

Environmental Awareness in the Educational Field with the use of Information and Communication Technologies

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Abstract— The general theme of this article is environmental awareness in the educational field with the use of ICTs. Our problem is whether teachers use and recognize technology as a partner in the process of environmental awareness? The objective is to analyze the use of technology as an environmental awareness process for the teacher in the investigated school, seeking to verify the use of educational technologies in the process of environmental awareness, and also to identify their developed activities and educational practices. As for the method, we used data collection with a likert scale, with 552 teachers and validated with a factorial analysis. Research was carried out in Elementary Schools in Goiânia, Brazil. In the main conclusions we highlight that teachers use the technological resource in their classes in order to raise environmental awareness, favoring an interdisciplinary educational work with innovative practices.

Keywords— Environmental Education; Technological Education; Innovative Practices.

Resumo— O tema geral desse artigo é a conscientização ambiental em âmbito educativo com o uso das TICs. Nossa problemática é saber se os professores utilizam e reconhecem a tecnologia como parceira no processo de conscientização ambiental? Objetivo é analisar o uso da tecnologia como processo de conscientização ambiental para o professor na escola investigada, buscando verificar o uso das tecnologias educacionais no processo de conscientização ambiental, e também identificar suas atividades desenvolvidas e suas práticas educativas. Quanto ao método utilizamos a coleta de dados com uma escala likert, com 552 professores e validamos com uma análise fatorial. Pesquisa realizou-se nas Escolas de Ensino Fundamental em Goiânia, Brasil. Nas principais conclusões destacamos que os professores utilizam o recurso tecnológico em suas aulas com fim de conscientização ambiental, favorecendo um trabalho interdisciplinar educativo com práticas inovadoras.

Palavras-chave— Educação Ambiental; Educação Tecnológica; Práticas Inovadoras.

I. INTRODUCTION

Nowadays, the concern with the environment is very significant due to the global repercussion of this issue. Many nations try to solve the problem of environmental degradation by promoting some strategies or new alternatives of knowledge and preservation. Environmental education, which is a challenge for all of us," arises from this theme, as these discussions go beyond education and involve professionals from other sectors of society who are constantly trying to reverse these problems (LEFF, 2017,

p.74). Regarding this theme, Environmental Education emerges as a great ally in this contemporary challenge, because it is innovative and effective in the face of discussions on environmental issues that go beyond education, other professionals and other sectors of society in an attempt to reverse this process. In view of the above, it is evident that the problem arises from the need to understand whether teachers use and recognize technology as a partner in the process of environmental awareness. And in this sense, this study has the general objective of

analyzing the use of technology in the process of environmental awareness by teachers of Municipal Elementary Schools in Goiania-Brazil. The specific objectives are: to verify the use of educational technologies in the process of environmental awareness. And following this line of investigation we seek to understand the challenges faced by teachers in the process of using technology in environmental education. To identify the practices developed by teachers involving technology and environmental education.

The fundamental purpose of environmental education is to ensure that individuals and citizens as a whole understand the complex nature of the environment (resulting from the interaction of its different aspects: social, cultural, economic, etc.). And along the same lines, environmental education is an educational process of a dialectic and systemic nature that should be developed basically at school, due to the social responsibility given to preparing children, adolescents, youth and adults for life. Therefore, we have to develop attitudes in students and in society, based on the acquisition of social values and interest in the environment.

For Ayes (2015), Environmental Education has a great relevance in the process of environmental awareness, the school is an ideal place for this achievement in defense of nature.

Thus, Ayes (2015), refers to that:

(...) "Teaching environmental discipline is an important factor in the teaching-learning process, so it establishes a relationship between environment and society. Therefore, it is essential to develop practices of conservation, preservation and sustainability. Thus, sustainable development encompasses environmental education, social education in the broader context of socio-cultural factors, as well as in the political and democratic sector (...)"

