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## Indigenous Culture: What can we learn (and teach)?

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### ABSTRACT

Valuing the culture of the native people of a country is always relevant, and science and biology classes can become an interesting space for this appreciation. It is suggested that cultural, behavioral, and social aspects inherited from the indigenous people in Brazil be used as didactic learning tools. It is demonstrated that knowledge related to the preservation of the Amazon Rainforest, hygiene, food, and medications, already present in different scales in Brazilian daily life, has its origin in knowledge from the native peoples of Brazil, although this origin is little known and publicized. It is noteworthy that these topics can be used in a multidisciplinary way so that students can perceive the acquisition in a broader way and interrelated to their daily lives. It is important not to miss any opportunity to increase scientific literacy in the classroom and the knowledge bequeathed by the Indians has potential for this learning. Finally, it is suggested to use the lessons to alert and confront the issue of scientific fake news through the internet and social media.

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## Introduction

There is a pre-eminent need for improvement in the teaching of science and biology around the world. Lessons are often perceived as tiring, lacking connection to reality or anything that is interesting to the students. The result is poor results in scientific literacy, including student vulnerability to false scientific news spread over the internet and social networks as well as students much more interested in spending class time accessing frivolous websites via their smartphones than in learning.

It is difficult to find students, and even teachers, who seek information outside of the two ubiquitous sources currently available, the Internet and social networks <sup>1</sup>. You hardly find anyone, even in the school environment, who is getting information through traditional media such as TV news, newspapers, magazines, books, among others <sup>2</sup>. Scientific journals? Many do not know about them, and if they do, they have not aroused interest in them. The result is that the school and classroom context end up becoming one more space for the dissemination of

news and knowledge without verification and, as a result, many fraudulent news, which further hinders the learning process.

Developing countries, such as Indonesia<sup>3</sup> and Brazil<sup>4</sup>, has a very low score in international science assessments, as demonstrated by the PISA tests carried out in many countries. These countries have encountered distinctive obstacles in this regard, which include limited teacher training, low salaries, structural problems, and access to new technologies in schools, many students with unfavorable conditions for learning, among other problems. It is necessary to increase investments, which is known to be very difficult, but creativity is also needed to face this challenge with resources that are not abundant.

Despite all the criticism relevant to these international assessments, they give us a picture of the challenge to be faced and make us question the didactic and pedagogical practice. How can we improve the learning of science and biology? How to make the classes attractive? How can we make the themes and contents of these disciplines interesting for the students? How can we increase learning and knowledge retention?

No opportunity should be missed for the increase of learning, for the improvement of the lessons, any new idea, any new strategy, any revision of educational practices, should be tested, analyzed, questioned, and if detected that they can have a positive effect, they should be implemented as soon as possible.

One way to promote scientific literacy is to diversify the lessons, even better if this process occurs in a multidisciplinary way, without science and biology having their content watertight, disconnected from other knowledge of the discipline itself or other subjects. One possible way to achieve this goal is to use knowledge from native or original peoples, or indigenous people, who have had much to teach us historically and today.

In this essay, I use the knowledge from the Brazilian indigenous people in the context of Latin America, but I believe that it is possible to inspire teachers all over the world, especially in those developing countries that have this kind of cultural richness through their original peoples. I look for cultural and behavioral aspects of native Brazilian peoples that can be used in lessons that are interdisciplinary, that can explore this knowledge that is often embedded in the population without them being aware of it. In my experience, the use of these kinds of strategies could awaken curiosity and enthusiasm for the lessons, and probably the retention of the content.

## **They are not Idyllic Societies**

I think it is important initially to show students that indigenous communities are not idyllic societies, living in complete harmony with nature, in total peace with each other and with other native peoples. This idea is false, exaggerated, often idealized in publications, movies, and cartoons. It is fundamental to deal with realism, with facts, with recognition of the adversities of their way of life, so that we can enter the virtues that we can extract from these people to be employed in the classroom.

