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## **AMAZONIAN ETHNOBIOLOGICAL KNOWLEDGE AS A DIDACTIC TOOL FOR A MEANINGFUL LEARNING OF ROCKS AND SOILS**

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**Abstract:** This article reports the results of using Amazonian ethnobiological knowledge as a didactic tool for meaningful learning about As Rochas e o Solo in an Elementary School in Tabatinga – Amazonas/Brazil. Our objective was to build and develop a teaching methodology that considers the students' prior knowledge, in order to work with content that has meaning and functionality in their lives and that encourages them to be protagonists of their own knowledge. The methodology used was action research and as a tool we used the didactic sequence. The results indicated that the use of didactic instruments that value the ecological, cultural and social richness of the Amazon, through the use of endogenous ethnobiological knowledge, that present an affective and symbolic representation for the students, are capable of promoting a meaningful learning of Science.

**Keywords:** Ethnobiology; Following teaching; Amazon Context; Previous knowledge.

## INTRODUCTION

The present study aims to develop a methodology that guarantees meaningful learning about "As Rochas e o Solo", using local ethnobiological knowledge as a didactic tool.

As stated by BAPTISTA (2002), in general, "the techniques used by teachers boil down to lectures and the reading of textbooks without any or little questioning about their contents". This characteristic with regard to teaching methodologies is quite recurrent and generates idleness in classes and passivity on the part of students.

In previous observations, we found the exhaustive use of lectures, which generated a lot of parallel conversation between students and difficulty in the teacher/student relationship. The methodology of the professors, for the most part, involved reading chapters, preparing summaries, correcting

notebooks, delivering assignments and seminars or tests. Therefore, the teaching-learning method used is based on repetition and memorization, in such a way that students assimilate the information through a banking system of education, as they receive the information, memorize and deposit their memories in the test, in the classes after the proves knowledge is already lost (FREIRE apud FOCHEZATTO and CONCEIÇÃO, 2012).

Another problem considered was the lack of contextualization in the teaching process, as students' cultural experiences are usually ignored when teaching scientific content addressed in the school curriculum (BITTENCOURT et. al, 2011). However, only when students are challenged to question and reflect on their own reality and the knowledge that surrounds it, in order to compare scientific concepts with those they already have, will they be setting out on meaningful learning. (BAPTISTA, 2002). For PELIZZARI (2002) learning is much more significant as the new content is incorporated into a student's knowledge structures and acquires meaning for him from the relationship with his prior knowledge.

We also identified that the construction of classes is fully subsidized by textbooks, used in a mandatory and immutable way, in such a way that, regardless of the exposed theme, the class is always linked to this resource. Another negative consequence of using the textbook as a "master guide" is the lack of examples consistent with the local reality, bearing in mind that the books are prepared in the South and Southeast regions of Brazil and in their examples little is said about vegetation of the Amazonian biome and there is no information about the population, its culture or its ethnobiological knowledge.

As ethnobiological knowledge POSEY (apud COSTA, 2006) defines:

The knowledge and concepts developed by any society regarding biology and the role of nature in the system of beliefs and adaptation of man to certain environments.

Adding up the aforementioned factors, the need to build a methodology that favors the science teaching-learning process is visible. Furthermore, no other studies were found in Public Schools in the state of Amazonas that addressed the use of ethnobiological knowledge and that provided data about different methodologies in the teaching of Science and Biology in this region. This study aims to develop a methodology that uses students' prior knowledge, working with content with meaning and functionality, which encourages research and promotes students' protagonism, in order to guarantee a meaningful learning about As Rochas e o Solo, using Amazonian ethnobiological knowledge as a teaching tool.

## **MATERIALS AND METHODS**

The methodology used in this research was action research, characterized as a qualitative research, indicated when a practical problem is diagnosed in the institutional and professional scope, with the objective of provoking changes in this scenario. According to ENGEL (2000), a problem is understood as "the awareness, on the part of the researcher, that something that intrigues him, that can be improved in the teaching area, or the recognition of the need for innovation in some aspect of the program education".

