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Environmental Education as a tool for discussing economic indicators of the ecological footprint in a public school in Campina Grande - PB

La Educación Ambiental como herramienta para la discusión de los indicadores económicos de la huella ecológica en una escuela pública de Campina Grande – PB

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Abstract: In this work, the School was approached as a priority institution in accelerating the process of knowledge about the environment, according to a local society unprepared to deal with the tools: ecological footprint and ecological calculator. In this sense, the underlying issue was to question whether the School as an institution should be circularly tooled with the contribution of environmental economics, transforming them into environmental education. That said, the methodology of case studies was used, observing a local school in the city of Campina Grande, PB. The results revealed a lack of knowledge and curiosity regarding environmental concepts, as well as urged that the School should be the instrument of this new history, where the environment and society through a transversal and multidisciplinary education would pierce spaces more quickly through basic knowledge.
Keywords: *Education; Environment; Ecological footprint; Economy.*

Resumen: Este trabajo aborda la escuela como difusora del proceso de conocimiento ambiental, según una sociedad local no preparada para lidiar con las herramientas derivadas de la huella ecológica. En este sentido, el problema de fondo era indagar si la escuela, como institución, debía instrumentarse curricularmente, con el aporte de la economía ambiental, convirtiéndola en promotora de la educación económica ambiental. Dicho esto, se utilizó la metodología de estudio de casos, observando una escuela pública en la ciudad de Campina Grande, PB. Los resultados revelaron cierto desconocimiento sobre la huella ecológica y, en la misma medida, reforzaron que la Escuela debe ser el instrumento de este proceso que incluye el medio ambiente, a través de una educación transversal y multidisciplinar, horadando espacios más rápidamente a través del conocimiento asociado a la economía en su base.
Palabras clave: *Educación; Medio Ambiente; Huella Ecológica; Economía.*

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INTRODUÇÃO

Environmental issues were vaguely known to Brazilian researchers until 1992. With the world environmental conference "Earth Summit", known by the mnemonic Eco-Rio[1], an attractive debate was opened about the environment and economic restructuring, where the main agenda pointed to the nature of the development created in the last century of industrialization. That said, a range of theorists, through the "our common future" report, pointed to the exhaustion of natural resources leading to the emergence of ecosystemic failure. With this, a contiguous concept was created, namely that of sustainability associated with the finite condition of natural resources. Likewise, new themes were discussed, such as: carbon credits, the Amazon, lungs of the world, global warming, and environmental education.

In the effervescence of these themes, a specific academic-university context was established that did not immediately provide an opportunity for the first and second grade school levels (today: elementary and high school, respectively) to share this knowledge. Vis-à-vis this interest, a huge gap was created, in terms of concreteness of the universal discussion, and the rooting of the ownership of the environment theme in society. In the midst of the various polemics, the so-called biologist ecologists emerged who took the place of the citizen debate, placing environmental education also as a matter of belonging to the public everyday life, exposing in fact the role of the basic school.

From Rachel Carson to G. Bruntdland[2], the discussion about the environment involved transversality and multidisciplinarity. The agenda 21 (UN, 1992) immediately adopted a joint action plan with education, which is the promoter of the dissemination of sustainability actions among local communities (UN, 1993; Rowe, 2007). Thus, education through the formal school, presents concepts and mentions about natural resources and sustainability, which is more than ever perceived as the recognition of the dissemination of knowledge via social accustoming, i.e., the links between environmental quality, human equality, globalization and its underlying policies (Sterling, 2001). This imposes that the School, having as its mysterious function critical inquiry, and systems thinking, explore the complexity and implications of the surrounding concepts of the environment.

Environmental education comes to the fore in Brazilian basic schools about 15 years ago with the emergence of isolated groups, mainly the WWF (World Wildlife Fund-Brazil, 2006) and BrasilEscola (2009), which propagate a series of discussions about the environment. These groups consider that

[1]In 1992, the United Nations Conference on Environment and Development took place in Rio de Janeiro, Brazil. It was the largest ever conference and the central objective was to identify principles for action for "Sustainable Development" in the future.

[2]G. Brundtland presents the report "Our Common Future" where several issues were raised among them population - population pressure, population and human rights, poverty, environment and development. The differences in perspectives seemed at first to be insurmountable and required much thought and willingness to communicate across the divisions of cultures, religions and regions.

environmental education, therefore, is more than a process that allows individuals to explore the issues of scientific research methods, but goes beyond that, sharing the understanding of these issues as a viable conjunctural space for understanding the role of natural resources via curricular introduction. As a result, they claim that individuals develop a deeper understanding of environmental issues and have the skills, to make informed and responsible decisions.

