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Using the Buriti Petiole (*Maurítiaflexuosa*) to teach biology from the perspective of Sustainability: Conceptions and Practices for high school teachers

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Abstract**—** *This project refers to the constant concerns of those who are concerned with education, specifically, teaching practice regarding the use of teaching resources. Thus, the work aims to build teaching materials using as a raw material the buriti petiole as well as its products.The project was developed based on a literary review focusing on action research. 15 schools, 32 teachers and 350 students participated in the project. The practical part of the project started with cutting the material (petiole of the buriti), removing the bark and drying it in an oven. After cutting and drying, the stems were prepared for the production of teaching materials. The materials produced were: anatomical models of the human body; cells; food chain game among others. In the evaluation, the anatomical pieces were the ones that had the highest approval by teachers in 80%, whereas for students it was the game of the food chain 45%. Among the anatomical pieces, the skeleton had the highest appreciation by teachers 77%, while the kidneys drew more attention from students 48%. For the parents, the digestive system was 38%. Thus, materials constructed with buriti stalk become a mediating tool between biodiversity and the possibility of learning from natural resources.*

Keywords**— Didactic resources. Pedagogical practice. Bidiversity.**

I. INTRODUTION

The educational literature has highlighted the importance of innovation and the application of different teaching materials in the teaching and learning processes. The authors start from the premise that teaching requires study, reflection beyond the planning of the actions themselves.

If we ask a teacher what teaching materials he uses in his biology classes, the answers will mostly refer to a few items: textbook, blackboard, videos and some other texts, as well as teaching objects. If the question asks him to explain the purpose of using a certain material, the answers will oscillate around something like: “facilitate or improve student learning”. A concept should not only serve to identify a material, but contain elements that are associated with its basic functions.

The first aspect that we perceive in this search for a concept is the diversity of expressions that are usually associated with what we call here didactic material. In addition to this term, there is also teaching material, teaching resources or means, didactic resources, pedagogical material or resource. "In summary, the words means, resource, material, auxiliary, combined with teaching, didactic, instructional, teaching-learning, educational and other terms, are expressions frequently found in educational literature" (CASTOLDI et. al; 2009).

The practices combined with the demonstrative experiments makes them arouse the students' curiosity and observation skills, emphasizing sensitivity as a way to draw their attention, leaving the teacher to mediate this knowledge, linking the practice with the theme already

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taught, making it as part of the development of classroom learning. (ARROIO et. al, 2006).

The use of methodological practices, it is necessary to stimulate students to seek knowledge with practice, using alternative methodologies making the student visualize something concrete, stimulated manual and creative skills in learning the discipline of Chemistry through the interaction of practice with the theory. (CARNEIRO; RANGEL; LIMA, 2011. SANTOS; SILVA 2011).

The interaction between practice and theory has been used by riverain and Amazonian indigenous people for years,through toys built with the stalk (petiole) of Buriti, as a form of figures that portray their daily life contextualizing the life of the jungle with the imagination of children thus teaching the youngest, the stories and legends that pass from generation to generation. (SILVA; CARVLHO, 2012).

Buriti for being a species native to the Amazon region, easy to access and with several purposes and options for the construction of handicrafts using its parts, its stem is a lightly brown wood when dry and when green they are white, its wood is widely used by riverside dwellers and rural residents in making handicrafts for the purpose of supplementing family income. (SAMPAIO; CARRAZZA, 2012).

In view of the need to produce new methodologies for increasing the teaching-learning process, as well as valuing biodiversity in our country, there was a possibility of using the buriti stalk as a tool in the construction of didactic materials for science teaching, the use of it provides a wide view in 3D and touch, being able to consider that the student will have better learning.

The definition of didactic material starts from a definition of education understood as a mediating activity of social practice. Libâneo (1985, p. 143), when referring to the fundamentals of teaching work from the perspective of the referred pedagogy, says: content and didactics of science and health the essential in teaching work is, therefore, the direct encounter of the student with the training material, with the mediation of the teacher.

The multiple subjective and sociocultural conditions that mediate the pedagogical act pose three aspects that have significant effects on the didactic process: the didactic means of stimulating the student in the face of these mediations; the differentiation of teaching work in the face of cultural differences; the methodological flexibility of the teacher that will allow him to make pedagogical-didactic decisions in the face of concrete and specific pedagogical situations in the classroom (SOUSSAN, 2003).