In fact, living so integrated with nature is not easy, surviving the bad weather in a forest like the Amazon is a daily challenge. Getting food, reasonably drinkable water, escaping from the beasts and inherent diseases is very difficult, because in their way of living the resources are not available, they must be searched for, and this search involves potential failures and risks.

But it is this need, this deprivation, and these hardships that have made possible an accumulation of unpublished knowledge, developed, and accumulated over decades, as challenges have arisen in the forest. The result is a unique body of knowledge that reflects the universal human characteristic of resilience and the intense will to survive.

Therefore, we have a lot to learn from these original peoples, and teachers can have tools to teach through this knowledge. Their culture, their experiences, their ways of living together can be used to awaken students to, first, the value of these societies, of these individuals, many

of whom are currently at risk of extinction, and then the very retention of the science developed by them, as something connected to a reality that is different from the urban one, but very rich and instigating, and applicable to our lives.

### **How to preserve a forest?**

A question can start this approach through the indigenous peoples: Can they survive in the forest without damaging it? Without destroying it? Or is it just a myth about the idyllic, iconic society in the forest?

The answer to this question takes us back to the ancestral native peoples, those who predate the current indigenous people, who lived in the Amazon Forest, forming communities that were larger than the ones we have today and who survived for a long time integrated with nature. Recent studies show that this preservation was much more efficient than previously thought <sup>5,6</sup>.

These ancient settlements in the Amazon managed to maintain themselves for millennia, using natural resources, but interfering with the environment in subtle ways and with little impact. The archeological sites show that this process occurred on a large scale, but we still need to understand how this happened. To try to understand this, we can take three paths: first, through a bibliographical survey of how the current indigenous and traditional peoples deal with forest resources, using plant species for food sources. One can also try to understand how these management practices were consolidated in time and space and how they coexisted with the forest. Finally, one should study the archeological sites in regions where there are indigenous villages and understand how the forest presents itself in these areas. The research revealed eight of these indigenous practices that ended up preserving the forest: I. Removal of plants with no utility; II. Protection of plants with some utility; III. Attracting plant-diffusing animals. IV. Displacement of plants with some utility. V. Choosing phenotypes of interest. VI. Watching out for fires. VII. Planting of plants of interest. VIII. Soil improvement. All this combined with agricultural practices that have been tested, changed, and maintained for generations, thus allowing the abundance of plant species in the forest fragments <sup>7</sup>.

In the spirit of inquiry-based teaching <sup>8</sup> it is suggested that the teacher only make this explanation later; first he or she can demonstrate that this preservation occurred, indicate that several researches point to this, even in larger settlements <sup>9</sup>. It is valuable to instigate students to research and reflect on how this might have happened. Ask students to come up with plausible hypotheses, based on current indigenous elements and the resource potential of the forest, and the apparent limited nature for the use of those resources. Demonstrate how important this kind of research is, how crucial it is to delve into such hypotheses. Only after the students' conclusions, these analyses, the students' conclusions, should the teacher present the ways that these peoples probably used to live with nature<sup>10</sup>.

In this lesson it is helpful to lead students to reflect that the ancient native peoples, even with larger populations living in the forest, did not cause the devastation that occurs today. The students must analyze why, even with all the current technology, compared to what existed centuries or even millennia ago, we are not able to live with nature in a harmonious way, so we have to think about how to do it, and maybe we can learn from these ancient peoples. We must always remember and remind the students that we depend on the forest much more than it depends on us, that it thrives without human, but the opposite will be very difficult.

### **It is always important to remind our students why the forest is essential.**

No opportunity should be missed to emphasize to students the value of the Amazon Forest, its biological value, its ecological importance and to the people who live there, whether indigenous or not. This value must be emphasized especially in countries, such as Brazil, in which, for ideological, political and cultural reasons<sup>11</sup>, and the dissemination of scientific fake

news, a part of the population believes that deforestation does not occur, and that this in the Amazon would be a fallacy<sup>12</sup>.