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According to Sato (2004), it was in 1972, through an International Conference, that significant advances were made, because the United Nations (UN) integrated man as that primordial being in the process of raising awareness

about the importance of nature for the life of living beings and for nature. In 1992, the United Nations Conference on Environment and Development (CNUMAD), also known as Rio-92, was held in Rio de Janeiro, Brazil, with the objective of promoting discussions on environmental issues. The scientists discussed the social dimension of the environmental problem because, before, man was considered the most important being of this awareness. Now, however, this conception is seen in a broader way and refers to man as the being that belongs to a society, from that moment on the term "socio-environmental" appears, all changes have the objective of solving or alleviating the problem (MENDONÇA, 2002).

A lot of change has been added, all approved by a large majority of speakers: Non-governmental organizations, civil society, researchers, influential people in the media and society - all defended the principles of respect and care for the environment. The value of education in the awareness process, society's responsibility, social and economic justice, respect, ecological aspects and quality of life for everyone on the planet were discussed.

At the same time the Global Forum-92 Rio/1992 took place, in this opportunity they prepared a document called "Earth Charter", in this document Environmental Education is defined as a dynamic process, conscious, individual and especially social transformation. Non-governmental organizations, civil society, researchers, influential people in the media and society participated and all defended the principles of respect and care for the environment. With this, they made a document called "Agenda 21", dealing with a primordial agreement between nature and society (MENDONÇA, 2002, p.98).

To know the concept of Environmental Education is important, because it is not easy to define it, because it is a multidisciplinary issue and depends on various contexts in society, history, economy, law, geography, tourism, finally of important and fundamental details in this process. Therefore, we find expressed in the law that establishes the National Policy of Environmental Education, as we see in Article 1 of Law No. 9.795/99 (BRAZIL, 1999):

Art. 1 Environmental education is understood as the processes through which the individual and the community build social values, knowledge, skills, attitudes and competencies directed towards the conservation of the environment, an asset for common use by the people, essential to a healthy

quality of life and its sustainability (BRAZIL, 1999).

The principles of education are also present in Article 1 of Law No. 9,795/99 (BRAZIL, 1999) mainly when there is mention of the principle of citizenship, where the development of the learner in maintaining a good quality of life and make a propagation of good attitudes to make an environmental education of quality.

Thus, Environmental Education aims to preserve the most precious heritage that one has that is nature and everything that surrounds it. Its goal is to seek the various solutions from the social, ethical, economic, ecological and environmental point of view. This is a task that also awakens in society the concern and care with what can cause damage to nature, such as: deforestation, soil degradation, air and water pollution, garbage. Today these concerns occur in several nations in the world, because it is a collective problem encompassing several countries and all with similar characteristics.

ENVIRONMENTAL EDUCATION PRACTICES

Thus, the environmental proposal in basic education rescues some paradigms, values and new pedagogical practices that will transform conscious subjects and citizens with an important role to change a reality.

According to the Environmental Education Law (EA) Law No. 9,795 of April 27, 1999, in Article 9, the EA must develop in the institutions the processes of primary, media and higher education within the curriculum, involving all segments through education. From basic education to higher and professional education.

And in Article 10 of that law, it ensures that it must intervene in education through activities, in schools, through awareness and changes to ecologically transformative thinking. It is not necessarily a discipline, but it easily facilitates the interaction of the curriculum in schools by adapting to all areas of knowledge.

For Alkimin et al. (2019), in order to carry out a work of environmental awareness in the school space, it is pertinent to go through the teacher training, whether initial or continued, "these spaces are rich in the art of researching, investigating and using creativity in the teaching-learning process" (ALKIMIN et al, 2019, p.68).

Thus, "practices in environmental education comes to collaborate through science and technology an awareness of sustainability. For this, teachers' knowledge in historical, socio-environmental, political, economic processes in defense of this process are relevant (BRAZIL, 2012).

