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The use of biology and natural environment contents in the teaching of environmental education

O uso de conteúdos sobre biologia e meio ambiente para ensinar Educação Ambiental

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ABSTRACT

This research aims at showing that games, dynamics, and good forest practices were fundamental to the teaching of environmental education. This study was performed with fifteen students from a state high school who attended theoretical and practical classes at the State University of Northern Paraná. Firstly, we conducted the application of one game about natural places and another one about animals and plants. After that, we did different dynamics about ecology and the environment. Finally, we asked the participants to develop the agroforest process. Text excerpts from a questionnaire were chosen by means of those different instruments/tools, which were subject to discursive textual analysis. The results showed that those practices were effective in teaching of environmental education. However, the results indicated that students know little about regional plants and regional animals. Therefore, there is a need to develop more activities so they learn the names of Brazilian plants and animals.

KEYWORDS: Environmental practices. Agroforest. Discursive textual analysis.

RESUMO

Essa pesquisa tem como objetivo mostrar que os jogos, dinâmicas e boas práticas florestais foram fundamentais para o ensino da Educação Ambiental. O estudo foi feito com 15 estudantes do Ensino Médio de uma escola Estadual, que participaram de aulas teóricas e práticas. As aulas foram conduzidas em uma Universidade do Norte Pioneiro. Primeiramente foi aplicado um jogo sobre ambientes naturais e outro sobre tipos de animais e plantas. Depois nós fizemos diferentes dinâmicas sobre ecologia e meio ambiente. Ao final nós perguntamos aos participantes sobre o desenvolvimento do processo de agrofloresta. Fragmentos textuais de um questionário foram selecionados para Análise Textual Discursiva. Os resultados mostraram que essas práticas foram efetivas no ensino de Educação Ambiental. Entretanto, os resultados indicaram que os estudantes conhecem pouco sobre animais e plantas regionais, havendo a necessidade de desenvolver mais atividades para que eles aprendam os nomes de plantas e animais brasileiros.

***PALAVRAS CHAVE**: práticas ambientais. Agrofloresta. Análise Textual Discursiva.*

INTRODUCTION

According to Krasilchik (2008), it is important to use different kinds of activities to learn. That means that teachers need to diversify methodologies in theoretical and practical classes. A way to diversify the teaching process is to develop practical activities that promote interaction. As Jeronen; Palmberg and Yli-Panula (2017) put it, having students work in groups was among the most indicated teaching methods in which they were active in the learning process. There was an appreciation of the teaching methods, which mainly had a good introduction and included active participation and interactivity.

All these activities show that this process encompasses Piaget's theory of constructivism (2007) which makes it evident that the knowledge of each human being is constructed in the subject's interaction with the environment in which he lives.

A study developed by Cunha and Leite (2009) mentions new forms and methodologies to learn environmental education. One of those recent methods was the "Environmental Perception", which makes it easy to understand the conception of the environment.

An analysis made by Santana et al. (2018) about their research presented in "VI Encontro Pesquisa de Educação Ambiental – EPEA" showed the importance of the inclusion of Environmental Education as a thematic in the basic education curriculum. They observed many actions on social topics. However, the researchers pointed out that there is still a long way to reach what the official documents referred to as Environmental Education.

Silva and Grillo (2008) reported that the application of educational games is very important in the process of environmental education teaching. That is especially true when it comes to children once one can perform playful and recreational activities, encouraging creativity, agility, and knowledge building. Moreover, they will simultaneously reflect on their attitudes and roles in the conservation of the environment.

Many authors use different environmental education actions to learn Biology and other sciences. Santos and Padilha (2021, p. 01) adopted some actions to teach environmental education, and the results obtained in this study demonstrated "the importance of inserting the themes related to forest resources in elementary school classes, further strengthening the construction of an environmentally conscious and sustainable society".

The use of games, dynamics, and agroforestry practices are some alternatives to make group work feasible. Therefore, this research aims at showing that games, dynamics, and good forest practices were fundamental to Environmental Education teaching.

1. ENVIRONMENTAL EDUCATION

According to Sorrentino et al. (2005), Environmental Education emerged as an education process that leads to environmental knowledge materialized in ethical values and political rules of social and market coexistence, which culminates in the balance between benefits and harms of appropriation and use of nature.

Asano and Poletto (2017, p.01) showed that Environmental Education "is fundamental for raising awareness so that natural resources are used in a sustainable way. It ensures that such resources can be used by present and future generations, seeking changes in habits and attitudes, forming a balance between society and nature, providing quality of life, without disrespecting the environment".

In their study, Silva et al. (2015) showed the course contributions to the students' understanding of appropriate notions of Environmental Education and Ecology. They also mentioned their interest to participate in activities with an environmental theme and their commitment to applying the acquired knowledge.