This spread of untrue information about Brazilian deforestation is based mainly on three conspiracy theories, which should be placed in the classroom so that students can perceive them as such. The first one simply judges that the cutting down (or the increase in this action) of the forest would be fake news, which would only be a form of coercion from developed countries, which have already destroyed their forests and are now accusing developing countries, such as Brazil and Indonesia, for example.

Another of these theories points out that these rich countries, notably the Europeans. Would have an interest in preventing the development of nations like Brazil, due to commercial competition. For if the mineral resources beneath the forest, such as niobium, gold, and oil, were exploited, these countries would be very strong economically. Moreover, the agents of foreign trade and farmers of developed countries, use this excuse of preservation to overtax and restrict the products of countries that have forests and thus create market reserves and protectionism of agricultural products and livestock<sup>13</sup>.

Finally, the conspiracy theorists proclaim on social networks and the internet that the actions of non-governmental organizations (NGOs) are fraudulent, that they are not acting altruistically, in favor of native peoples and for the protection of fauna and flora<sup>14</sup>. These organizations would be at the service of rich countries, and continuing the previous thesis, hindering the progress of developing countries. There is a diversity of misrepresentation of this role of NGOs, but always without any humanitarian cause, without protection of the environment.

Another important aspect to clarify for students concerns the real role of the Amazon Rainforest for the global environment. It is fundamental to emphasize that this forest is not the "world's lung"<sup>15</sup>, This is a term that is very commonly bandied about, even by many educators. The role of large-scale oxygen producer is performed mainly by marine phytoplankton<sup>16</sup>. This does not minimize the importance of the forest, but it is crucial to give credible information in the classroom.

One of the most valuable aspects of the Amazon Rainforest, and one that needs to be presented to students, is its formidable biodiversity<sup>17</sup>. Besides the species of living beings already discovered, which are enormous in number and diversity, there are still an incalculable number of species to be identified. One must reflect on the potential for the use of some of these beings for medicine, for example. To illustrate this, the teacher can cite the use of a substance from the venom of the Brazilian jararaca snake (*Bothrops jararaca*), from which was developed one of the medicines used in the world against blood pressure<sup>18</sup>.

Another factor that shows the relevance of the Amazon Rainforest, easily perceived by the students, is that it makes up the largest reserve of fresh water, available in liquid form in the world<sup>19</sup>. It is interesting to note that there is no river in the world with the volume of water of the Amazon and that the entire hydrographic basin has a significant part of the planet's river water. But it should be pointed out that all this reserve is far away from the main Brazilian urban centers, so this water resource is fundamental for the Amazon region itself.

One reason to value the Amazon and that should be part of Brazilian education is to demonstrate that this forest is a crucial mechanism for climate regulation in Brazil. The rainfall in the southeast region (the richest, most populated and industrialized) and in the center-west region (one of the most booming in agriculture), depend on the humidity corridor provided by evaporation, by the water cycle in the rainforest region, and by the forest region<sup>20</sup>. So it is necessary that students, and Brazilian society, realize that deforestation is bad business, environmentally and economically. This impact seems to reverberate in the Latin American and global climate as well.

Education can help prevent or mitigate what has been happening in Brazil at the beginning of the third decade of the 21st century. This movement against devastation must be increasingly

intensified, as climate change intensifies, while the spread of false news in relation to this process also intensifies <sup>21</sup>. It is necessary to spread the knowledge that the forest mitigates climate change, global warming, and its increase, by capturing carbon from the atmosphere through the growth of plants <sup>22</sup>. But this process is being reversed <sup>23</sup>, and this carbon is going back into the atmosphere, by the destruction of these plants, especially through burning.

Thus, we have a lot to learn from the Indians (indigenous people of the Amazonian rainforest) who preserved and preserve the Amazon Forest, and all the others that may eventually be preserved. It is essential that the knowledge developed over millennia be an educational basis for the behavior and actions of society, so that we can change our relationship with nature, and the school can be a starting point for this change of course.