TIC PRACTICES

The speed with which information reaches its destination is impressive, it transcends the information and changes of all sectors of today's society, especially reflected in the health, education, politics and customs of all involved in this reality. And from this perspective, according to Cabero (2016), in the face of the great revolutions in humanity in terms of communication, technology is undoubtedly the most current at this time.

In fact, defining technology goes beyond a simple concept. In reality, it is to say something very innovative, current and necessary in contemporary society. Thus, Hernández and De Barros (2016), as far as ICTs are concerned, can help in several aspects in society, such as: improving learning, innovating practices, exchanging organizations (HERNÁNDEZ and DE BARROS, 2016, p. 58).

For these authors, policies to incorporate technologies in schools favour innovative practices in general, but it is also necessary to reflect on the performance of teachers and their competence to use them for learning purposes. Asseveram Hernández and De Barros (2016) que: "The training of teachers is essential in the process of building innovative practices as well as the appropriate use of information and communication technologies (ICTs) in education" (HERNÁNDEZ e DE BARROS, 2016, p. 288).

Therefore, for Belloni (2001), there are several reasons for the use of technology in education, because used in a cognitive approach, it allows the student to codify, acquire knowledge, opine and transform reality. Education always constitutes a process of communication, beyond information and education. It defends that technology gives the student the opportunity of a new world vision, being the school a perfect space to accumulate new knowledge and change reality. And in this sense, the use of technology reinforces a paradigm that allows an interaction between information and the opinion of acquired knowledge. The school has a great challenge to work with such important themes and present in society, so it is good to know how teachers live and experience this theme at school.

Social and technological advances are providing changes in several areas, implying the need to rethink the ways in which education operates. Thus, the school requires changes in values, attitudes and actions in the way it interacts with nature and existence. It is essential to respect differences, but to create more opportunities for social permanence among all individuals every day. And this transformation is based on being structured in such a

way as to stimulate the exchange and appreciation of ideas, the respect for contradictory points of view and the appreciation of plurality and difference and participation in actions that value the environment.

In this way, it implies taking on new ways of perceiving the world that extrapolate the idea of conservation and involve a direct relationship between feeling, living, thinking and being, each one taken into consideration with a view to protecting and expanding life on the planet. The driving force in working on environmental awareness in the educational field is to create in school, an environment capable of submerging everyone involved in the educational process and also society to collaborate through science and technology for an educational awareness.

Historical, socio-environmental, political and economic knowledge in defense of this process is relevant. Due to this indigence, we realize the importance of working on some legal frameworks, which are also expressed in the Federal Constitution (1988 pg. 103), where it states in Art. 225 that "Everyone has the right to an ecologically balanced environment, a good for the common use of the people and essential to a healthy quality of life, imposing on the public power and the collectivity the duty to defend it and preserve it for present and future generations". In subsection VI, it indicates that one should "promote environmental education at all levels of education and public awareness for the preservation of the environment" (BRAZIL, 1999).

II. METHODOLOGY

In the words of Pérez Ferra (2009), the method is the procedure to achieve the objectives and the methodology constitutes the study of the method. For him, the reference is the classification given, which focuses on the fact that research methods may be oriented either to obtaining basic knowledge or to obtaining knowledge applied to decision making and actions for the exchange of knowledge (25).

We conducted a quantitative research, because according to Hernández and De Barros (2018) it is an investigation that has as its primary objective to study the properties and quantitative phenomena and also the relationships that provide the revision of existing theories.

As a tool we use the likert scale application. The population researched includes all the teachers of the Municipal schools who work with environmental awareness and innovative practices, totaling five hundred and fifty-two (552) participating teachers. Thus, the show

coincides with the population. A matrix of operation was used for the construction of the instrument, observing the objectives, variables, dimensions, indicators, items and units of measurement (MEJÍA, 2005, p.67). We designed our scale, Likert type, composed of 25 items, grouped in four dimensions (extracted from the specific objectives): being them: A (Environmental Education), B (Technologies), C (Educational Process), D (Awareness), E (Practices). The reliability of our scale was calculated through Cronbach's alpha, and the value obtained was excellent (864).