The results of the study by Poletto; Oliveira and Alves (2019) showed that ludic activities contribute to building knowledge about Environmental Education and also promote awareness of the topic. Other activities that helped with the maintenance of the locations, such as emphasizing practical actions, making the participants reflect on sustainability, and arousing interest in being environmental agents. The participants' knowledge improvement about environmental education was remarkable. We believe it can help in the future concerning the preservation of nature and sustainable use of natural resources.

In the pedagogical aspect, Environmental Education appeared as a new aspect of the educational act with an interdisciplinary character, aiming to approach mainly the environmental theme in all subjects of the basic education network, as it is considered a transversal theme, especially in subjects related to natural sciences, due to the close relationship with the environmental issue (AMARAL, 2001).

Dias (2004) reports that the environment is constantly shifting due to changes in its biotic and abiotic components, making positive or negative anthropogenic actions more evident. Therefore, understanding the knowledge about Biology and the environment is important for the development of Environmental Education.

2. MATERIALS AND METHODOLOGY

The research was conducted at the State University of Northern Paraná, in LIPEEBEA (the department lab). The result presented here is part of the project **The teaching of environmental education to high school students**, developed in the Institutional Program of University Extension. Classes were taught every Tuesday and Friday for three months in 2019. The team that conducted the activities was composed of one professor from the University, two undergraduate students from the Biology department, and one master's student, who was supported by Araucária Foundation. The research subjects were fifteen students from a state high school, who participated in theoretical and practical classes.

Firstly, they played two games; the first of them was about natural places and the other one about animals and plants. After that, they did three dynamics about ecology and the environment. At the end of the sequence, the students were asked to develop the agroforest process.

To develop the first game, we used a computer and photos of animals and plants that were displayed to students. While playing bingo, they interacted by describing the characteristics and behavior of animals whose pictures they had.

The second game focused on the description of places. The students had photos of places with different features and environmental conditions. In order to do that, each student was given a set of pictures. Then, they were asked to choose one of the photos and characterize it with a riddle. The other students were supposed to guess which picture the student chose.

As for the dynamics, we developed three activities. The first one was about ecological balance. The professor asked the students to stand on one foot and he pushed them a little. Afterwards, the professor asked the students to pair up and he pushed them a little again. The same happened when students were told to form trios and groups. At the end of the activities, the professor used this experience to show that the environment is only balanced when it has a lot of organisms.

The second dynamic was about ecological interaction. The professor asked the students to make one circle, and all the students held hands and stayed in front of the center of the circle. They needed to make another circle, but now facing back to the center. At this moment, they couldn't let each other's hands go and couldn't cross their arms or hands. The objective of this dynamic was to show students that all organisms work together.

The third dynamic was about the food chain. The students were separated into three groups (one group was composed of tapirs, another group was composed of jaguars and the

members of the third group were plants). The group of tapirs needed to pass the jaguars to get to the plants. The tapirs captured by jaguars became jaguars, too. The plants captured by tapirs became tapirs and the members who weren't captured by jaguars and tapirs became plants. This process was repeated several times. The objective of this dynamic was to show students the types of organisms in the food chain.

The agroforest practice happened in an area at University. At first, students cleaned the area. Then, they cultivated some plants such as pumpkins, okra, parsley, tomatoes, chive, arugula, and medicinal plants. We didn't use pesticides and chemical fertilizers on the plants and they mainly harvested pumpkin and okra. This practice was aimed at teaching about sustainable production.

In order to select students, we used the criterion of diversity and saturation. As for diversity, we applied the criterion of internal diversification (GUERRA, 2006), which enables us to explore the diversity of opinions of a particular group (in our case, high school students). As for the saturation criterion, we applied the precepts of Pires (1997, p. 157), which "allows one to generalize the results of the universe of the study (population) to which the analyzed group belongs to (empirical-analytical generalization)". In this case, we selected five students to represent the group, named S1, S7, S12, S14, and S16.

For the data gathering, we used different tools such as questionnaires, evaluative analysis, and reports. All subjects were coded in S1, S2…..S15 (the letter **S** stands for students). The answers were coded in Q1, Q2…..Q22 (letter **Q** stands for questions). The assessments were coded in E1 and E2 (letter **E** stands for evaluation). Text excerpts were chosen by means of those different instruments/tools, the excerpts were translated into English, which in turn were subject to the Discursive Textual Analysis (MORAES, 2003). For the Discursive Textual Analysis, two categories were created.

The first category was **Consequences of anthropic actions on animals** with three subunits: *enough knowledge, insufficient knowledge,* and *lack of knowledge*. The second category was **Plants and Indication of allegedly Brazilian animals and plants** with the subunits: *regional animals*, *exotic animals*, *regional plants,* and *exotic plants*. Those categories were based on questions about plants and animals as follows: Question 16 - What is the influence of garbage on the regional fauna and flora? Explain. Question 17 - Which native animals of the region do you know? Name them. Question 18 - What native plants of the region do you know? Name them. Question 19 - What is the influence of deforestation on the regional fauna and flora? Explain. Question 20 - What is the influence of fires on the regional fauna and

flora? Explain. Those questions were drawn from a broad questionnaire about environmental education and urban solid residues.