The U.S. experience is inspiring for the world through the Environmental Protection Agency (EPA) and the National Environmental Education Act of 1990 (contained in NEPA), which demonstrate national leadership in increasing children and youth's contact with environmental instruction via curricular inclusion. EPA established its Office of Environmental Education (AEB) to implement this program and today it is disseminated virtually worldwide through five grants: National Environmental Management Studies Network, President's Environmental Youth Awards, Tribal Lands Environmental Grant Program, Environmental Education Awards, Environmental Training, and Youth Programs and Conferences (JRH). The need for more citizens to think not only about economic variables, but also about the environmental and social impact of their actions, are definers of more sustainable development (IUCN, 2003).

FUNDAMENTAÇÃO TEÓRICA

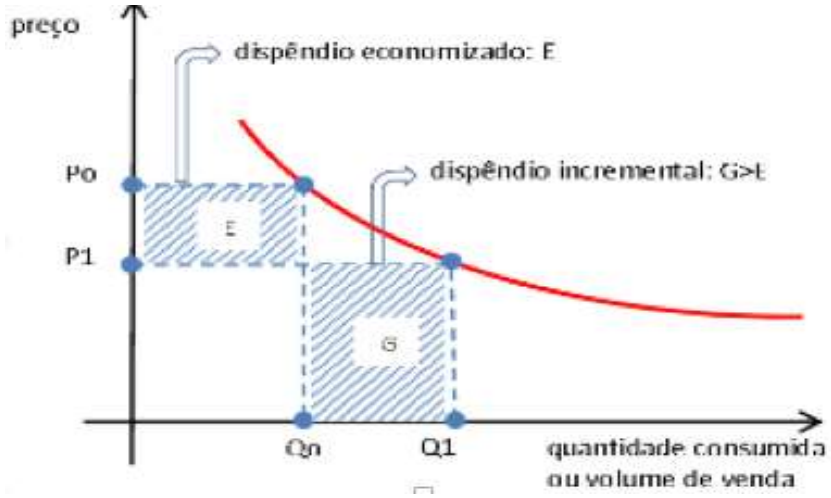
A pegada ecológica como forma de entendimento do conceito de sustentabilidade ambiental

More than 36 million people have researched the ecological footprint[3], since its inception. Originally, this concept was created by professors Mathis Wakernagel and Will Rees in 1992, amid the swirl of environmentalist messages coming from the more industrialized world. In what was witnessed as discussions were leaving the walls of the University of Britsh Columbia in Vancouver, CA, the Global Footprint Network creates a formula to calculate the ecological footprint, on the planet, through points in the industrial production matrix. The ecological calculator measures, therefore, the relationship between the consumption, exploitation and use of natural resources and the planet's capacity to replace such elements naturally. According to Wackernagel (1992), the ecological footprint is a measure in hectares, as it refers to the territorial area used to maintain the Earth's biocapacity. Thus, it was created contiguously to the concept of ecological footprint, the concept of biocapacity, which is an important recognition of the Brundtland discussions in 1992, referring to how much the planet could support in relation to human activities without losing its natural space. The calculations made in 1992 pointed out that the planet's biocapacity was 2.1 hectares per year, while our consumption points to 2.7 hectares per year, thus revealing

[3]The Ecological Footprint is a measure in global hectare (kha) calculated according to six different components: carbon footprint, cropland footprint, forest footprint, grazing footprint, built-up area footprint,fishing area footprint (WWF, 2012).

a negative ecological footprint. This means that we are consuming what should be replaced by 1.4 hectares of planet Earth annually, a figure that increases when we refer only to developed countries (Figure 1).

FIGURE 1: Relationship of price to quantity consumed.



SOURCE: Wacknagel & Rees (1992).

Note: As financial expenditures are compared to revenues, the National Footprint Accounts compare Gross Domestic Product values to obtain a comparison of natural capital. An ecological deficit situation is identified when the Footprint value is greater than the biocapacity value; conversely, when the biocapacity is greater than the Footprint, the National Footprint Accounts report a situation of ecological reserves.