In this case, the problem found was the difficulty in promoting a meaningful learning of Sciences, which in order to solve it, action research was applied in order to seek strategies that improve the teaching-learning process through research, as demonstrated by THIOLENT:

Action research is a type of empirically based social research that is conceived and carried out in close association with an action or with the resolution of a collective problem and in which researchers and participants representative of the situation or problem are cooperatively involved. or participatory (2008, p. 14).

BARBIER (2007) argues that action research "is a form of research in which there is a deliberate action to transform reality, having a double objective: transforming reality and producing knowledge related to these transformations". Therefore, action research has an interventionist character, as it proposes actions to be performed in the studied environment and subsequently evaluates whether the interventions carried out resulted in the expected effects or not. With this, it not only generates benefits in the practical field, improving it, but also produces scientific knowledge of academic interest.

According to TRIPP (2005), action research, in general, is carried out through four phases, to be executed after identifying the problem, namely: plan an improvement in practice, act to implement the planned improvement, monitor and describe the effects of the action and finally evaluate the results of the action. We followed the phases mentioned above, as we considered that this sequence of actions was adequate for this study.

According to SILVA (2014, personal information), "qualitative research has the natural environment as the direct source of data and the researcher as its main instrument". Therefore, the main data collection tool used was participant observation, with a duration of 240 hours of Supervised Curricular Internship, referring to the disciplines of Teaching Practice of Science and Biology I and II, with three hours/class per week, in which data were recorded in field notes and photographs.

## STUDY AREA

The present study took place at the Pedro Teixeira State School, in the municipality of Tabatinga, located in the west of the state of Amazonas, on the triple border between Brazil-Colombia-Peru. It has an area of 3,225.064 km<sup>2</sup>, with a population, according to estimates by the Brazilian Institute of Geography and Statistics (IBGE, 2013) of 58,314 inhabitants, being the most populous municipality in its micro-region, with a density of 18 inhabitants per km<sup>2</sup>, has an altitude of 73 meters, Latitude: 4° 15' 12" South Longitude: 69° 56' 19" West, equatorial climate, hot and humid.

The Pedro Teixeira State School is located in the Dom Pedro I neighborhood, in the urban area of the municipality of Tabatinga - AM. It operates in three shifts: Morning, Afternoon and Night and offers Elementary Education from 1st to 9th grade and Youth and Adult Education (EJA).

During the day, most of the students are from the Dom Pedro I neighborhood, that is, from the urban area of the city of Tabatinga, children of military personnel and civil servants. During the night, in Youth and Adult Education, students come from different neighborhoods of the city, most are workers in the private or self-employed sector and students from indigenous ethnic groups.

## METHODOLOGICAL PROCEDURES

The didactic unit worked portrayed the Rocks and the Soil, based on the 6th grade Science book, called Planeta Terra, by Fernando Gewandsznajder, 1st Edition, Editora Ática, published in 2012. The order of presentation of the themes arranged in the book was respected, starting with the characterization of the Earth's interior, followed by rocks and soil.

As a method for constructing the classes, we used the Didactic Sequence proposed by

ZABALA (1998, p. 18), defined as: "a set of ordered, structured and articulated activities for the achievement of certain educational objectives, which have a beginning and an end known to teachers and students alike. It is important to emphasize the relevance that, the order in which the activities are proposed and the existence of interaction between the contents present to characterize the didactic sequence and its objectives.

ZABALA (1998) demonstrates four examples of didactic intervention units, the first being simpler and the last more complex. We believe that unit 04 proposed by the author is the most suitable for promoting meaningful learning, as the process contains steps that favor learning, such as: conscious use of prior knowledge, which allows content work with meaning and functionality in the life of the student; I encourage research, in which knowledge is acquired through discovery; teaching and assessment of conceptual, procedural and attitudinal content and promoting student protagonism.

This didactic sequence initially approached the layers of the Earth, then the rocks and finally the soils, inter-relating all the themes, showing the cumulative character of the construction of knowledge and the holistic vision that we must have of the Universe.

