Validation and application of a measurement scale on environmental practices for high school teachers in Patos, Paraíba

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ABSTRACT. The objective was to create, validate and apply a measurement scale on environmental practices for teachers of various educational areas (exact sciences, humanities, natural sciences and Portuguese), from six public high schools in the city of Patos, Paraíba. To that end, it was created a questionnaire related to the topic, consisting of 24 items in the Likert scale model, being statistically validated as its consistency and reliability by factor analysis and by the α-Cronbach's test. The assessed measurement scale has been validated (n = 34) with the exclusion of five items, getting excellent α-Cronbach's coefficient (0.95). In the application of the questionnaire (n = 68), most teachers had social and environmental practices little consistent with environmentally sustainable practices. The results suggest that the high school teachers of the surveyed public schools have inadequate knowledge and/or practices for teaching Environmental Education, revealing that, probably, the students are not receiving basic environmental knowledge for their critical and reflective thinking on the various environmental problems.

Keywords: ecological attitude, environmental education, factor analysis, teachers.

Validação e aplicação de uma escala de medida sobre práticas ambientais em escolas do ensino médio da cidade de Patos, Paraíba

RESUMO. O objetivo desse trabalho foi elaborar, validar e aplicar uma escala de medida sobre práticas socioambientais para os professores de diversas áreas de ensino (exatas, humanas, naturais e língua portuguesa), de seis escolas públicas do ensino médio público da cidade de Patos, Paraíba. Para tanto, foi criado um questionário relacionado com o tema, constituído por 24 itens no modelo da escala de Likert, sendo validado estatisticamente quanto à sua consistência e confiabilidade por meio da análise fatorial e o teste de α-Cronbach. A escala de medida avaliada foi validada (n = 34) com a exclusão de cinco itens, ficando com excelente coeficiente α-Cronbach (0,95). Na aplicação do questionário (n = 68), a maioria dos professores apresentou práticas socioambientais pouco compatíveis com práticas ambientalmente sustentáveis. Os resultados sugerem que os professores do ensino médio das escolas públicas pesquisadas possuem conhecimentos e/ou práticas inadequadas para o ensino da Educação Ambiental, revelando que, provavelmente, os alunos não estejam recebendo saberes ambientais fundamentais para o seu pensamento crítico e reflexivo sobre os diversos problemas ambientais atuais.

Palavras-chave: atitude ecológica, educação ambiental, analise de fator, docentes.

Introduction

Anthropic actions over the past decades have caused massive environmental degradation. The uncontrolled economic growth has generated enormous economic, social and environmental imbalances, promoting the need for awareness of the social and environmental risks of the current development model, and of its responsibility for the well-being of future generations.

In this context, the pursuit of environmental awareness is critical to the conservation and maintenance of nature, and individuals with awareness tend to make decisions that consider the environmental impact of their actions (Battistella, Velter, Grohmann, & Casasola, 2012). Among the emerging actions to sensitize people for a more harmonious living with the environment, there is the inclusion of Environmental Education in the school (Vasconcelos & Silva, 2015).

The Environmental Education has gained prominence as a crosscutting theme in the school curriculum (Brasil, 1997), being a key resource for educating young people and citizens about

environmental problems (Lopes et al., 2011; Lima & Braga, 2014), by providing a more critical view and understanding of the reality, which may guide students (Almeida, Boas, & Amaral, 2015), making them better able to identify environmental problems and take part in their solution.

Environmental Education should be included in all levels and types of education in Brazil (Brasil, 1999; Gavião & Lima, 2014) and in all areas of knowledge (Oliveira, 2015), however, it is not yet significantly inserted in the educational space (Hair, Anderson, Tatham, & Black, 2011), and its inclusion in a reductionist way should be avoided, involving larger and more aware political attitudes (Ramos, Vicente, Valente, Gadelha, & Martins, 2015), being included in the school curriculum permanently and continuously (Sá, Pereira, & Moura, 2012).