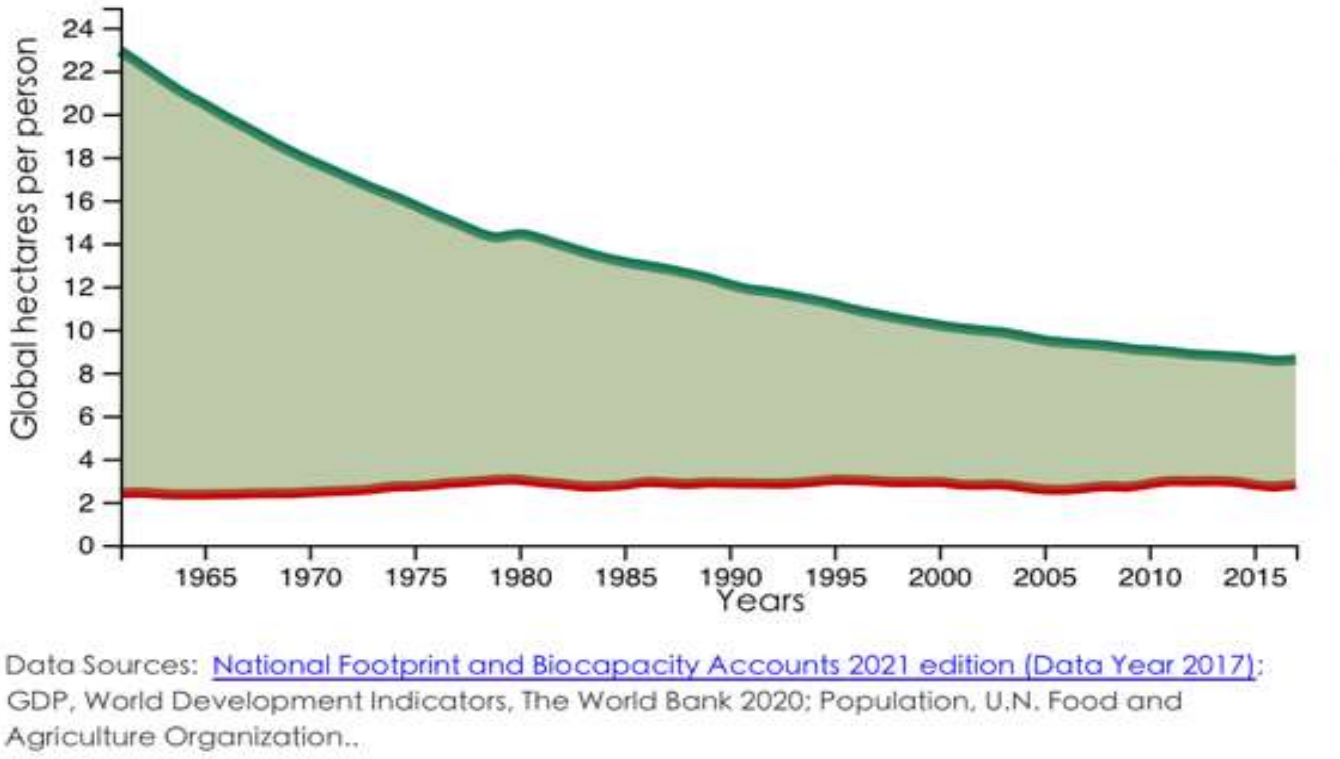
The concept of ecological footprint also refers to the amount of waste we produce in relation to the limits of how much the planet can absorb and transform into resources over time. This relationship, too, is important for measuring natural resource use and waste production against the planet's replacement rate. From the importance of this understanding of the planet, to the underlying activities of exploitation, another concept was derived, that of a sustainable society, where natural resources are used in a balanced way without compromising their availability for future generations.

Since it is a given, the ecological footprint measures, in quantitative terms, the natural elements needed to maintain society's lifestyle in general. Therefore, if an individual's level of consumption is higher than what can be replenished by nature, it means that he or she is providing an unsustainable burden to society, posing a threat to the planet's life support. The Ecological Footprint (E.P.) also uses material and energy flows to estimate the biophysical 'load' that human populations or industrial processes impose on ecosystems worldwide (Rees, 1992; Wackernagel and Rees, 1996). Their analysis estimates offer among others the 'load' in terms of the total ecosystem area needed to support an individual, a city, a region, a

country, or the entire world human population (Wackernagel and Rees, 1996; Wackernagel et al. 2006). The basic assumption is that different categories of human activity, such as energy and resource consumption and waste emission, require a certain amount of production or absorption land or water. This in the current of globalization, the P. E offers elements necessary to know and sustain the existence of a given human population is much larger and often much further from the area in which that population lives more than before (GFN, 2009).

