PERCEPTION OF PLANT ANATOMY OF STUDENTS FROM PUBLIC SCHOOLS IN ALTAMIRA, PA: AN EXPERIENCE REPORT

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ABSTRACT

The difficulty of teaching botany, intensified by botanical blindness, is a contemporary challenge, especially among students who do not recognize the local flora. The objective of this study was to verify the perception of plant anatomy by elementary and high school students from public schools in the municipality of Altamira, PA. Plant parts, such as seeds, leaves and wood, were collected and submitted to micro plant techniques to produce histotheca and anatomical cubes of the Amazonian flora. The material made was exhibited in four schools, accompanied by photographs and testimonies from the students. The results showed great curiosity from the students, who associated the samples with the plants of their daily lives, explored histological stains, manipulated microscopes and identified species present in their backyards. It is concluded that interactive didactic methodologies are important and effective to improve the perception of nature and highlights the need for public policies that improve school infrastructure and strengthen the connection between universities and public schools.

Keywords: Botanical blindness. Didactic methodologies. Plant anatomy. Environmental education.

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INTRODUCTION

The school as an institution plays an essential role in the formation of individuals capable of acting independently, critically and reflectively in society, using the knowledge accumulated throughout history (Carvalho, 2006). In addition to transmitting knowledge, education has the responsibility of forming citizens who are aware of and engaged with environmental issues. Several authors (Silva et al., 2020; Santos and Oliveira, 2019; Pereira and Lima, 2021; Almeida et al., 2022) argue that the integration of environmental education into the school curriculum, combining theory and practice, is essential to develop values such as environmental responsibility and solidarity.

However, there is a complexity faced by elementary and high school teachers when teaching botany, leaving a little bit of the information contained in textbooks and applying broad practices for greater proximity to students. With the advancement of new technologies, students are less and less aware of nature and its preservation, Lima et al. (1999) highlight that carrying out practical activities is crucial to develop scientific concepts, this is because these activities make learning more dynamic and interesting, especially when related to the daily life of students. The lack of basic resources, as reported by Lima (2004), prevents many teachers from diversifying their pedagogical practices, compromising the quality of the teaching-learning process and limiting the development of essential skills for the twenty-first century.

Allied to this, there is also a major obstacle when it comes to teaching botany, known as botanical blindness, a term that refers to the fact that, despite the information about the importance of plants for human beings, interest in botany is so small that plants are rarely perceived as anything more than "components of the environment" or "object for landscaping and decoration" (Hershey, 2002; Wandersee and Schussler, 2001). Knowledge of botany is aggravated not only by the lack of stimulus to look at and interact with plants, but also by the lack of specific materials, equipment and methodologies that can aid in learning (Arruda and Laburú, 1996; Ceccantini, 2006).

Active methodologies have been explored as effective tools to overcome challenges in botany teaching. For example, Freire et al. (2023) discuss the use of virtual and augmented reality in the teaching of biological sciences, providing immersive experiences that bring students closer to the object of study. In addition, active methodologies, such as the development of didactic guides for medicinal plants, have shown positive results in combating botanical blindness and promoting greater student involvement (Santos et al., 2021). Gómez et al. (2020) highlight that interdisciplinary and contextualized activities make learning more meaningful, connecting students to plants in their daily lives.

In this sense, there is a concern to study problems related to the teaching and learning of plant diversity, since it is essential that theoretical and practical activities are proposed that aim to seek changes in the way these themes are taught in schools and in the classroom (Silva and Ghilardi-Lopes, 2014). In this context, it is evident the need to investigate the perception of plant anatomy of students in the public school system of the city of Altamira, in the State of Pará, in order to assist in the development of teaching-learning measures contributing to the valuation of botany in the citizenship formation of education students.

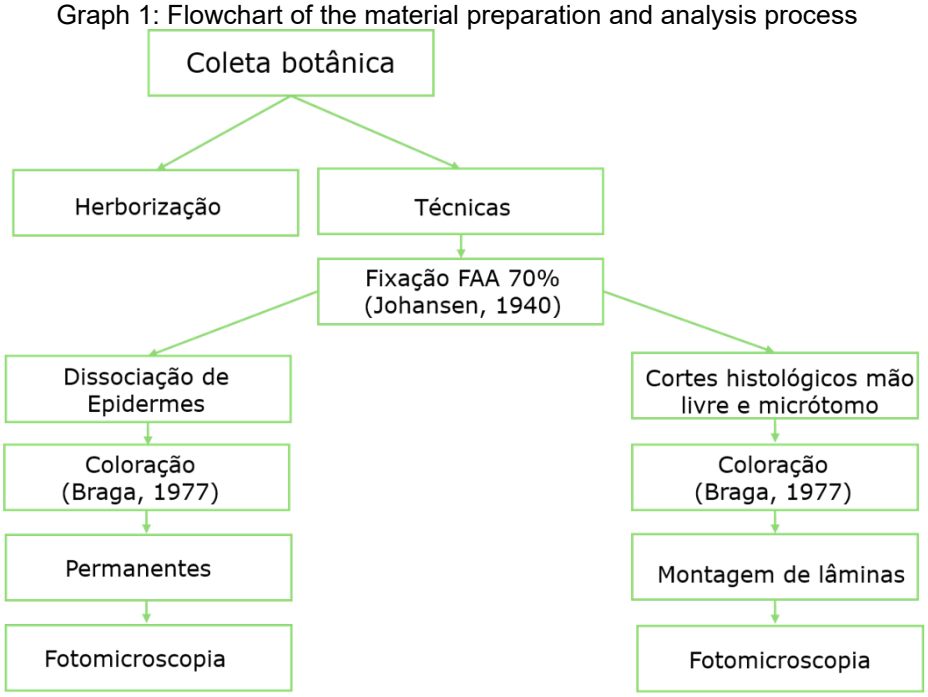
METHODOLOGY

The botanical materials used for exhibition in public schools were collected and prepared at the Laboratory of Wood Technology and Biomass Chemistry of the Federal University of Pará, Altamira Campus. The samples made from plant parts included various types of seeds, leaves, and units of raw and refined wood. After collection, the materials underwent plant microtechniques, such as freehand cuts, the use of microtomes, staining, histochemical tests, and the assembly of temporary and permanent slides (Figure 1). In addition, didactic cubes were made in the three directions of wood cutting: transverse and longitudinal (radial and tangential).