For the complex approach between society, environment and education, the involvement of the whole school community is needed, involving the interdisciplinary knowledge and the training and professionalization of teachers (Jacobi, Tristão, & Franco, 2009). Thus, the teacher is an important mediator of this knowledge, which makes vehement the need for their training to meet effectively the demand that this education requires (Oliveira & Corona 2008; Silva, Silva, Silva, Silva, & Oliveira, 2015).

With a view to measure the knowledge related to the environmental knowledge, several researchers have proposed measurement scales for this purpose. In general, studies investigating the ecological behavior use verbal self-report measures, since the ecological behavior has many facets and dimensions. The environmental performance measurement basically aims at general investigations: of measures, such as the proposed by Karp (1996), investigating the dimensions of the environmental performance in so-called first-world realities; or with more specific goals (Kaiser, Doka, Hofstetter, & Ranney, 1998), researching the behavior of recycling, of energy and water conservation, among others (Pato & Tamayo, 2006).

This research aimed to create, validate and implement a measurement scale on environmental practices for high school teachers in Patos, Paraíba.

Material and methods

All teachers who took place in this research were teaching in schools located in the city of Patos, Paraíba. This city has an area of approximately 473 km² and about 103,000 inhabitants (IBGE, 2010),

being located 307 kilometers from João Pessoa, the State capital.

The research was conducted between March 2013 and March 2014, in six public schools in the city of Patos, Paraíba. The study population was composed of teachers of various high school areas. The definition of the sample size was given according to Rocha (1997) and considering a sampling error of 10%. Thus, a sample of 68 teachers was defined, selected at random in six schools (Table 1).

Table 1. Total number of teachers (TT) who teach in state high schools in Patos-PB (2013) and number of respondents (TR) per school.

School	TT	TR
Monsenhor Manoel Vieira	72	25
Dr. Dionísio da Costa	27	9
José Gomes Alves	40	10
Auzanir Lacerda	27	10
Antônia Araújo	14	8
Dom Expedito Eduardo de Oliveira	13	6

Source: Authors.

Data collection was performed through the application of a measurement scale consisting of 24 items, built on the model of the Likert Scale (Table 2). In addition to these items, there were the following variables to define the interviewed teacher profile: gender, public education time, year of graduation and teaching disciplines.

The items had five levels of responses, related to the level of agreement of teachers, ranging from completely disagree (level 1) to completely agree (level 5), or to the level of approach, ranging from never (level 1) to very much approach (level 5) on environmental issues.

The research was conducted in two stages. In the first stage, the scale with 24 items was statistically validated, being applied to a population of 34 respondents. After its validation, in the second stage, it was applied to a larger sample population (n = 68).

The validation was given through the analysis of the α-Cronbach's coefficient, where a set of items presenting a value less than 0.70 is considered to be reliable (Crombach, 1996). The item-total correlation analysis of each item was used as value of exclusion of scale items, being considered, for deletion, values less than 0.35.

The possible need for the exclusion of items was also defined using the factor analysis with the Kaiser Meyer-Olkin index (KMO), the item being considered satisfactory when the KMO value has statistical significance at the level of $p < 0.05$ (Hair et al., 2011). Statistical analyzes were performed using SPSS statistical software v.20.0.

Table 2. Items of the measurement scale created and applied in the research.

Item	Statements
i1	In my classes, I address environmental issues with a satisfactory frequency.
i2	I believe that Environmental Education should be a discipline.
i3	I meet difficulties to develop Environmental Education projects in school.
i4	I encourage students to take actions that preserve the environment.
i5	I often take students to know the regional fauna and flora.
i6	I often take students to know the reality of the pollution in the city.
i7	I always avoid that students generate waste in the activities using paper.
i8	I always use rechargeable whiteboard brushes.
i9	I always try to optimize the use of paper in the written tests.
i10	I reuse materials such as posters in my classes.
i11	I've done training/improvement courses in the Environmental Education area.
i12	In my graduation, Environmental Education-related issues were discussed.
i13	I am a participant in the discussions and actions in Environmental Education at school.
i14	Measures such as school garden and trees are important to the school.
i15	I know the Brazilian laws related to the environment.