The factorial analysis technique that we apply in our research follows the following steps:

First it became necessary to study the correlation matrix to see if our data is adequate to perform a Factorial Analysis. For it, such a matrix must have a certain structure. To prove this, if it was used the Kaiser-Meyer-Olkin measure of show adequacy (KMO coefficient), in our case the value is 0.704, following Kaiser (1974) the value is acceptable, and we continue with the analysis of the collected data.

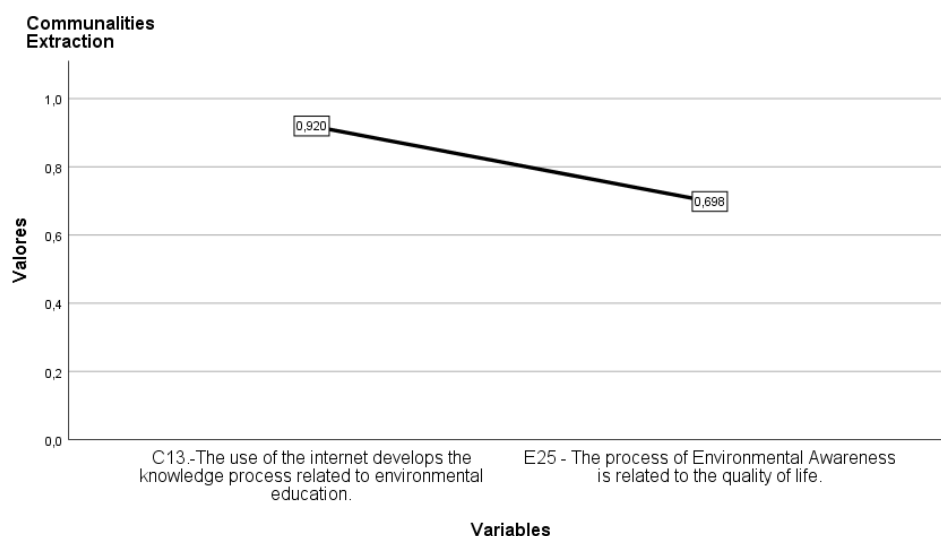
In a second moment, the factors are extracted with the SPSS program, which gives us different methods that differ in the interactive algorithm that uses the extractions. The SPSS brings by default the Main Components method which starts with the total of communalities (whose value is one) in the common factors and, therefore, the final value of communalities at the end of the interactive process is an indicator of the quality of the extraction in the sense that the variables with low final communalities values are poorly explained by the model. In good extraction, these values should be high (the closer to a better one) in all variables (KAISER, 1974, p. 98).

III. RESULTS AND DISCUSSIONS

Factorial analysis was performed because it is a data reduction technique that serves us to find groups of variables that correlate with each other from a group of variables. In Graphic 1 below we demonstrate the communalities, better and less represented, and in these results show us only that there is an item with value, 667 in the rest has a value superior to 500, we say nevertheless we do not eliminate this item.

As we can see in the Graph 1, C13 is the best represented item, with 0 (0,920). "The use of the Internet develops the knowledge process related to environmental education". However, E23 is the worst represented item (0,698). "Projects involving environmental education should be developed in all schools".