The approach to characterizing the Earth's interior was introduced with the science fiction film "O Núcleo", which depicts a trip to the core, in which the different layers of the Earth are shown (crust, mantle and core) and also, with images of volcanic eruptions. From this, we questioned the students in order to identify their prior knowledge and what they learned from the film. According to Sepúlveda (apud Baptista et al, 2008), prior knowledge "[...] includes the whole set of assumptions and beliefs culturally founded and integrates the worldview of individuals".

After the film, we gave an expository class with the presentation of conceptual content about the Earth's interior and asked them to make a diagram of the Earth's interior in a styrofoam globe, demonstrating the crust, mantle and core, in order to evaluate the procedural contents.

In the next class, we asked the students about the occurrence of volcanoes in Brazil and in the world. Then we approach that volcanoes arise from the collision between two tectonic plates and as a result of friction the rock heats up and melts, after understanding this phenomenon, we explain the Theory of Tectonic Plates and Continental Drift, the formation of mountains and earthquakes. To evaluate the procedural contents, we used a simulation of the world map as a puzzle to verify if the students identified the existing complementarity between the continents. The simulation, in this case, was used with the objective of helping to memorize facts and concepts (KRASILCHIK, 2004). To evaluate the learning of the conceptual contents presented, we applied an individual written test and in another class we played a game of questions and answers, in a group.

Following the didactic sequence, we started the theme "The Rocks and the Minerals", evaluating the previous knowledge, through oral questioning. Through an expository class, we present the conceptual contents about minerals and their properties, exposing that the scientifically constructed and accepted answer indicates that rocks are formed of minerals and, in addition, we explain that rocks constitute the solid part of the Earth, that is, the lithosphere (terrestrial crust and upper part of the mantle), relating this theme to the previously studied layers of the Earth.

We showed images of rocks, indicating their names and some characteristics. Then, through a practical class, fragments of

magmatic, sedimentary and metamorphic rocks collected by the students were exposed and we asked them to classify and group the rock samples present according to the common characteristics they observed in the images presented. According to HOFSTEIN (apud KRASILCHIK, 2004), the main functions of practical classes for teaching Science are: awakening and maintaining students' interest, developing the ability to solve problems and understanding basic concepts.

Finishing the evaluation about the Rocks, we went over individual memorization exercises to fix the results of the conclusions and generalizations. Bearing in mind that rocks give rise to soil, this was the next theme of the didactic sequence. We started again by evaluating prior knowledge with a question related to food and then we discussed the importance of agriculture.

Aiming to characterize the agriculture practiced in Alto Solimões, we asked the students to carry out a group interview with local farmers, focusing on the use of fire in Amazonian agriculture. In the classroom, the groups commented on the experience gained from the interview and wrote a short argumentative text positioning themselves as favorable or unfavorable to burning before planting.

After understanding agriculture and its importance for food production, we show that the soil provides most of the necessary substances for plant development. So, we conceptualize soil and explain that they are originated by the transformation of rocks. To teach about the types of soil, we used the demonstrative modality, which according to KRASILCHIK (2004) serves mainly to present techniques, specimens, etc. to the class. and is justified in cases where the teacher wants everyone to see the same phenomenon simultaneously. Therefore, using samples of

sandy, clayey and humus soils, also collected by the students themselves, we identified their components and classified them.

In order to demonstrate local traditional knowledge, we read and discussed the text "The types of soil" from the Ticuna book *Let's Take Care of Our Land*. This text emphasizes the use of paú (typical regional fertilizer made from decomposing trunks and branches) and Indian black earth, as examples of humiferous soil. Bearing in mind that the text portrays indigenous knowledge, which in many situations is devalued and marginalized, this class aimed to exercise tolerance and respect for cultural diversity and ethnic minorities.

Concluding the theme, we approach the erosive processes, for this we read the text "A Terra Caída" from the Book *Ticuna Vamos Cuidar da Nossa Terra*, which portrays the possible causes of erosion, such as: the rain, the river current and the "Big Snake". So, we asked the students if they knew the legend of the "Big Snake", if they considered it true and the reason for accepting or denying this knowledge. Based on the conclusions of the discussion, through an expository class, we present the environmental and anthropic factors that cause erosion.