3. RESULTS AND DISCUSSION

Results showed that those practices were effective in the teaching of environmental education. Games showed to be efficient to teach Biology and Ecology topics. Longo (2012) reported that the use of games assists the teaching and learning process in schools. Those processes happened in a playful motivating fun way bringing environmental education topics to everyday life. Students became more competent and creative in solving problems. He also stated that by means of games we can reach goals related to cognition, affection, socialization, motivation, and creativity. Some students mentioned names and animal behavior; others discussed types of plants, as we can observe in the excerpts “trumpet tree, pine cone tree and Brazilian grape tree (jabuticabeira)” (S12, Q18, E2); “capybara, coati” (S16, Q17, E2). The excerpts indicated that the responses fell into two categories that were “consequences of anthropic actions on animals and plants” and “Indication of allegedly Brazilian animals and plants”.

A study conducted with children showed that they understood the condition and environmental problems by being stimulated to acquire knowledge and adopt new behaviors to protect and improve the environment (SILVA, 2006).

Table 1 - Consequences of anthropic actions on animals and plants

Description: This category shows excerpts on the contributions of a sequence of activities from a course for high school students according to the evaluative synthesis. The excerpts are concerning animals and plants in the process of environmental education.	
Enough knowledge	Anthropic actions can cause: • death because if plants died, animals wouldn't have food (S1, Q16, E1); • pollution (S1, Q20, E1) (S14, Q20, E1); • the disappearance of species of a region (S16, Q19, E1); • (droughts) the world can run out of water (S12, Q19, E1); • death of animals (S7, Q19, E1); • death of living beings (S1, Q19, E2); • destroy animals' homes (S7, Q20, E2); • accidents because animals go to roads (S7, Q20, E2); • destruction of the environment where animals live (S12, Q16, E2); • disappearance of fauna and flora of a region (S16, Q20, E2); • pollution and depletion of the ozone layer (S16, Q20, E2);
Insufficient knowledge	• the disappearance of some things (S7, Q19, E1); • destruction (S7, Q16, E1);
Lack of knowledge	• infertility of a region (S16, Q20, E1);

Font: authors (2021)

By analyzing the results in table 1, we can observe how students improved their knowledge about the consequences of anthropic actions on animals and plants. The excerpts in the first evaluation highlighted some aspects mainly about the death of animals and plants and pollution "pollution" (S1, Q20, E1) (S14, Q20, E1); "the disappearance of species of a region" (S16, Q19, E1). On the second evaluation, they not only improved this knowledge but also expanded their remarks about the destruction of the environment, death of fauna and flora, the ozone layer, and "animals road accidents" (S7, Q20, E2); "destruction of the environment where animals live" (S12, Q16, E2); "can cause the disappearance of fauna and flora of a region" (S16, Q20, E2) and "pollution and rupture of the ozone layer" (S16, Q20, E2). There is evidence that students improved their knowledge showing that those practices were effective in the teaching of environmental education.

The excerpts above are evidenced in a study about anthropic actions against animals which reported that human beings are destroying the habitat of animals, leaving them no choice except surviving urbanization or escaping. However, the latter can cause road accidents, which impact the population that is also affected by the loss of their habitat (AVELARA; SILVAB; BAPTISTA, 2015).

This concern of the participants is evident in a study by Collier (2019) "the protected riparian forests had best environmental conditions and ichthyofauna with higher diversity and evenness" (p 01). The author still reports that impacts caused by sugarcane plantations and

urban development resulted in the simplification of the ichthyofauna and nutrient enrichment, which underpinned a process of eutrophication (COLLIER, 2019, page 01).

A student reported indirectly about the Food Chain in his excerpt "if plants died, animals wouldn't have food" (S1, Q16, E1), which showed that he had knowledge, but he didn't know how to write with the correct words.

Other investigators found that most of the students from Australia, Canada, and the USA "had some difficulty in providing a complete explanation of the complex feeding relationship that occurs within a food web and that some of these students revealed one or more misconceptions about these relationships" (BARMAN; GRIFFITHS; OKEBUKOLA, 1995)

There is only one student that was classified with lack of knowledge saying that the consequences of anthropic actions on animals and plants cause the "infertility of a region" (S16, Q20, E1).