### **The hygiene habits we inherited from them.**

It is very common in developing countries, such as those in Latin America, to value customs and habits supposedly inherited from Europeans. It is often seen as something lesser, or primitive, in comparison with something better, or more civilized that would have originated from the European conquerors.

It would be interesting to use the classroom to attenuate this distortion and deception, and one of the ways is to show that the good hygiene habits of Brazilians are due to the native peoples and not to the "noble" Europeans. The European colonizers did not have the habit of bathing frequently, many even today, so the habit of taking daily baths is inherited from the natives. Many diseases related to poor hygiene raged in Europe for centuries.

The value of showering, cleaning yourself frequently, and washing your hands (so relevant during the pandemic period <sup>24</sup>) that are perceived as healthy, but many don't recognize this as something from the native peoples. Teachers can use the discussion about how hygiene protects against various diseases and parasites to promote an interdisciplinary lesson that addresses the origin of this type of care in Brazil and demonstrate that there has been a gain in quality and life expectancy throughout the world.

The teacher can teach that during the great pandemics of history the hygienic issue was preponderant, that the change of habits was crucial in the better general health of the population. This class could incorporate biology, science, history, culture, etc., promoting learning away from the idea of watertight, disconnected knowledge and allowing the student to build a broader knowledge, with better understanding of the phenomena.

It is also interesting to discuss how the Indians developed such different habits from the Europeans, what are the hypotheses that explain this behavior? Are the indigenous peoples' habits related to living in a tropical climate, with the forest, with learning to survive the hardships of direct contact with nature, with the harsh experiences with various diseases? An approach that allows students to reflect on this origin can be didactically rich and will enable knowledge through investigation and analysis.

### **The valuable foods we inherited from the indigenous people**

Several foods that are part of the Brazilian diet, such as manioc, corn, various roots, some leaves, various fruits, palm heart, coconut, various fish, nuts, various wild fruits, among others, have their origin in the cuisine of the original peoples.

Students, in general, as well as many of the population, find it curious that a fruit rich in vitamin C, the Amazonian camu camu <sup>25</sup>, used by Indians, and little known is used by the general population. Again, the lesson can be multidisciplinary, talking about health, the importance of vitamin C for health, healthy eating, and the potential of what we can learn from the Indians to have good nutrition.

But many might argue that this fruit is exotic and that nothing from the cuisine of these peoples would make it into the dishes in Brazilian daily life. But this is not true: dishes with

manioc and corn are used frequent in the Brazilian family diet. These two foods, rich in energy and nutrients<sup>26,27</sup>, are still tasty, used in various ways in the food of Brazil. Many people don't associate these foods with the Indians, and it would be another opportunity to address why these foods, rich in carbohydrates, were so widely used by the native peoples. Was it because of the type of cultivation? This could generate a good debate and several hypotheses.

Finally, the demonstration of these healthy, good-tasting foods of indigenous origin can help demystify an erroneous view of native peoples today. The perception that they are cannibals in a significant percentage. Even today there are Brazilians who believe that the 'primitive' indigenous people of the Amazon rainforest are cannibals, and do not know about their rich and nutritious cuisine. In this way, we would have another interdisciplinary moment, which could involve the history of centuries ago, when there was indeed cannibalism among the indigenous people of the Amazon rainforest<sup>28</sup>, but it is also interesting to discuss again, why did this occur? What factors may have led to this behavior? Without prejudice and understanding that this belongs to the past.

### **There are medicines that come from the indigenous tradition.**

Another precious heritage that the indigenous people have left and continue to leave behind concerns medicines for several diseases, which are little known by the population. Again, this knowledge was accumulated during millennia of survival in nature, living with diseases, parasites, insects, and all kinds of illnesses, testing, discarding, and highlighting those plants with medicinal potential.