Environmental issues taught in the classroom		
i16 Pollution of soils	i19 Waterborne diseases	i22 Pollution of the sea
i17 Drought in the Northeast	i20 Desertification	i23 Climate changes
i18 Pollution of rivers and lakes	i21 Pesticides	i24 Air pollution.

Source: Authors.

Results and discussion

The α-Cronbach's for the scale containing 24 items was equal to 0.93. The item-total correlation ranged from 0.057 to 0.887 (Table 3). Based on this correlation, five items (i2, i4, i8, i9 and i10) were rejected as they had item-total correlation values <0.350 (Table 4).

Table 3. Item-total correlation of the items of the evaluated measurement scale.

Item	Correlation	Item	Correlation	Item	Correlation
i1	0.696	**i9**	**0.057**	i17	0.708
i2	**0.114**	**i10**	**0.328**	i18	0.808
i3	0.831	i11	0.359	i19	0.745
i4	**0.124**	i12	0.524	i20	0.887
i5	0.370	i13	0.591	i21	0.885
i6	0.492	i14	0.610	i22	0.685
i7	0.487	i15	0.353	i23	0.780
i8	**0.126**	i16	0.787	i24	0.845

Source: Authors.

Table 4. Factor analysis of the evaluated measurement scale, with two main factors.

Variable	Factor	
	Factor 1	Factor 2
	i1 = 0.758	i5 = 0.481
	i3 = 0.874	i6 = 0.572
	i14 = 0.678	i7 = 0.600
	i16 = 0.826	i11 = 0.423
	i17 = 0.767	i12 = 0.433
Factor loadings	i18 = 0.850	i13 = 0.620
	i19 = 0.809	i15 = 0.699
	i20 = 0.902	
	i21 = 0.908	
	i22 = 0.735	
	i23 = 0.830	
	i24 = 0.896	
Total items	12	7
Eigen value	9.787	1.821
Variance explained (%)	48.94	11.32
α-Cronbach	0.956	0.717

Source: Authors.

The factor analysis is a multivariate statistical technique that is applied to gather and correlate data of variables (eigen values >1), in this case, of items, and to find new significant variables (Buyukozturk, 2003), which will assist in the decision making regarding the consistency of a measurement scale.

The factor analysis for the assessed scale suggested that it contained two main factors. After excluding the above items, it was not reported the need for further rejections, since all items showed significant values of factor loadings for the two main factors considered (Table 4). The eigenvalues and the variance explained by the two factors were: 9.78 (48.94%) and 1.82 (9.11%), respectively. Thus, these factors explained 60.26% of the data variance.

The first factor consisted of 12 items (i1, i3, i14, i16-i23), with α-Cronbach's equal to 0.96 and factor loadings ranging from 0.678 to 0.908. As these items are related to the educational aspects of Environmental Eucation at school, this factor was named as "The Environmental Education teaching at school".

The second factor involved seven 07 items (i5, i6, i7, i11, i12, i13 and i15), reporting Cronbach's α = 0.72 and factor loadings between 0.423 and 0.699, being related to educational activities in the society and to the aspects that relate the teacher's level of involvement. Hence, this factor was named as "Transdisciplinary practices and involvement in Environmental Education".

After the exclusions, the scale was composed of 20 items and its α-Cronbach's increased to 0.94. Furthermore, the value of the KMO test was satisfactory (0.801) and the sphericity test was significant at the level of $p < 0.001$ ($χ^2 = 508,118$; df = 171).

Among the teachers interviewed, there were 32 men and 36 women, where most were between 28 and 45 years (61.4%, n = 42) and completed the

graduation between 2003 and 2016 (64.6%, n = 44), with wide variation in their teaching time (Figure 1).