In this sense, the article aims to build teaching materials using as a raw material the buriti petiole as well as its products (educational games, models, educational toys, anatomical pieces, among others).

II. MATERIALS AND METHODS

The project was prepared based on a literary review, with a focus on research, which sought to obtain data on alternative materials to improve science classes in elementary schools in public schools in Imperatriz, Maranhão.

Action research requires a relationship structure between researchers and people involved in the study of the participatory / collective reality. Thiollent says:

> Search-action is a type of social research that is conceived and carried out in close association with an action or with the resolution of a collective problem and not which researchers and participants representing the situation of the reality to be investigated are cooperatively committed and participatory. (THIOLLENT, 1985: 14).

Putting the research action into practice, the practical part begins, with the collection of the buriti stalk at the Aurora farm, owned by Mr. Rafael Almeida, located at TO 23, in the municipality of São Miguel do Tocantins, in the extreme north of the state do Tocantins, Brazil.For the collection, a stick with a machete at its end was used, the stalk was removed and cut from the leaf blade (like leaves) and soon after it was again cut into pieces of approximately 30 cm.

After being cut to the boards, they were taken to the sun for 3 days until complete drying, then the peel was removed, thus enabling the beginning of the construction of the teaching materials as shown in figure 01.

Fig.1: Shows the sequence of the process.
Source: Authors – 2019

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With the help of a stylus and a knife, the imperfections that remained on the boards were removed giving it straight and patterned lines, after this procedure they were ready for the start of activities.

With the standardized splints, the pedagogical models were made, with the observation of the figure to be reproduced, with the help of a stylus, the molding of the boards begins according to what is desired and with the measurements. Figure 02.

Fig.2: Shows how anatomical pieces were found
Source: Authors – 2019

With the pieces ready and cut, the polishing starts with the help of sandpaper No. 230, after polishing, the pieces already acquire a pleasant aspect. Then the powder (cellulose) was placed on some pieces to make them more presentable. Cellulose was produced from the stem itself without the bark.

Using the stalk, other materials from the buriti palm were built, all handmade to prove the project proposal figure 03.

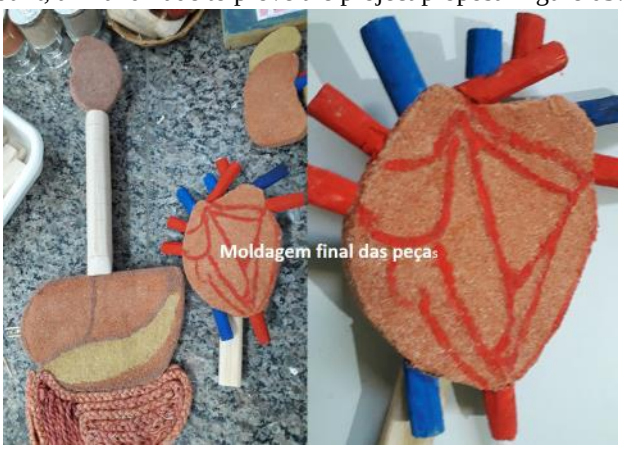

Fig.3: Shows the final composition of the pieces.
Source: Authors – 2019

For the making of the educational games, six pet bottles were used, which were covered with cellulose removed from the buriti stalk, white glue, decorative tape and buriti fiber. For the production and cellulose, pieces of buriti stalk were placed in the blender and beat until it became powder, then took to the oven at 50 ° C for 24 hours to dry (remove the water). For coloring, natural dyes taken from seeds and leaves were used.

After this stage, the effectiveness of the materials was evaluated. Where the biology professors expressed their opinion figure 04.

Fig.4: Models built using the buriti petiole (stem).
Source: Authors – 2019

III. RESULTS

The presence of teaching materials in high school classes has been encouraged and it is rare to discuss teaching without mentioning this teaching resource. However, the use of teaching materials is not enough if they are restricted only to the manipulation of students in a playful manner and without an educational function. It is necessary that its use is linked to well-defined objectives in terms of promoting learning, that is, a careful planning of action.