An example of this legacy is Andiroba oil (*Carapa guyanensis*), that would act as an anti-inflammatory<sup>29</sup> and would also work as a powerful cicatrizing agent<sup>30</sup>. This substance would also be effective in combating insect larvae<sup>31</sup>, especially against *Aedes aegypti* larvae, mosquitoes that transmit the viruses that cause dengue, chicungunha and zika, typically Brazilian scourges. Once again, the biology class can be broad and diverse, talking about medicines, Indians, Brazilian diseases, and their prophylaxis.

One of the most used substances of indigenous origin (in a diversified way) in Brazilian daily life, and few know where this knowledge comes from, is guaraná powder (*Paullinia cupana*)<sup>32</sup>. It is widely known that this product has effects as a stomach tonic, stimulant (widely used), and antidiarrheal. It is also said to have a positive role in activating brain functions; combating arteriosclerosis and migraines, and calming the heart and stopping bleeding. It is interesting to discuss with the students their previous knowledge about the use of guaraná as therapy, it is possible that several families already use it and don't even know that they owe it to the native people of Brazil.

Respiratory problems are among the diseases that most worry the Brazilian population, and among the legacies left by the indigenous people is the Copaíba oil (*Copaifera langsdorffii*)<sup>33</sup>. This plant and its oil have medicinal properties against excessive phlegm and bronchitis. Another potential use of this plant comes from the popular perception that it is a forest antibiotic, with great potential for fighting bacteria<sup>34</sup> and fungi<sup>35</sup>. This approach to fighting bacteria can open up a space for the classroom to be a place of alert about the misuse of antibiotics, which increased a lot in Brazil during the COVID-19 pandemic, due to misinformation on the Internet and social networks, even by doctors<sup>36</sup>, reverberating in the increase of bacterial resistance<sup>37</sup>. It is necessary that students and society are aware of the consequences of this procedure, with the difficulty of fighting bacterial infections, and the increase in morbidity and mortality.

Finally, biology class can have a fun (and educational) moment when it touches on another medicinal heritage of the indigenous people of the plants, the use of Catuaba<sup>38</sup>. Several plants bear the name Catuaba (*Erythroxylum catuaba*, *Anemopaegma glaucum* and *Avenca paegma mirandum*) that make energy available, commonly in the form of alcoholic beverages. Due to

its property of vasodilation, it is frequently associated with an increase in sexual capacity and in combating impotence. It is also perceived as a possibility to combat physical tiredness, insomnia, and poor memory. It is likely that many students already have some information, from their previous knowledge of these power, so discussion of Catuaba can generate a jocular character in the class and generate a relaxation in the class.

But are all these (and other) drugs really effective? This would be a very fruitful debate for the classroom, enabling students to learn a little about how science works, about the scientific method, and about the history of science. The teacher can ask how would it be possible to confirm the effectiveness or otherwise of these drugs? How can they be tested, what is the methodology, what is the role of the placebo? How is research done? The students could investigate which of these substances have or have not had their function confirmed by traditional medicine. Discuss how the Indians developed this knowledge; establish a parallel between the development of knowledge by traditional peoples and modern medicine.

### Science and biology classes as a cultural opportunity

No opportunity to diversify the didactics in biology and science classes should be wasted; there should always be the intention of making the class more interesting, instigating, and challenging for teachers and students. Addressing the heritage provided by native people can be one of these possibilities to enhance the lessons.

Teachers can teach science through research<sup>39</sup>, not only showing students how scientists conduct research but also encouraging research by themselves. In this way, students and teachers can increase both their knowledge of topics in science and their knowledge of science as a way of knowing<sup>40</sup>. In this way, these teachers and students will be more resistant to the fraudulent scientific news that is spread on social networks and the internet.

The lessons need to be creative, interesting, and attract the attention of a new type of student, one who spends much of his or her time on social networks, the Internet, and online games. To compete with this kind of distraction is no easy task and getting to know the indigenous culture and what it provides can offer something that students can't find on social networks and awaken their curiosity, enthusiasm, and willingness to learn. Students (and teachers) will be able to reflect on the legacies of the original peoples, to elaborate hypotheses about how this knowledge was built, how it is possible to live in relative harmony with nature.

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