In the example of Brazil from 2015, the total biocapacity reading was 8.6 gha while the per person footprint was 2.8 gha. In response, the reserve biocapacity was 5.4 gha, confirming it as one of the countries still creditors in terms of carbon reserves (Figure 2).

FIGURE 2: National Footprint by biocapacity.



SOURCE: WB (2020).

Allied to the critical topics of the E.P., some themes emerge which are derived from the ecological footprint framework:

- Multidisciplinary ecological education: ecological footprint calculations present ecological processes of which question society's ways of living today. The calculations take into account the

natural limits to resource use and thus help students to learn about the concept of overshoot and its implications for future generations.

- Spreading knowledge: examining the ecological footprint inevitably leads to investigations into the development of socio-political systems, population demographics, consumption trends, and favoring new models of economic development.
- Life Style: The ecological footprint calculator provides a unique feedback mechanism and measure of the impacts of your percapita consumption associated with lifestyle" i.e. the modus operandi of consumption.
- Environmental history: The social modus operandi and accurate assessments of the cumulative impacts of how human society has shaped the natural world and vice versa. Comparative ecological footprint calculations by individuals, groups, or entire nations can provide a basis for comprehensive discussions about inequality in resource use and waste, as well as the cultural, political, and economic systems that structure them.
- Ecological accounting: the ecological footprint calculator recommends multiple and very different models of achieving sustainability, and fosters the great discussion about ecological ICMS, payment for environmental services (PES) and so on.
- Future directions: Footprint discussions often lead to broad questions, such as how to define and build a sustainable society.

An education that leads to sustainability: the role of the School

The School is the best social mediator and the greatest instrumentalist of universal concepts and is therefore the best choice for mentoring environmental education. First, because it envelops a whole social and economic belt in a more comprehensive way. And secondly, because it has the institutional power to confer a formative academic degree. That said, as a measure and as a concept it is extremely useful as a tool for building equity and promoting well-being.

Education for sustainable development is essential to the process from early childhood to adult education. Education is of special importance for children, as values, lifestyles, and attitudes are determined at a very early age. Environmental education (EE) and education for sustainable development (ESD) has become an increasing priority at local, national, and international levels in recent years. The central role of environmental education and ESD in promoting the values and skills necessary to fulfill the school's mission is undisputed as it champions diverse social levels.

In its most basic definition, sustainability refers to a way of life that takes into account the limits of the natural environment as the support and foundation of knowledge. Sustainability has two dimensions:

influence and dependence. The deeper the understanding of human influence on the environment, the more we see the dependency relationship between ecological systems and the diversity of economic activities.

Education comes in as an adjunct in the sense of engendering first of all: awareness and understanding. Secondly, in the sense of engaging individuals in critical reflection of current lifestyles and actions and enabling them to make informed decisions and changes towards a more sustainable world as set out in the definition of the ecological footprint (Fien and Tilbury, 2002; Tilbury, 2004).

Sustainability knowledge, values, and practices offer a way to do this, with their focus on addressing environmental and social issues through social, behavioral, and critical pedagogical practices, and their support for interdisciplinary approaches to overcome curriculum fragmentation (Tilbury, 1995).

A escola como espaço de educação ambiental

Sustainability problems are undoubtedly among the major concerns of today, and they encompass almost every aspect of society. This class of socio-ecological dilemmas is well known as wicked problems (Rittel and Webber, 1973). Perverse problems4 are those of complex issues, which do not clearly define and which cannot be solved, through traditional modes of decision making. They are not necessarily morally wicked, and problematic because their solutions resist the usual attempts to solve them and bring other, often unforeseen, implications.

Contrasting them as tame problems, for which scientific knowledge uses common sense, can lead to trivialization and disdain by society, but if treated as procedures can derive solutions (Brown et al., 2010; Rittel and Webber, 1973). Sustainability problems are an example, well known of wicked problems in which these highlight difficulties in the formulation problem, and may present several solutions, but are not compatible, are unique, and consist of competing objectives, and are described by open-ended terms (Lotz-Sisitka et al., 2015; Seager et al., 2012). Thus, the challenge arises for educational institutions to tool individuals with skills needed to understand and solve problems of this nature.