The important thing about the action is that it is reflective and that the student learns in a meaningful way, developing activities in which they reason, understand, elaborate and rework their knowledge, and the use of materials can bring a great contribution in this sense. After all, the student is an active subject in the construction of his knowledge; he learns from his experiences and actions, whether individual or shared with the other. (FIORENTINI; MIORIM, 1990, p. 6).

Although we know that the teaching materials alone will not teach the content, as it is necessary, in most cases, that the teacher intervenes, and for this it is necessary that the teacher, who is willing to make use of these teaching trends, do a study of the alternative teaching materials you are planning to use.

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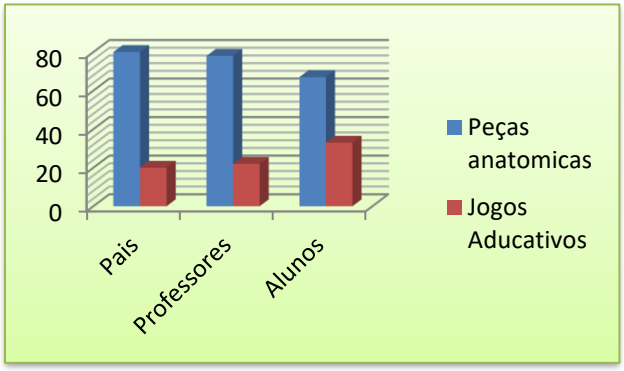
It is worth emphasizing that this project should not only be about how to use a certain material, but a study about the conditions, contents and motivations for using didactic material in the classroom. Only the presence of teaching materials is not able to positively transform the teaching-learning process. It is extremely important that the teacher knows how to use it, knows how to incorporate it in his daily practice, according to the structural conditions of his school and the needs of his students.

The use of alternative teaching materials allows the student to visualize and construct meanings, leading him to reasoning. Through it, the teacher observes, estimates, relates information, seeks solutions to the problems presented, compares the results, produces new ideas, and then reaches abstraction. Thus, the construction of knowledge occurs.

Thus, what was built and produced with the buriti stalk was put into practice. Among all the manufactured materials, the ones that drew the most attention were the anatomical pieces, graph 01.



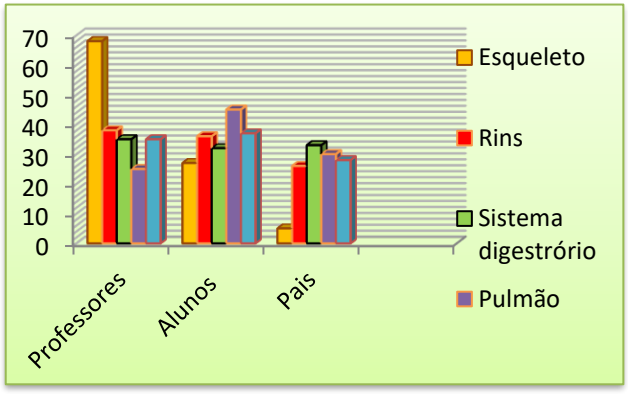
Graph 01: Shows the satisfaction of parents, teachers and students about the material
Source: Authors – 2019

Analyzing the results, it was observed that the anatomical pieces drew more attention than the educational games, this result is related to the way they were constructed and to the contents that were being applied at the time of the activity.

According to BECKER, 1992 apud SILVA et al. 2012, p. 2

> There is no doubt that teaching resources play a major role in learning. For this process, the teacher must bet and believe in the student's ability to build his own knowledge, encouraging him and creating situations that lead him to reflect and establish a relationship between different contexts of daily life, thus producing new knowledge, raising awareness still the student, that knowledge is not given as something finished and finished, but that it is continuously under construction through the interactions of individuals with the physical and social environment.

Among the anatomical pieces produced with the buriti stalk, the one that drew the most attention was the graphic human skeleton 02.



Graph 02: Present to the satisfaction of teachers, students and parents about the anatomical pieces built with buriti stalk.
Source: Authors – 2019

Fig.5: Material that stood out in the evaluation.
Source: Authors – 2019

Because it depends on greater creativity in the construction of each piece, the skeleton was what attracted the attention of both teachers and students. Our body has always aroused the curiosity of science and people, to know how we are trained.

This activity made it possible to observe the concept of environmental education, when teachers and students realized the importance of natural resources associated with teaching materials in the perspective of sustainability.