Graph 1- Major and minor communalities represented



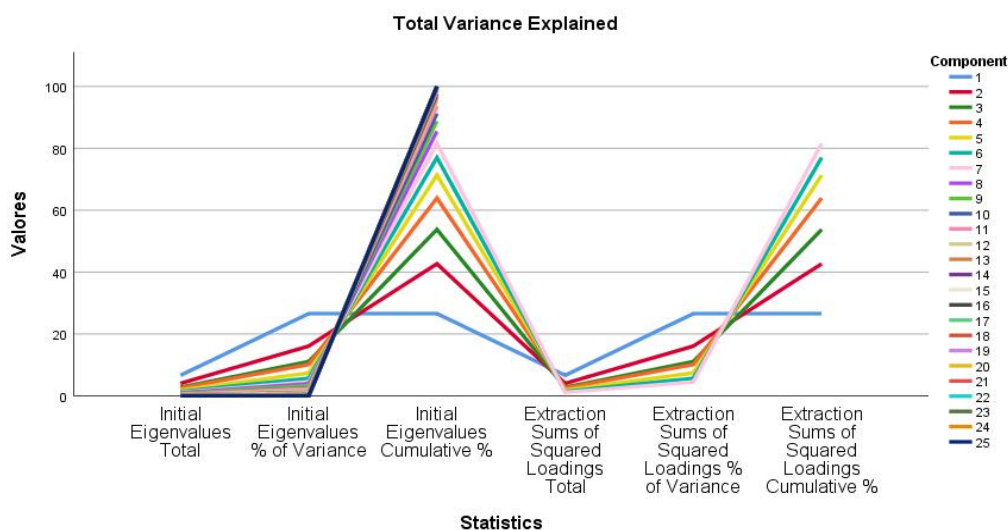
Source: own.

In the sequence we carry out the rotation of the factors, using the Varimax rotation that optimizes the most extreme factor loads possible in the factors (high and low), which indicates those that we have to keep of the main components whose own values are greater than the unit,

although the most used criterion is to observe the percentage of total variance explained by each component or factor, and when this reaches a cumulative percentage considered high of factors (KAISER, 1974, p.95).

Then in the Graph 2 below we show the initial representative eigenvalues:

Graph 2 - Presentation of initial eigenvalues



Source: own

Table 1 - Total variation explained.

Component	Initial values				
	Total	% change	cumulative %	Total	cumulative %
1	6,662	26,649	26,649	6,662	26,649
2	4,037	16,147	42,796	4,037	42,796
3	2,766	11,064	53,860	2,766	53,860
4	2,535	10,139	63,999	2,535	63,999
5	1,834	7,336	71,335	1,834	71,335
6	1,419	5,674	77,009	1,419	77,009
7	1,133	4,531	81,539	1,133	81,539

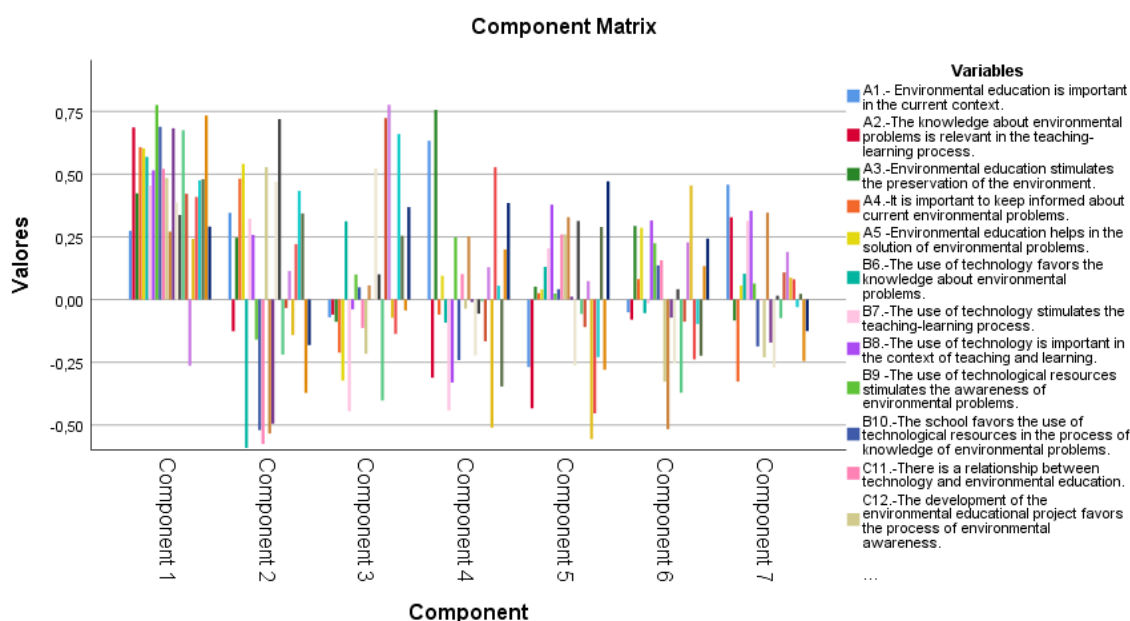
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In our case, these are the first 7 factors, which explain an 81.532% cumulative variation.