By making the invisible visible, education coupled with economics shows that much of consumption patterns and their many environmental impacts, are not immediately obvious as they are obscured by our limited knowledge of any number of complex extraction and production processes.

The ecological footprint encourages investigation and discussion of these processes and thus offers many opportunities to more fully consider human impacts on the natural world. With the rapid increase in

4 In the United States it has been forbidden since 1992 to wash cars with treated street water, the penalty being imprisonment and a fine of more than $900.

world population and industrialization, the demand for natural resource-intensive products are more and more effusive.

METHODOLOGY

According to Gil (2008) "the methods aim at providing the researcher with the technical means to ensure objectivity and accuracy in the study of social facts. More specifically, these methods aim to provide, these methods, the necessary guidance for conducting social research, especially with regard to obtaining, processing and validation of data relevant to the issue being investigated" (GIL, 2008).

Branski (2015) addresses the case study methodology as "a research method that generally uses qualitative data, collected from real events, in order to explain, explore or describe current phenomena within their own context. Which matches what Yin, 2009 who states that MEC (case study methodology) is characterized as a detailed and exhaustive study of a few, or even a single object, providing in-depth knowledge.

Fontgalland (2021) apud Branski (2015) argues that to develop a research using the case study method, five stages must be fulfilled: research design; research design; data preparation and collection; case and between-case analysis; and report writing (figure 1). The last two steps occur in parallel. In this work, the case study methodology was chosen because it validates the understanding of the research in question, considering the outlines elaborated in Gerhardt and Silveira (2009) and in Branski (2014).

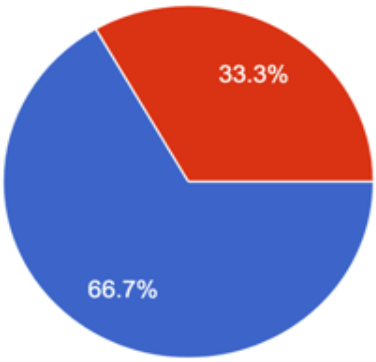
In this study, the methodology used was that of case studies where it was raised through tabulated data, in research, via questionnaires, the influence of the ecological footprint on environmental education via knowledge of the environmentalist theoretical framework. The questionnaire was made with 143 students and proceeded through questions via drop-box, concerning the surroundings of formal curricular schooling, and the concepts of environment involving the contours of the ecological footprint.

RESULTS AND DISCUSSIONS

Ten questions were presented to 143 students from a public school in the city of Campina Grande, PB. From the order of the questions, multiple choice and drop down box criteria were used, allowing comments and choice of other more elucidative answer alternatives.

The existence of the ecological footprint, as a tool of public domain, is still little noticed, since 66.7% of respondents are unaware of the theme or have no affinity with it. This reveals, still, the little influence of the ecological footprint, in the curriculum projects, in the city of Campina Grande.

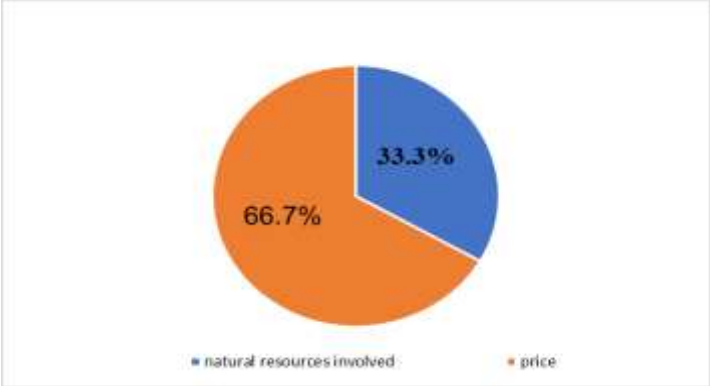
FIGURE 3: Knowledge of Ecological Footprint and environmental tools.



SOURCE: Own Elaboration (2021).

According to Wacknagel & Galli (2003), anything other than information, of good quality[5] is critical to the survival of academic studies. Good decisions are made on as much empirical evidence as possible, not on blind assumption. It is imprudent - or dangerous - to act on anything less. This brings us back to the question that was asked about knowledge of the depletion of natural resources related to industrial activities, where 76.2% of the respondents said that they did not know about the subject and only 23.8% had heard something but not much. Regarding the choice of goods, according to Figure 4, whether by price or by the natural resources involved, 66.7% chose the price option. As usual, the demand-supply effect takes the lead. Citing Wackangel & Galli (2003) it is understood that the market exerts a strong pressure on the individual: price-demand condition. In this reading, ecological, water, biomass and fossil energy resources are an absolute value where the consumption needs of humans are not necessarily open doors to exploitation economies. However, exploitation exceeds what the planet can regenerate - by an ever-increasing margin.