The variability of the teaching time may represent significant differences in the didactic approach between them, since this variation range includes various stages of evolution in the teaching-learning process that took place in Brazil. Notwithstanding, about one-third of the teachers interviewed (32.8%, n = 22) had over 18 years of teaching time.

Most teachers (58.8%, n = 40) stated that they address environmental issues with satisfactory frequency in their classes (Table 5). They (73.5%, n = 50) affirmed that practical actions, such as a school garden, contribute to the teaching of Environmental Education, and 76.5% (n = 52) of them faced little or no difficulty in developing environmental projects at school.

Among the various environmental issues, those related to the pollution of soils and seas are never or rarely approached by about two-thirds of the teachers (66.2%, n = 45 and 61.8%, n = 42,

respectively). On the other hand, they stated approaching, more often (very often-always), issues related to drought (55.9%, n = 45) and climate changes (66.2%, n = 45; Figure 2). The results show that the most common environmental issues in the classroom are those most evident in the region (Drought and Climate Changes).

However, it is essential that teachers teach other issues of equal importance, such as pollution of soils and seas, so that students have the most extensive knowledge and awaken their critical thinking about current environmental problems.

Zanatta, Rosa, Santos, & Salamoni (2013) report that: It is very important to work with Environmental Education in schools, since these are the social space and the place where the student will continue his/her process of socialization. What is said and done at school is valued, it is an example of what society wants and approves. Environmentally friendly behaviors must be learned in practice in everyday school life, contributing to the formation of responsible citizens.
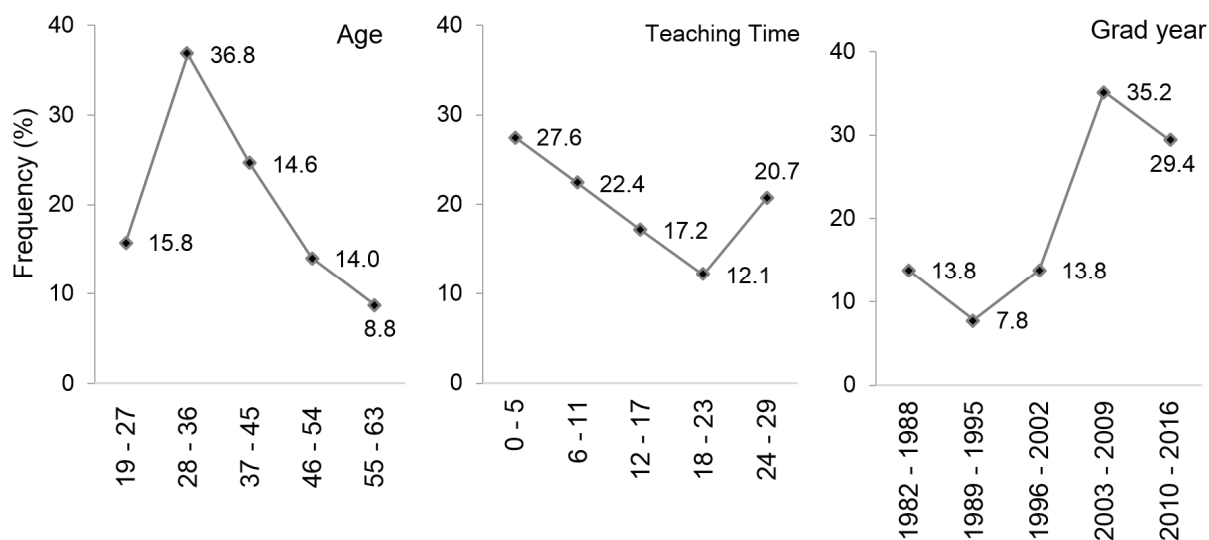

Figure 1. Age, teaching time and year of graduation of the interviewed teachers.

Table 5. Frequency (%) of the responses of teachers to the measurement scale applied.