Around this theme, it was observed that the doubts and fears in relation to the human need to explore and remove

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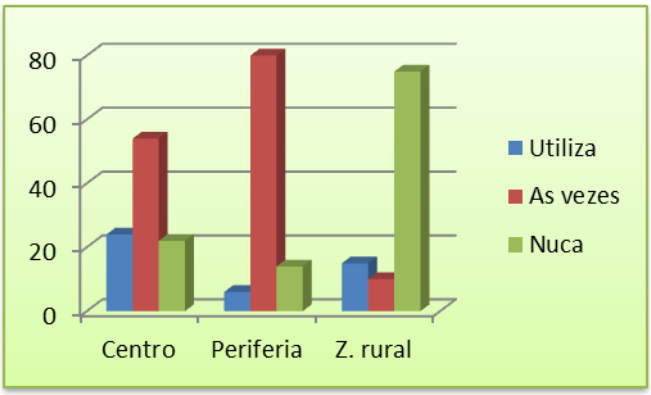
natural resources in an unsustainable manner are the consequences of the various transformations and behaviors of people in relation to the future of the planet. The main focus is the search for sustainable development, which allows the non-depletion of the natural resources available on the planet, preserving water, air, soil, fauna and flowers. Thus, teachers from three different locations in the city were asked how they use natural resources in the preparation of their classes.



Graph 03: shows the result of how teachers use natural resources as a teaching methodology. Source: Authors.

Analyzing the graph, it is observed that only one parameter "sometimes" stands out among teachers from the periphery of the city (80%) and rural areas by 10%.

It is clear that greater knowledge is needed on environmental issues related to natural resources as tools for teaching.

There are several definitions available in the literature for Environmental Education as a method for teaching. According to Reigota (2006), environmental education is understood as political education, in which it prepares subjects to participate actively, thus claiming ethics, social justice and the formation of citizenship in their relations between society and nature .

Thus, the concept of Environmental Education according to Federal Law No. 9,795 / 99, in its article 1 of chapter I, is defined as:

> The processes through which the individual and the community build social values, knowledge, skills, attitudes and competences aimed at the conservation of the environment, a common use of the people, essential to the healthy quality of life and its sustainability. (BRAZIL, 1999).

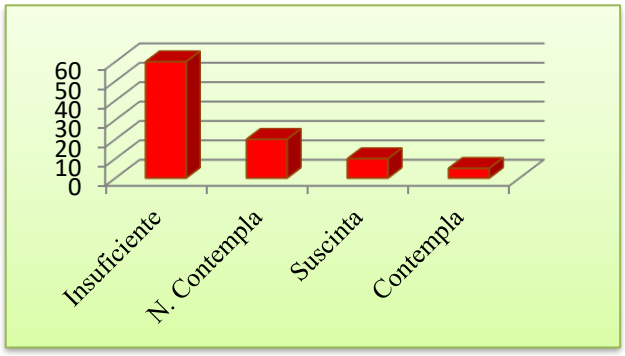
In this sense, Environmental Education is considered a process that involves cultural values, behavior, science, technology, education, knowledge and the environment in the search for sustainable development to maintain nature and its social implications.

Due to environmental problems in contemporary society, such as environmental degradation, identified in the waste of natural resources, in poverty, consumerism, the use of unsustainable technologies and lack of environmental responsibility.

Environmental Education has a fundamental role in the formation of critical citizens in relation to processes related to the environment.

Thus, environmental education aims to enable attitudes and behaviors in relation to consumerism in our society, as well as providing changes in values and perceptions about socio-environmental issues in a local and planetary way.

With this proposal, teachers were asked whether textbooks provide an environmental theme in the construction of knowledge using natural resources. The teachers' response is shown in graph 04.



Graph 4: Teachers' opinion on the theme EA in the textbook.
Source: Authors

The way in which the theme is presented, natural resources in the textbook, according to 57% of teachers, is insufficient without further study. For 25% this theme is not considered. Around 16.5% consider that it is approached, but in a brief way and only 8.5% consider that the student's reality is adequate.

However, with the constant concern around the environmental issue, this scenario is changing, many of the new textbooks already address this issue, in a contextualized way. An example in the area of sciences is the textbook "CienciaCidadã" (Santos; Mól, 2010), by Nova Geração, which covers sustainability and the environment in almost every chapter. In this sense, it presents aspects such as consumerism, garbage, recycling, air pollution, global warming, ozone layer and sustainable agriculture, contextualizing with the content of Chemical Sciences. Thus, the student mediated by the teacher can relate to the content worked with their daily lives.

