature (Santos, 2015). All students reported being satisfied or very satisfied with the visit and the knowledge acquired during the visit to the ecological park.

Results of the final questionnaire

In the final assessment, 27 students answered a form containing seven questions, five of which were multiple choice and two were essay questions. Question 1 aimed to verify whether the students' perception of vegetables had changed, that is, whether there was a decrease in botanical imperceptibility among students (Figure 2). In total, 27 students answered the questionnaire; however, 33 responses were obtained because, although students were asked to answer with one word, some cited two. Previously, 65% of students initially recognized the animals, and now, in the final assessment, 45% of them recognized them, meaning there was a 20% decrease in botanical misperception. However, it is clear that it was not possible to eliminate it completely. This was the first visit providing students with contact with plants. For the author, the reduction in botanical

imperception can already be evaluated as positive. To put an end to this phenomenon, it is necessary that throughout the student's school life there are projects aimed at environmental education (Gonçalves 2023) .

Regarding question no. 2, "Plants are extremely important living beings and are studied within science. There is a specific area dedicated to the study of plants, known as," 100% of students were able to answer correctly "botany." It is clear that students were able to relate the concept of botany to the study of plants, demonstrating that this information was truly understood and not just memorized (Lima 2019) . Students should not resign themselves to the obligation of memorizing content because when there is a properly planned methodology, with teachers and students willing to make changes, it is possible to build a meaningful lesson. Thus, mediation and interaction become fundamental prerequisites for meaningful learning to occur (Guimarães et al. 2023) .

Regarding question no. 3, which sought to verify students' knowledge of the bryophyte plant group, it was found that 86% of students were able to understand the characteristics of this plant group, which is a positive result when compared to the initial questionnaire (Figure 4-A), where no student had any knowledge of the group. Throughout the teaching sequence, students were able to see bryophytes in the school environment, at home, and in the ecological park. In other words, it is believed that contact with the plant enabled the positive result, as already observed in the works of Souza and Araújo(2022) .

Regarding question no. 4, which aimed to assess the students' knowledge of the group of pteridophyte plants, it was found that 82% of the students were able to recognize the group. This was a positive result when compared to the initial questionnaire (Figure 4-B), where none of the students had any knowledge about the group. The pteridophytes were seen during the visit to the ecological park, which may have contributed to learning about the group.

In question 5, which aimed to assess students' knowledge of the gymnosperm plant group, although only 3% of students were able to answer satisfactorily in the initial questionnaire, the results of the new assessment show that 68% of students were able to acquire the knowledge to classify the group. This result is not considered positive, especially when compared to the other plant groups in the questionnaire. This was the only group with which the students had no face-to-face contact, mainly due to the characteristic habitat of gymnosperms. For better student learning, direct contact with the plant both at home and in the school environment is very promising and improves knowledge (Rodrigues and Takahasi 2023) .

In question no. 6, which assessed students' knowledge of the angiosperm plant group, the result was positive, as 89% of students were able to answer correctly. The fact that students performed better in relation to this group of plants is due to their greater contact with the group, which is present in their daily lives, food, and perceptions, as also demonstrated in the research by Silva and Barros (2017b) , who asked 7th-grade elementary school students to name any type of plant, and 95% of the students mentioned a plant from the angiosperm group. Thus, we know that the angiosperm group is the most diverse of all groups, with the largest number of species and occupying the most adapted places (Costa et al. 2023). Therefore, as students have more contact with this group, they found it easier. This corroborates the fact that contact with the object of study is important for the acquisition of knowledge.

Question 7 sought to verify whether, after the teaching sequence, students were able to attribute an important role to plants on our planet. In the initial questionnaire, 53% of students responded that they did not know the function of plants. In this question answered in the final questionnaire, all students were able to attribute some significance to plants. The question was open-ended, and students could describe various functions of plants, which is why 55 different answers were counted. The answers were sorted into categories (Table 2) for better analysis. Students were largely able to understand the importance of plants for feeding various animals belonging to the ecosystem, as they are the major producers in the food chain. In addition, they

were able to relate the importance of plants to the air, correlating them with air humidity, shade, and temperature. They also noted the importance of plants for the preservation of rivers, highlighting the issue of silting. Some responses also addressed the importance of plants for the entire environment. Some students highlighted the importance of plants for the soil, preventing landslides. There were responses that pointed out the medicinal importance of plants and their use as raw material. To a lesser extent, one student demonstrated in their response the importance of plants as shelter for animals, and another student noted the importance of plants for landscaping.

Table 2 - Categorization and number of occurrences of responses provided by students regarding question no. 7: "Plants perform various functions on our planet. If you were able to recognize these functions, write them down below."