Item	Concordance scale (%)*				
	1	2	3	4	5
Factor 1. The Environmental Education teaching at school					
Measures such as school garden and trees are important to the school.	2.9	0.0	4.4	19.1	73.5
In my classes, I address environmental issues with a satisfactory frequency.	8.8	19.1	13.2	48.5	10.3
I meet difficulties to develop Environmental Education projects in school.	10.3	13.2	45.6	23.5	7.4
Factor 2. Transdisciplinary practices and involvement in Environmental Education					
I often take students to know the regional fauna and flora.	42.6	23.5	19.1	14.7	0.0
I often take students to know the reality of the pollution in the city.	45.6	32.4	10.3	11.8	0.0
I always avoid that students generate waste in the activities using paper.	8.8	14.7	57.4	8.8	10.3
I've done training/improvement courses in the Environmental Education area.	32.4	22.1	22.1	14.7	8.8
In my graduation, Environmental Education-related issues were discussed.	19.1	22.1	13.2	19.1	26.5
I am a participant in the discussions and actions in Environmental Education at school.	11.8	22.1	25.0	17.6	23.5
I know the Brazilian laws related to the environment.	38.2	17.6	17.6	4.4	22.1

* Scale levels: 1 - Strongly disagree; 2 - Disagree largely; 3 - Indifferent; 4 - I agree for the most part; 5 - I agree completely. Source: Authors.
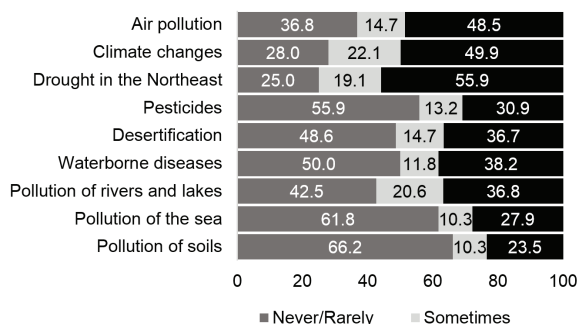
Figure 2 Frequency (%) of the responses of teachers to the measurement scale related to the environmental issues addressed in the classroom.

The numerous environmental problems are partly due to the lack of sensitization of people, and regardless of the model adopted to explain the state of aggression to the environment, the educational process is always an alternative to change this scenario.

The need for the formation of a social and environmental conscience becomes urgent, and in this effort, the Environmental Education plays a key and leading role for the school routine. This awareness must be consistent on the teacher, to encourage others and become a motivator of social and environmental practices among students and, consequently, in the society he/she belongs.

In the attempt to raise awareness and sensitize everyone about the degradations caused by man to the environment, the Environmental Education comes up with emergency and transformative approach, encouraging a good relationship between man and nature. Evidencing a fundamental way to the formation of conscience of all and a viable alternative to a knowledge oriented to social, ethical and human values.

Essential for a good quality of life, the Environmental Education is an effective tool to create and implement sustainable actions in the interactions between society and nature, the school being an educational space conducive to educate citizens.

The training in Environmental Education, during the graduation period of the majority of the interviewed teachers (58.8%, n = 55) was between little and completely insufficient. Only 23.5% (n = 31) reported having done some kind of training in this area after graduation (Table 1). Some of the teachers interviewed graduated in past decades (35.4% graduated between 1982 and 2002). By the recent history of Environmental Education in the world and in Brazil, it is likely that thtable 1e access to information about Environmental Education, during the formation of these teachers, was scarce or very different from recently graduated teachers.

The elevated time of teaching and graduation may reveal the need for these teachers to train in Environmental Education, since its inclusion in the Brazilian institutions was only standardized in the late 1990. So, if these teachers have not had training in the environmental area after their graduation, they are likely to have limited knowledge, not assigning the Environmental Education topic its due importance, because they feel unprepared with this issue (Almeida, 2013).

Among the teachers interviewed, 33.8% (n = 23) graduated in exact sciences (Mathematics, Chemistry and Physics), 32.3% (n = 22) in the Humanities area (History, Geography, Sociology, Philosophy and Trade), 16.2% (n = 11) in the area of Natural Sciences (Biology) and 17.7% (n = 12) were teaching Portuguese.