FIGURE 4: Choice of products by natural resources or price.



SOURCE: Own Elaboration (2021).

5Our emphasis

Also according to Wackernagel & Galli (2012), nations can remain competitive, even in this world of limited resources (a fact that does not limit the industrial product matrix). It all comes down to decisions. The Footprint can support and inform countries' policy issues from a number of angles here broken down into questions:

- To what extent is natural capital relevant to economic success?
- What potential risks does the deficit to biocapacity present in the composition of the National Product?
- What informational strategies are used to use the ecological footprint as a signal of a country in a deficit situation?
- What will the future look like if we do not solve the "resource limitation problem"?
- What immediate actions can decision makers take to ensure a viable future for their countries?
- How is it in each country's self-interest to make resource management a priority?

TABLE 1: Lifestyle Change and Individual Income in Salary expressed in R$ (2021).

Use of products with natural resource content	**S1 (> 10 salaries)**	**S2 (< 8 salaries)**	**S3 (< 5 salaries)**	**S4 (< 3 salaries)**
Strong	104	116	143	142
Moderate	89	56	32	23
Weak	23	12	8	2
Do not use	0	0	0	0

SOURCE: Own Elaboration (2021). Note: S1, S2, S3 e S4 – lifestyles conditioned on income.

By addressing these issues, one can glimpse the difference between a country's long-term success and its vulnerability when it comes to natural resources. Strategic decision making, based on an understanding of economic fundamentals, can set a nation on a path to greater success and economic security. Pioneers who choose to understand their resource needs, limits, and dependence can best ensure the well-being of their people and the prosperity of their nations.

In Table 1, we looked at 4 lifestyles conditioned on individuals' income (expressed in terms of nominal wages), and correlated them with products and their respective natural resource content. It was clear that individuals with higher incomes tend to opt for a lifestyle that saves on natural resources, given that the prices of goods have less influence on the purchase decision. Thus, it could also be inferred that they may have some environmental education. For individuals earning less than three salaries, prices exert a strong influence on final decisions, and they are strong in a more natural resource-sparing lifestyle. In this case, we cannot say that there is or there is not, ignorance of some environmental argument, but it is

plausible to say that income is implicative of their behavior in relation to the consumption of goods that spend more in terms of natural resources.

CONCLUSIONS

In this study, topics regarding the importance of environmental education were evidenced where the School is more significant institution which contributes to the permanent learning of the ecological footprint in a permanent and formal way. The practices are effective in changing attitudes, awareness and behavior of students regarding environmental problems (Cetin, 2015). The individual, as an integral part of nature, participates since always, in all historical stages making produce significant amount of exhaustive processes in the environment (see experiment table 1).

It is noticeable that in the city of Campina Grande, there is still a great ignorance about the ecological footprint and the other concepts that this tool supports and, therefore, there is more than ever the need to involve the elementary school in this interest.

The concept of "ecological footprint" is an almost intuitive measure of the impact of individuals or societies on nature. It provides a simple but elegant accounting tool that can help to account for the impact of human consumption patterns on the Earth. Currently, the ecological footprint is already 30% larger than what the world can provide.

As an educational tool the ecological footprint is a more effective than the knowledge we have didactically in terms of changing our environmental attitudes and behavior positively, because it digitally expresses our negative effects on the world. In this study, it was intended to stimulate the use of the ecological footprint, as a tool of environmental education as an effective condition for changing awareness, attitudes and directions of scientific-technological research in perspective of teachers and students towards a sustainable life. As components of environmental education from the ecological footprint it is suggested:

- Awareness and sensitivity to the environment and environmental challenges;
- Knowledge and understanding of the environment and environmental challenges;
- Attitudes of concern for the environment and motivation to improve or maintain environmental quality.
- Ability to identify and help solve environmental challenges;
- Participation in activities that lead to the resolution of environmental challenges;

- Environmental education does not advocate a particular point of view or course of action. Instead, environmental education teaches individuals to weigh the various sides of an issue through critical thinking and enhances their own problem-solving and decision-making skills.

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