Figure 1: (A) Sample staining processes and (B) leaf diaphanization

Source: Authors, 2023

Graph 1: Flowchart of the material preparation and analysis process



Source: Authors, 2023

Four public schools were selected for the exhibition of the botanical material (Emef Joao Rodrigues Da Silva, Emeif Getúlio Vargas, Emeif Maria Luiza Da Silva Holanda and Emeif Florêncio Filho) in which all are represented by elementary and high school students. The exhibition was divided into three stages: (1) planning and preparation of materials, such as slides for microscopy and plant cell models; (2) survey of students' previous knowledge through a conversation circle, using as a starting point their experiences with plants and (3) introduction of plant anatomy content, combining theory and practice.

RESULTS AND DISCUSSIONS

The exhibition of the botanical material was a new and stimulating experience for many students, generating great interest and several questions. Materials such as diaphanized leaves and colorful anatomical sections of plant structures were presented, providing a rich and detailed view of the world of plants. One of the aspects most commented by the students was the diversity of the diaphanized leaves, which generated discussions about the different forms of leaf veining. In addition, the students were curious about the processes involved in the staining of the anatomical sections, which were prepared with specific dyes such as Safranina and Toluidine blue. These dyes help to highlight cell structures, allowing for a clearer view of microscopic details. The process involved steps such as fixation, dehydration and staining of the samples, followed by mounting on slides for observation at the criterion. This type of activity is essential to arouse

the scientific curiosity of students, as highlighted by Berlyn and Miksche (1976), who emphasize the importance of preparation and observation techniques in science teaching.

Figure 2 (A, B, C, D and E) Exhibition and evaluation of the material made.

Source: Authors, 2023

During the activity, many students established connections between the samples observed and the plants they found in their own homes. Comments such as "There are some of these sheets at my grandmother's house", showed that the children were relating what they saw to their daily lives. These associations are essential for children to realize how plants are part of their lives, whether in food, play or even in the urban landscape. Research by Gomes et al. (2020) and Silva (2021) highlights the importance of bringing the vivid context of children into science teaching, which facilitates the understanding and appreciation of the natural environment. These practices make learning more meaningful by integrating scientific knowledge with the students' reality.

Another positive point of the activity was the students' pleasure in handling the microscope (Figure 2 (A, D)). They were amazed to observe the internal structures of plants, such as stomata, trichomes, and conductive vessels, broadening their understanding of the complexity of plants. This curiosity and excitement were fundamental to the learning, as they motivated the students to explore the different parts of the plants more deeply. Johansen (1940) and Franklin (1945) emphasize that the use of this teaching tool is an excellent way to bring students closer to the microscopic world and the biological sciences in general.

These moments of interaction with botanical material not only teach about plant biology but also help students connect more deeply with the environment. By understanding how plants work and how they are present in their daily lives, students develop a greater empathy for nature and a stronger ecological awareness. Lima (2022) argues that active methodologies, in which students become protagonists of their learning, promote greater engagement and understanding of the contents. This is in line with the ideas of Hattie (2008) and Darling-Hammond (2017), who point out the importance of making teaching more personalized and inclusive, so that all students feel involved in the process.

The choice of public schools to hold the exhibition was an important decision, as it allowed the project to reach a diverse audience, with different socioeconomic contexts. In schools with greater vulnerability, students were not only curious about the scientific content, but also began to value the environment and the plants around them more. In other schools, with more access to resources, the project strengthened students' interest in science and technology. This variation in impact shows how teaching can be adapted to different realities, ensuring that everyone has the chance to learn meaningfully. Santos (2021) points out that it is important to differentiate teaching approaches, taking into account the characteristics of the students, so that everyone can benefit from the activities.

Although technologies such as augmented and virtual reality were not directly used in this project, they have great potential to further enrich science teaching activities. With augmented reality, students could explore 3D models of plants and observe their parts interactively, while virtual reality would allow for immersions in different ecosystems, showing the role of plants in the environment. These tools increase student engagement and make learning even more dynamic, as Freire et al. (2023) can highlight, who highlight the positive impact of interactive technologies on teaching.

The combination of theoretical and practical classes has effective display as it allows students to learn more practically and concretely. This is in line with constructivist theory, which argues that knowledge is built from the interaction of students with the environment and with others. Zabala (2015) emphasizes that this type of approach helps to make learning more meaningful, especially in areas such as botany, which may seem distant from the reality of children.

CONCLUSION

The use of didactic practices, such as the use of active methodologies and laboratory activities, proved to be essential to improve the teaching of Botany. By providing hands-on experiences, students were able to establish clearer connections between theory and

practice, gaining a better understanding of plant structures and the crucial role of plants in their daily lives. The use of microscopes and the exposure of botanical samples facilitated this approach, making learning more engaging and dynamic.

It is recommended that the implementation of these approaches continue to be explored in public and private schools, with the use of more advanced technologies, which can further amplify the educational impact. It is also essential that teachers receive adequate support to apply these methodologies, ensuring a more accessible and effective teaching, capable of arousing students' curiosity and forming citizens who are more aware and critical of the environment.

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