We can observe that the students showed an improvement in their knowledge about regional animals in table 2. The excerpts in the first evaluation highlighted aspects especially related to five regional animals: canaries, blue jackdaws, coatis, and tapirs. Canaries and coatis are found normally in urban areas. According to Rodrigues (2017), coatis adapt easily to the city, so much that its population doesn't experience a decrease even after the destruction of its original habitat. However, vertebrate intake may have occurred opportunistically. An anthropic influence was noticed with the intake of processed foods, non-digestible discarded waste, and cultivated fruits. The anthropic presence has influenced the diet of coatis and their activities of foraging in the areas studied.

Reinert and Bornschein (1998) reported that the diet of blue jackdaws is made of seeds of araucária. Therefore, we believe that the students indicate the blue jackdaw because we have the araucária (Paraná State Pine Tree) in Paraná State, which produces seeds that are part of its diet.

Tapirs and capybara are the animals that are the most involved in road accidents and are also more popular because there are many reports about those events. Many road accidents were reported by Freitas and Barszcz (2015) who confirmed that capybaras are animals that have caused the most road accidents, which end up killing both humans and capybaras. The excerpts in the second evaluation highlighted the students indicating those animals as well as capybaras. Only S12 indicated an exotic animal: raccoons.

The results about regional plants showed that the students indicated only four plants: pine cone tree (S12) araucária (Paraná State Pine tree) (S16 and S7), Brazilian grape tree (jabuticabeira) (S12 and S14) and trumpet tree (S7 and S12). This is considered to be superficial

knowledge about plants. They indicate only coffee plants in the group of exotic plants. This number of indications makes it evident that the high school students have acquired little knowledge about regional plants and animals and that the teachers have little time to teach their students about regional plants and animals.

In schools, Botany is one of the most complex areas, whose contents can be difficult to assimilate (MATOS, 2016). This content is meaningful in the study of ecosystems, but the learning process indicates the need for improvement, which is characterized sometimes by students' learning difficulties. This probably happens because Botany contents present many technical terms that are difficult to assimilate and distant from social reality (SILVA, 2013; TOWATA; URSI; SANTOS, 2010). Other than that, studies have shown that teachers have difficulty teaching Botany because they think it's a complex branch of Biology (NASCIMENTO et al., 2017). However, in the study of Freitas et al. (2012), they reported that there isn't only one way to learn and that it is important to keep students active because they are building their knowledge.

Table 2 - Indication of allegedly brazilian animals and plants

Description: This category brings excerpts that show the contributions of a sequence of activities in a course for high school students according to evaluative synthesis. The excerpts are related to regional and exotic animals and plants.	
Regional animals	• canaries, coatis (S12, Q17, E1) • coatis (S16, Q17, E1) • tapirs, blue jackdaws (S7, Q17, E1); (S1, Q17, E1 e E2) • capybara, coati (S16, Q17, E2)
Exotic animals	• raccoon (S12, Q17, E2)
Regional plants	• pine cone tree (S12, Q18, E1) • araucária (Paraná State Pine tree) (S16, Q18, E1 e E2); (S7, Q18, E1); (S7, Q18, E1) • Brazilian grapetree (jabuticabeira) (S14, Q18, E2) • trumpet tree, pine cone tree and Brazilian grape tree (jabuticabeira) (S12, Q18, E2) • araucária (Paraná State Pine tree) and trumpet tree (S7, Q18, E2)
Exotic Plants	• coffee plant (S16, Q18, E2)

Font: authors (2021)

In this study, an analysis concerning learning contents about environmental education was conducted. The excerpts allowed us to assess students' prior and acquired knowledge of some environmental aspects and species. Rickinson (2001) reported that "the base evidence also provides more information about students' environmental knowledge and attitudes about

their educational experiences and preferences". According to the author, this approach is "more about learning outcomes than about learning processes (p.01)".

We believe that it is fundamental to use different kinds of activities to learn Botany. This experience demonstrates that the teacher needs to diversify the methodology process, including theoretical and practical classes (KRASILCHIK, 2008).

4. CONCLUSION

Results showed that those practices were effective in the teaching of environmental education, because games, dynamics and the agroforestry training activity contributed to the construction of knowledge in the participants. Games helped a lot in the assimilation of biology and ecology contents. The dynamics helped to understand the behavior of organisms, the causes and consequences of human actions, such as habitat destruction, urbanization, pollution and death of animals.

However the results indicated that students know little about regional plants and regional animals. Therefore, there is a need to develop more activities so they learn names of Brazilian plants and animals.

We believe that the practice of agroforestry together with the dynamics favored this process of knowledge construction and Environmental Education, especially regarding the concept of food chain and occupation of the environment by human beings. We realized that the period of carrying out the activities may not have been enough for the assimilation of more knowledge and for a deep interaction of the participants with the environment.

There is a need to add more activities and a longer period of time for the entire process. In addition, the collection of information through interviews and experience reports would be an instrument that would probably provide more information for research and deductions on the subject. All of this would provide a continuous Environmental Education process, which is favorable to the participants.

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