Also, we conducted a study of factor scores. This gives us the value that each item of the display gets in each

factor in the component matrix below, which are estimated by different methods since it is not possible to obtain them exactly. Calculating the component matrix, we finally have 7 factors left (Graph 3).

Graph 3 - Component Matrix. (Extraction method: Principal component analysis).



Source: own.

After demonstrating the graph 3 we extracted the corresponding items for the different factors. As we demonstrate in the Chart1.

Chart 1- Factors and items.

Factor	Name	Items integrated into each factor in the questionnaire.
I	A.- ENVIRONMENTAL EDUCATION	A2.-The knowledge about environmental problems is relevant in the teaching-learning process. A4.- It is important to keep informed about current environmental problems. A5.-Environmental education helps to solve environmental problems.
	B.-TECHNOLOGY	B6.-The use of technology favors the knowledge about environmental problems. B7.-The use of technology stimulates the teaching-learning process. B8.- It is important to use technology in the context of teaching learning. B9.-The use of technological resources stimulates the awareness of environmental problems. B10.-A school favours the use of technological resources in the process of learning about environmental problems.
	C.-EDUCATIONAL PROCESS	C11 - There is a relationship between technology and environmental education. C14.-The blog and the educational platform are technological resources used in the process of environmental awareness.
	D. AWARENESS	D17.-The use of the school's technological resources favors the dynamics of environmental awareness. E23 - Projects involving environmental education should be developed in all schools. E24 - In the school context, working on environmental education in an interdisciplinary way helps in the process of environmental awareness.
	E.-PRACTICES	

Source: own.

As the Chart 1 shows, in the original scale we had 25 items, and it is reduced by 13 items with a higher reliability than the original scale according to Cronbach's alpha which gave us a value of 0,881.

The descriptive analysis was done by analyzing the most significant data offered by the Likert scale according to the dimensions of the research. Remembering that the dimensions of the descriptive analysis are related to the following dimensions: Dimension A- Environmental education, B-Technology, C-Educational process, D-Awareness, E-Practices.

Thus, on dimension A- Environmental education, the descriptive analysis of this dimension gives us some information to highlight. Thus, the teachers interviewed think that environmental education is important in the current context, which stimulates the preservation of the environment, they also think that it is important to keep informed about current environmental problems, also most of them think that environmental education helps in solving environmental problems. The results show that, in Table 1, in view of the Environmental Education dimension, teachers mostly agree that Environmental Education stimulates the preservation of the environment, because it points to a totality of communality of results of

(1,000) and extraction of (0,915). These data point to a good performance related to the choice of teachers, with emphasis on A3.- Environmental education stimulates the preservation of the environment. In view of the above, we turned to Mendonça (2002) to emphasize that Environmental Education in the globalized perspective of education guides the awareness of the process of sustainability.