Category	Occurrence
Food	16
Air	12
River preservation	7
Environment	7
Soil protection	5
Medicinal importance	3
Raw material for various purposes	3
Shelter for animals	1
Landscaping	1

Source: authors (2023).

It is the role of schools to encourage students to reflect on topics related to environmental education, knowing that change is a slow and gradual process (Alfane et al. 2023) . When students begin to recognize the importance of plants, they begin to develop greater environmental awareness. Students begin to value and respect nature, understanding the importance of environmental preservation for the well-being of all living beings on the planet. In this way, the role of plants in the balance and sustainability of the environment comes to be understood and valued by students, thus contributing to the formation of more responsible citizens who are engaged in protecting our planet.

Final Considerations

This study evaluated the effectiveness of visiting Taboão Ecological Park as a pedagogical strategy for teaching botany and environmental education. The analysis of the results, obtained through diagnostic assessments conducted before and after the visit, revealed a significant improvement in students' understanding of plants and their ecological roles. The practical experience provided by the visit to the park proved to be highly beneficial, especially in terms of understanding the characteristics and importance of plants, which the students did not initially understand in depth.

The data indicate that students showed a notable increase in knowledge assimilation, particularly in relation to plants they had the opportunity to observe directly. Seeing the plants in their natural habitat facilitated learning and helped students recognize the ecological importance of plant species. The visit to the park not only expanded students' knowledge of plant morphology and function, but also raised awareness about environmental preservation and the role of plants in ecosystems.

In addition, student feedback was positively receptive, reflecting high engagement and satisfaction with the experience. The research confirms that Taboão Ecological Park can serve as a valuable educational resource, offering a practical and interactive approach to teaching botany and environmental education. Thus, we believe in the importance of incorporating visits to ecological parks and similar natural environments into educational practices in order to enrich the learning process and promote a deeper and more meaningful understanding of topics related to botany and environmental preservation.

References

Alfane, Issa Buana, Roberto da Costa Chaua, and Victorino Correia Kinhama. 2023. "The school and its role in environmental education: a study with school communities in the Muatala neighborhood, city of Nampula (2019–2022)." *Ibero-American Journal of Humanities, Sciences, and Education* 9 (5): 14–30. https://periodicorease.pro.br/rease/article/view/9479.

Amatuzzi, Laise. 2023. "Survey and analysis of teaching materials for botany education." Final Course Project (Full Degree), Federal University of São Carlos. https://repositorio.ufscar.br/handle/ufscar/17893.

Aragão, Paulo de Tarso Teles Dourado, and João Garcia Alves-Filho. 2016. "Importance of practical classes in biology teaching, according to the assessment of students at a school in the city of Sobral/CE." *Essentia - UVA Journal of Culture, Science, and Technology.* //essentia.uvanet.br/index.php/ESSENTIA/article/view/112.

Balas, Benjamin, and Jennifer L. Momsen. 2014. "Attention 'Blinks' Differently for Plants and Animals." *CBE—Life Sciences Education* 13 (3): 437–43. https://doi.org/10.1187/cbe.14-05-0080.

Barbosa, Maria da Conceição Pereira, Josivan Washington M. dos Santos, Flávia Carolina Lins da Silva, and Betânia Cristina Guilherme. 2020. "The teaching of botany through didactic sequence: an experience in teaching science with practical classes." *Brazilian Journal of Development* 6 (7): 45105–22. https://doi.org/10.34117/bjdv6n7-217.

Cairus, Regina Julia do Reis. 2020. *Practical activities in biology teaching from the perspective of inclusive education*. December 18. https://repositorio.unb.br/handle/10482/40678.

Carvalho, Josabete Salgueiro Bezerra de, Luís Fernando M. da Silva, and Conceição Aparecida Soares Mendonça. 2018. "Prior knowledge of 8th grade students about the concept of fruit: a reference point for the teaching-learning process." *Education and (Trans)formation* 3 (1): 1. https://www.journals.ufrpe.br/index.php/educacaoetransformacao/article/view/1846.

Carvalho, Mariana Moreira. 2017. "Botany in Elementary School II: application of CTS movement concepts through active methodology." Text, University of São Paulo. https://doi.org/10.11606/D.97.2017.tde-30062017-203800.

Costa, Jeferson Miranda, Marcio Roberto Pietrobom, Marcos Benigno Silva Martins, and Ricardo Leite Ferreira Filho. 2023. "The collection of pteridophytes in the herbarium of the Federal Institute of Pará - Abaetetuba campus (Hifpa)." *Biodiversity* 22 (1): 1. https://periodicoscientificos.ufmt.br/ojs/index.php/biodiversidade/article/view/15258.