## RESULTS AND DISCUSSION

After showing the film "O Núcleo", the class answered the question: "Where does lava in volcanoes come from?" Most of the students answered that "it comes from inside the Earth". In this case, it became clear to them that the lava on the Earth's surface is the magma present inside the Planet and that this magma comes from the mantle, one of the Earth's layers, demonstrating that they were able to find the scientific information presented in the film. From the discussion about the film, we approach the three layers of the Earth.

In the next class, when we asked if there are volcanoes in Brazil? Everyone answered "no", we asked why, but no one could explain. Then, student A said: "I've seen news of a volcano on TV, but it was outside, it wasn't in Brazil". We asked if anyone had seen news of volcanoes in Brazil and everyone said "no" and concluded that if the news about volcanoes broadcast on television is always from other countries and they never watched news about eruptions that occurred in Brazil, it means that there are no volcanoes in the country. This shows us that prior knowledge about this topic comes from the television media, which we emphasize is practically the only vehicle of information that students have access to, as for them the use of the Internet and the reading of printed newspapers are restricted. After the discussion, we explain that in Brazil there are no volcanoes because it is in the center of the South American Plate and we present the Theory of Tectonic Plates and Continental Drift, the formation of mountains and earthquakes, highlighting the relationship between these events.

The evaluation of the procedural contents by making a diagram of the interior of the Earth and the puzzle of Pangea in a Styrofoam globe was very positive, as can be seen in figures 1 and 2. In the first case, all groups produced the diagram, which was aesthetically beautiful and exposed all layers of the Earth. In the second case, the objective of the class was equally achieved, as the students perceived the complementarity between the continents, providing a better understanding of the Theory of Continental Drift. However, the groups' explanations about their schemes were disorganized, confirming the need to work more on attitudinal content, so that they improve their posture in front of an audience and respect during colleagues' speech.

As for the conceptual contents, the first assessment was through a written test, where we noticed that the class had difficulties in describing the scientific concept correctly. However, when we applied a game of questions and answers, we verified that the children were able to recognize the concepts when they visualized them, denoting that, despite not having “memorized” the concept, they understood it and were able to apply it in everyday situations. -a day, normally. The school emerged as a space for explaining the world to children, however, we realize that, over the centuries, the school has distanced itself from the reality that surrounds its students and its walls have grown around a universe of its own that distances and alienates them. Hence the question: what is the role of the school today and what knowledge do we want to transmit?

About rocks, when we ask “What are rocks made of? Most of the class agreed that rocks are “made of stone”, where they meant that rocks and stones have equivalent meanings. This statement reveals that prior knowledge, in this case, is essentially empirical, from

observation of the environment, that is, the rocks are the stones they see in their backyard, on the street or on the riverbank. In addition, the popular name “stone” used is a result of common sense, heard by students in their daily lives at home and in the local community. For AIKENHEAD (apud BAPTISTA et. al, 2008), the knowledge that people have about nature is strongly influenced by the cultural contexts in which they are inserted and integrate their worldviews, a fact that proves the results found here.

Other students stated that the rocks were made up of iron, nickel or aluminum, an answer certainly influenced by the classes on the Earth’s layers, in which we said that the Earth’s core was composed of iron and nickel. We present the concept of mineral, give examples and emphasize that Fe and Ni are minerals and that rocks are made up of minerals. For this class we used the expository modality, however, at the beginning of the class the students remained passive, then they started the parallel conversations that intensified to the point that we had to end the class. The passivity of the students represents



Figure 1 – Diagram of a styrofoam globe, made by 6th grade students, showing the Earth’s layers.

Source:ROBERTO, Layane, 2014.



Figure 2 – Assembly of the Pangea puzzle.

Source: ROBERTO, Layane, 2014.

one of the great disadvantages of lectures, as it generates a series of inconveniences: the retention of information is small, because there is a decrease in the attention of the listeners during the class (KRASILCHICK, 2004).