In the continuation of the research, on the B-Technology dimension, it results that the interviewed teachers agree many times that the use of technology favors knowledge about environmental problems, also the use of technological resources stimulates the awareness of environmental problems, the teachers agree that there is a relationship between technology and environmental education, as well as that the Internet or technologies develop knowledge about environmental education. Regarding the Technology dimension in table 1, most teachers agree that the use of the Internet develops the knowledge process related to environmental education demonstrated in the result of communality of (1,000) and extraction of (0,923), these results give emphasis to C13.- The use of the Internet develops the knowledge process related to environmental education. As mentioned by Cabero and Cejudo (2006), technology is an important resource that provides many transformations in various sectors and here, especially in education, it is an innovative resource in contemporary times.

About the third dimension of the descriptive analysis, C.-Educational process, this dimension tells us that teachers agree that the use of technological resources favors the dynamics of environmental awareness, as well as that it is important to discuss environmental education at school. It is noted that in the Educational Process dimension in table 1, teachers mostly agree that it is important to discuss environmental education at school, being represented by the result of data communality in (1,000) and extraction of (0,900), giving emphasis to the answer of C15.-It is important to discuss environmental education at school. As mentioned by Leff (2002), this theme in the educational process worked in an interdisciplinary way will value and reinvigorate significant values and attitudes.

Regarding the fourth dimension, D.-Consciousness, it results that teachers agree that the teacher is prepared to work on the subject of environmental education, but they do not agree that environmental education should be worked only in science classes. Regarding the Awareness process, table 1, teachers chose to highlight the use of technological resources in the awareness process, resulting in a communality of (1,000)

and an extraction of (0,811), proving the response of D17.- The use of the school's technological resources favors the dynamics of environmental awareness. Another important point in the awareness process, Brazil (2012), historical, economic, political and socio-environmental knowledge.

On the last dimension, E.-Practices, in this dimension teachers are very much in agreement that it is important to discuss the subject of environmental education in the classroom, as well as to develop projects on the subject, and to carry out interdisciplinary work on environmental education. It is noted that referring to the practical dimension in table 1, the teachers recognize that it is important to discuss the theme on environmental education in the classroom, resulting in communality of (1,000) and extraction (0,916) in face of the answer of E22.- It is important to discuss the theme on environmental education in the classroom. Besides agreeing in its majority that, in the context, working on the subject of environmental education in an interdisciplinary way helps in the process of environmental awareness, the result is exposed by the communality of (1,000) and extraction (0,876). Proving the response of E24. -In the school context, working on environmental education in an interdisciplinary way helps in the process of environmental awareness. The statements corroborate the objectives of environmental education, according to Article 13, meeting the need to update the curriculum in the manner of environmental education. Thus, the Factorial Analysis was made to give validity to the scale, because we do not intend to make the scale just to investigate, but to make a scale validated in its construction in a scientific way, so that it is a valid instrument for the scientific community. The original scale has 25 items, and we managed with factor analysis to validate it and reduce it to 13 items with the greatest reliability.

IV. CONCLUSIONS

Projects involving environmental education should be developed in all schools, as this challenge arises from the lack of structure in some schools to develop this skill.

When identifying the activities developed by teachers involving technology and environmental education, we realized that the predominant use of blog, platform, internet as technological resources within the process of environmental awareness, because they believe there is a representative relationship between technology and environmental education.

The educational practices of teachers in the field proposed by the research, include that the use of projects

and interdisciplinary work on environmental education are important as resources to be used in classroom dynamics.

It is clear that teachers in their entirety appreciate this issue, believing that technology and environmental education are in fact partners in the awareness process, and that the school in question is inserted in this context of using technology for this purpose.

Environmental awareness is present in teachers' actions in the face of an extremely important issue such as environmental education, as well as the use of technologies for innovative practices. All teachers have demonstrated a methodological look to achieve the challenges of education, and this shows us that they are responsible and dynamic professionals in their practice. Another factor to be taken into account is that they show that they develop practices with a preservation character to the environment, where it reveals us that they are concerned with the quality of life of all, considering that in face of this challenge the teacher and student are the main agents.

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