Support materials, such as textbooks, are fundamental tools for the classroom teacher. The book is an important kn

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owledge support and serves as a guide for knowledge production activities. According to (BACHELARD, 1965). Science is essentially the social production of the scientific city, so the book, inasmuch as it conveys science to scientists, plays a decisive role in the construction of scientific knowledge, in keeping scientists in school.

However, the textbook is also an instrument for transmitting the ideological and cultural values of its authors, and teachers should not take the opinions or thoughts expressed in it as absolute truth, as, as stated by Lopes (1993, p.6),scientific thinking is placed in the book in a socialized way, the author expresses consensual truths. Having an organic character, the book establishes its own questions, and cannot be read without obeying the order of the chapters, without following the author's order of thought.

Thus, one can identify the complexity that is the textbook and the responsibility of the authors in the elaboration of this material, as they are values and ideologies, which often influence the teaching and learning process in a positive or negative way.

According to Lopes (1993, p.6), The book does not dialogue with the reader or polemic with his reason. It just confirms common knowledge and hinders scientific knowledge. In their eagerness to make science easy and accessible, the authors of chemistry textbooks abuse realistic metaphors, trivializing concepts. The goal is to keep the student away from the rational, making each and every concept visible and palpable.

Thus, as this project exposes, many authors of biology textbooks for high school use analogies to "facilitate" the understanding of the contents, creating obstacles to scientific knowledge.

Therefore, the teacher has a fundamental role in this process, that of mediator, seeking information and research. “When the textbook is insufficient in relation to the use of natural resources in the production of didactic materials, it is up to the teacher to seek to complement it, either to expand his information and the activities proposed in it or to circumvent its gaps.

Through the results obtained, it is possible to answer the initial question that guided this investigation: how to improve the qualities of high school biology classes so that the learning result is positive? Thus, it can be said that the main potentialities are related to the teacher's creativity, and this is passed on to students. This creativity promotes socialization in general and effective cooperation, in addition to the idea of making learning more attractive, captivating students' interest and attention.

Taking into account that not all schools have a series of resources (teaching materials) available, we believe that the teacher can stimulate the making of teaching materials, and we understand that the teacher can use these resources as one of the ways to develop his / her training and his pedagogical practice, making his work more meaningful.

The making of different teaching materials with the stalk of the buriti allowed us to verify that there is a need for a greater dissemination of these materials and their potential. Knowing that the use of resources by teachers is unfortunately very limited. For a better use and use of these resources it was thought and to leave for the future some proposals and suggestions so that the teachers use more the didactic materials so that a more efficient teaching-learning process can be built.

IV. CONCLUSION

From the above, it is concluded that the use of different didactic resources is beneficial and necessary for the teaching of biology. However, most teachers are still resistant to more dynamic and innovative methods and remain linked to more traditional teaching methods.

For all of the above, whatever the reasons presented and the arguments discussed, the overriding fact is that the choice and use of appropriate and diverse teaching resources can influence the teaching-learning process. Therefore, greater incentive to innovation in the teaching action methodology is necessary.

Therefore, it can be explained that it is possible to work on concepts and meanings of the sciences combined with the environment, leaving the content of biology contextualized and interesting for the student. Thus, contributing to improve the teaching of biological sciences and the teaching and learning process, making the concepts more meaningful for the student. The importance of this analysis is emphasized here, since the thematic production of pedagogical materials using the buriti petiole to transform the biological science classes of public schools in Imperatriz - Maranhão, Brazil, into dynamic and attractive classes is a mandatory subject in all teaching. . modalities and in all disciplines, supported by Brazilian legislation.

Based on these results, the study demonstrated a proposal for pedagogical materials for high school with the petiole of buriti as a tool in contextualizing the practical with the theoretical, being a way of circumventing the lack of financial and physical resources, as it brings the daily life of the student. student to the classroom together with the idea of nature preservation, making the student seek knowledge on the subject and awareness of preservation. Thus, the materials built with the petit of buriti become a mediating tool between biodiversity and the possibility of learning from natural resources.

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