To encourage research, we asked them to choose a product from their home, such as talc, toothpaste, soap, makeup, batteries and write the chemical composition on the labels. In class, analyzing what they wrote, they observed that several of the components mentioned were the minerals studied in the previous class and realized that the scientific knowledge acquired at school is present and can be applied to their daily lives. Establishing this relationship between science and reality gives meaning to the scientific knowledge acquired, facilitating meaningful learning:

When the learner has a new body of information in front of him and manages to make connections between this material that is presented to him and his previous knowledge on related subjects, he will be constructing personal meanings for this information, transforming it into knowledge, into meanings about the presented content (TAVARES, 2008).

We show images of rocks, indicating their names, whether they were magmatic, sedimentary or metamorphic and the characteristics that defined them as such. As a strategy to create connections between empirical knowledge (derived from experiences) and scientific knowledge (at school), we asked the students themselves to collect samples of rock fragments to classify in the classroom, so that after studying them they could recognize in the environment the information acquired at the School.

With the rock samples we did a practical class, where the students must classify them as magmatic, sedimentary and metamorphic. When classifying, they realized that most

of the samples were of sedimentary rocks, making them conclude that in Tabatinga, sedimentary rocks are predominant, allowing the understanding of the subject in the local scope. In addition, this class was very participative, we believe that this happened because the students felt more comfortable, more stimulated and receptive, considering that the practical classes are visually more attractive and allow the teacher to establish a more horizontal relationship with the class.

With regard to Soils and Agriculture, we asked the class about their food, where they reported what they had eaten the day before. We also asked about the origin of these foods and how they were produced. The answers ranged from - supermarket and factory to - at the fair, in the fields and planted in my backyard. We discussed the answers and the students concluded that the first step in producing food is planting, that some foods are consumed directly after harvesting and that others are processed and that agriculture is very important for society. Afterwards, we gave an expository class on conventional agriculture.

Aiming to exercise in students the ability to learn to learn, we asked them to interview farmers, in order to characterize local agriculture, with a focus on building a favorable or unfavorable position regarding the use of fire in agriculture, considering the social, economic and social aspects. environmental. The answers provided by the farmers enabled the students to better understand regional agricultural practices and, based on what they learned in the class on conventional (intensive) agriculture given before the interview, they noticed the differences between the two models. We discuss the climatic, geographic, economic characteristics and, with greater emphasis, the cultural aspects that originate these differences, portraying the heritage of



traditional indigenous knowledge that influences the agriculture practiced in the Amazon region.

In addition, the interview awakened in the students a critical position in relation to deforestation, considering the environmental impacts. But, as can be seen in figures 3 and 4, they also understood the local economic and cultural mitigating factors in carrying out slash-and-burn agriculture.

We verified that the use of the interview as an investigation process placed the students in the position of protagonists in the construction of their own knowledge, guaranteeing a learning with better meaning for the children.

Through a practical class, using samples of sandy, clayey and humus soils, also collected by the students themselves, they were able to identify their components and classify them. In this class, as in the practical class on rocks, the students noticed that most of the samples were from clayey soils, which triggered the discussion about the influence of climate, vegetation and hydrography on the composition of Amazonian soils.

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Still on Soils, we read the text “The types of soil” from the Ticuna book Let’s Take Care of Our Land. The main objective of reading this text was to introduce students to the wealth of indigenous ethnobiological knowledge and place our object of study in the Amazonian context, mainly due to the similarity between the informative content contained in the textbook and the explanation given in the Ticuna Book, emphasizing the presence of other elements in the latter, resulting from the influence of the culture and cosmovision of the ethnic group in the observation of nature.

Unfortunately, the class was not receptive to the exposed ethnobiological knowledge,

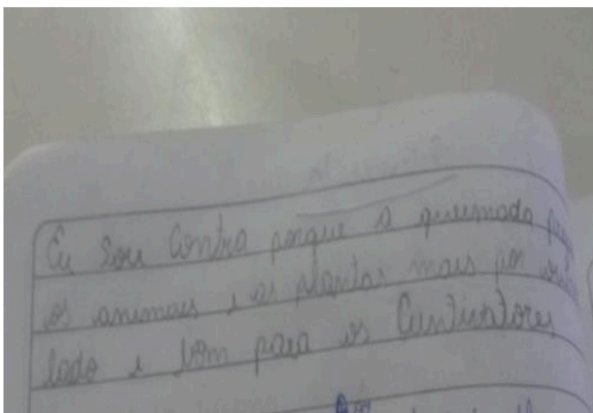


Figure 3: Considerations about the use of fire in agriculture: “(sic) I am against it because burning harms animals and plants but on the other hand it is good for cultivators”.