Freire, Paulo. 1996. *Pedagogy of Autonomy: Knowledge Necessary for Educational Practice*.25thed. Reading Collection. http://www.apeoesp.org.br/sistema/ck/files/4-%20Freire_P_%20Pedagogia%20da%20autonomia.pdf.

Gonçalves, Karolini Ferreira. 2023. "Awakening to plants: contributions of environmental education to overcoming plant blindness." Final Course Project (Bachelor's Degree in Pedagogy), Federal University of Goiás. http://repositorio.bc.ufg.br/handle/ri/22277.

Guimarães, Alves Ueudison, Joelven Roberto Alves da Rocha, Sonia Lopes dos Santos, and Norma Suely da Silva Santos. 2023. "Teacher training: active methodologies involving theory and practice." *RECIMA21 - Multidisciplinary Scientific Journal,* April 26. https://recima21.com.br/index.php/recima21/article/view/3043.

Krasilchik, Myriam. 2004. *Biology Teaching Practice*. EdUSP.

Lima, H. O. 2019. "The teaching of botany from a practical, theoretical, and regional perspective."

Mendes, Samuel Lucas Da Silva Delgado, Alexandra Elaine Rizzo, and Diogo Mayrinck. 2023. "Reflections on the teaching of evolution in the current context of taxonomic impediment." *Investigations in Science Teaching* 28 (1): 1. https://doi.org/10.22600/1518-8795.ienci2023v28n1p78.

Moreira, Marco Antonio. 2002. "What is meaningful learning, after all?" *Inaugural Lecture of the Graduate Program in Natural Science Teaching,* Institute of Physics, Federal University of Mato Grosso, April 23. http://periodicos.uea.edu.br/index.php/arete/article/view/151/150.

Oliveira, Tamires Ferreira de. 2022. "Development of a booklet as a teaching resource for teaching/learning the importance of bryophytes and pteridophytes at the high school level." Bachelor's thesis. October 19. https://repositorio.ufpe.br/handle/123456789/47339.

Piaget, Jean. 2010. *Where is education headed?*22ndedition. José Olympio. Rodrigues, Flávio Henrique de Souza, and Adriana Takahasi. 2023. "New perspectives on everyday plants for elementary school students in Campo Grande (MS), ." *Revista Brasileira de Educação Ambiental (RevBEA)* 18 (3): 3. https://doi.org/10.34024/revbea.2023.v18.14132.

Santos, Lucas Carvalho dos. 2022. "The importance of playful experimental activities in teaching physics at the Youth and Adult Education Center (CEJA)." Final Course Project (Bachelor's Degree in Rural Education), Federal University of Campina Grande. http://dspace.sti.ufcg.edu.br:8080/jspui/handle/riufcg/24994.

Santos, Rita Isabel Costa. 2015. "The importance of practical, experimental, and laboratory work, as well as field classes (study visits and field trips) in teaching Biology and Geology." Master's thesis. https://run.unl.pt/handle/10362/19011.

Silva, Camilo Machado. 2023. "The importance of environmental education in Cimba Park in 2016." Final course project (Full Degree in Geography), Federal University of Tocantins. http://repositorio.uft.edu.br/handle/11612/4998.

Silva, Maria Milena Fernandes da, and Ileane Oliveira Barros. 2017a. "Bryophytes and Pteridophytes: The Perspective of Seventh-Grade Students in Jaguaribe, CE." *Conexões - Science and Technology* 11 (6): 6. https://doi.org/10.21439/conexoes.v11i6.994.

Silva, Maria Milena Fernandes da, and Ileane Oliveira Barros. 2017b. "Bryophytes and Pteridophytes: The Perspective of Seventh-Grade Students in Jaguaribe, CE." *Conexões - Science and Technology* 11 (6): 6. https://doi.org/10.21439/conexoes.v11i6.994.

Silva, Renata Priscila, Carmen Roselaine De Oliveira Farias, and Rita Paradeda Muhle. 2024. "From the field practice of the naturalist tradition of biology to the field class at school: distances and approximations." *Science & Education (Bauru)* 30: 1–16. https://doi.org/10.1590/1516-731320240003b.

Souza, Eliandra Araujo, and Joeliza Nunes Araújo. 2022. "Meaningful learning in botany: a study with high school students involving the topic of bryophytes." *Experiences in Science Teaching* 17 (3): 3. https://fisica.ufmt.br/eenciojs/index.php/eenci/article/view/1048.