Environmental Education depends on adequate training of professionals, since, as a mediator of the teaching-learning process, the teacher is one of the responsibles for making this possible (Pereira, Guimarães, Souza, & Rocha, 2010).

The environmental dimension involves a number of actors of the educational universe (Georgin & Oliveira, 2014). And in that context, it is the teacher's role to seek new knowledge and practice activities that may arouse a critical awareness in the students, forming ethical citizens and humans.

Despite the fact that the teaching in high schools is performed from disciplines and teachers from different areas of knowledge, it is expected for the Environmental Education to involve all curriculum subjects; the National Curriculum Parameters (NCPs) defines that the Environmental Education should not be a content of a particular discipline, but rather addressed in an interdisciplinary way and through crosscutting themes (Gomes, 2014).

As a crosscutting issue, the Environmental Education should be integrated with the various areas of knowledge, focusing mainly on the awakening of consciousness, so that new habits targeted to the sustainable use of natural resources can be transmitted (Souza, Machado, Reis, Santos, & Dias, 2013).

Only 41.2% (n = 28) of the respondents said they were involved largely or completely on discussions and actions related to Environmental Education at school. In addition, 73.5% (n = 50) said they know little or have no knowledge about brazilian environmental laws.

Teachers with little knowledge of Environmental Education may impair good educational practices involving students' everyday situations, and a proper context with reality (Almeida, 2013). Although teachers have stated that practical actions out of the

classroom contribute to the teaching of Environmental Education, most of them are limited to the teaching in the classroom, not experiencing the transdisciplinary environmental knowledge out of it, when it comes to the fauna, the flora and the perception of the city pollution. In addition, 57.4% (n = 39) assumed an indifferent posture as to the sensitization of students to the responsible consumption of paper.

It is essential to develop the student skills and attitudes aimed at the creation of a healthy environment (Santos, Medeiros, Tavares, Oliveira, & Silva, 2016), awakening the individual and collective concern for environmental issues. room activities and field, with projects and activities geared towards increased participation, leading self-confidence, positive attitudes and personal commitment to environmental protection (França & Guimarães, 2014).

The school is one of the most important places to practice Environmental Education (Silva, Oliveira, & Nascimento, 2016), once that young people have opportunities to experience first contacts with the issues related to the environment, and teachers, through projects or everyday examples, can sensitize students to the importance of preserving the environment, thus ensuring the survival of future generations (Freitas, Senna, & Alves, 2012).

Ambivero, Lopes, and Loureiro (2015) state that: The Environmental Education in Brazil, objectified in PNEA, is turned to the human formation, to the complex, critical and problematizing understanding of the social and environmental reality. This means that the central concept of the educational act is no longer the transmission of knowledge, as it per se would be sufficient to generate an "ethical subject" that would behave properly, or the adoption of environmentally friendly behaviors inspired by good practices, as if these would replicate automatically. The core of the educational process is the very educational praxis, the theory-practice indissociabilityin the human activity of transforming the world and of self-transformation.

The teacher is the key mediator in the construction of a more just and democratic society, and one of the favorable ways to lead the Environmental Education for various levels is through his/her actions. The teacher who accepts to work with Environmental Education needs to make education a source of social change, as the Environmental Education is a product of the society and, accordingly, it has the role to minimize the environmental damage in order to establish balance in the society-nature conviviality (Assis & Chaves, 2014).

Conclusion

The assessed measurement scale was validated after the exclusion of five items, being made up of 19 items. The validated scale has high reliability and internal consistency.

Teachers interviewed stated addressing Environmental Education in their classes with satisfactory frequency. However, many of them were not trained to mediate this environmental knowledge.

This scenario suggests that teachers may insert Environmental Education superficially and/or discontinuously, wherein students are not getting the basic environmental knowledge for their critical and reflective thinking. It is emerging the need to include in the Pedagogical Program of the schools of Patos, Paraíba, the training of teachers for Environmental Education teaching.

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