Source: PEDROSA, Hermísia, 2014.

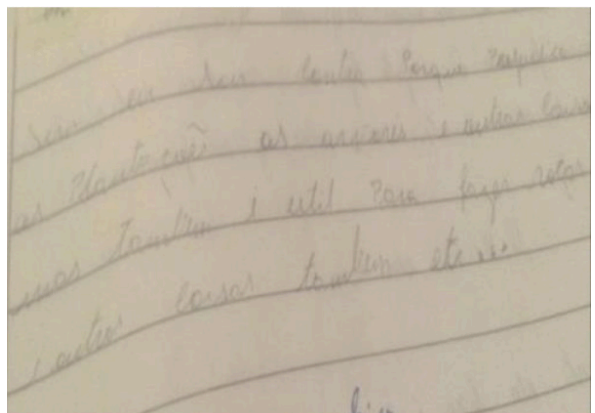


Figure 4: Considerations about the use of fire in agriculture: “(sic) Yes, I am against it because it harms plantations, trees and other things, but it is also useful for making fields for other things, etc”.

Source: PEDROSA, Hermísia, 2014.

disregarding it as a source of information and even making derogatory comments, as exemplified in the speech of student B, when we said that the text was written by Ticuna indigenous people: "How can he know from that? Ticuna doesn't even know how to write...". We believe that this negative reaction to Ticuna knowledge is due to the incipient use of the Amazonian cultural diversity in Basic Education at the City's schools. Taking advantage of the situation, we dialogued with the group in order to build a process of promoting respect for Indigenous Peoples and valuing their knowledge associated with biodiversity, as an important cultural heritage of our region.

Finishing the didactic sequence, we read the Ticuna text "A Terra Caída" from the book *Vamos Cuidar da Nossa Terra*, which portrays the possible causes of erosion, among them the assertion that when the "Big Snake" passes close to the bed of the Solimões river, the phenomenon of fallen lands. During the debate, the class was divided, some said they believed in the existence of the "Big Snake" and even narrated a story they had heard from family members. Others said they didn't believe it, as they had never seen it.

This debate was more open, several students spoke and the others acted with respect to their colleague's belief. We believe that the discussion generated in the reading of the previous Ticuna text promoted this posture.

## **FINAL CONSIDERATIONS**

Bearing in mind that the class is made up of students from the urban area of Tabatinga and the Rocks and Soils themes are intrinsically related to the rural space, we identified that their previous knowledge about the theme comes from television, from the knowledge acquired in Early Childhood Education (1st to 4th year), observations

of the landscape (empirical) and the family environment.

In the expository classes, students' inattention to the teacher's explanations was evident, the intense parallel conversation between students and consequently the low learning of conceptual contents. On the other hand, using the other didactic modalities, the students became more intensely involved, evidencing the need to explore these resources more, in order to favor a meaningful learning.

Specifically, the practical classes promoted greater class participation and allowed us to expressively use the dialectical method, with intense exchanges between students and between them and the teacher, providing a more meaningful learning of the contents.

The use of indigenous ethnobiological knowledge in the school context is scarce, which justifies the students' estrangement from the exposure of information from the traditional knowledge of ethnic minorities. Therefore, it is necessary to use teaching processes at the School aimed at building respect for Indigenous Peoples and valuing their knowledge associated with biodiversity, as an important cultural heritage of our region.

Finally, we consider that didactic instruments that value the ecological, cultural and social richness of the Amazon, through the use of endogenous ethnobiological knowledge, which present an affective and symbolic representation for students, are capable of promoting a meaningful learning of Science.

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