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## The complexity of environmental education: teaching ideas and strategies from teachers

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### Abstract

The research presented tries to understand and analyze the conceptions that the teachers keep from different levels of education (primary, secondary, and higher education), about the paradigm in which are placed in the treatment of Environmental Education (EE), as well as methodological strategies used and / or designed for practice. This work argues with the intention of detecting possible reductionism, determinism and fragmentation, in the conceptions of teachers. To do this quantitative techniques have been combined, by using a questionnaire, with qualitative techniques, through the interview in depth; which has allowed us to know and analyze the current situation of the participating teachers in their conceptions of EE, as well as methodological aspects used in its treatment. For this, it conducted an investigation of descriptive-interpretative type with 58 teaching participants, of different educational levels and they teach different subjects and / or disciplines. The results make visible that there is interest in a reflective view closer to the complex thought in the treatment of EE, however we check reductionism associated with the difficulties of their practice.

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*Keywords:* teacher; environmental education; paradigm; complexity; methodological strategies.

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### 1. Introduction

Modestly, environmental education in our country was proposed as a boost to the participation of the population in the preservation and environmental systems, or what we call natural resources (Romero, R.M., 2014). However, we

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can say that despite that this work has not only achieved the purposes that the deterioration of ecosystems is arrested or reversed, but on the contrary, it seems, that this has reached many alarming levels that they seriously threaten the life not only of species diversity, but also and mainly that of the human species.

In this regard, we believe that one of the major obstacles in the development of environmental education, both in the field of research and professional practice, It is due to a fragmented view of the world, a vision that separates us from the intricate web of interrelationships that constitute the very nature of life, the Earth and the Cosmos (Limón, 2000). This is a reduced vision that leads in most cases to simplify and unify understanding of the world around us and its phenomena.

The environmental issue, is more than an ecological problem, a crisis of thought and understanding, ontology and epistemology with which Western civilization has understood being (existence), the entities and to things; scientific and technological rationality with which has been dominated nature and economized the modern world; relationships and interdependencies between these material and symbolic processes, and natural and technological ones (Leff, 2007). In accordance with Mora (2009), environmental problems are not only problems of development, but basically problems of knowledge and education, that go beyond learning about the environment, and they also have to do with the way of understanding and addressing environmental problems.

From this point of view, we must remember the importance and responsibility that educators and / or teachers to maintain direct contact with children and adolescents (Primary Education, Secondary Education, Bachelor, Higher education) while we have access to all persons aged 6 to 16 years in compulsory education in Spain, as well as higher education.

## 2. Methodology

This research is part of descriptive and interpretative methodology that combines both quantitative and qualitative techniques.

### 2.1. Objective

Know and analyze the conceptions that teachers hold in different educational levels (primary, secondary, and higher education), about the approach or paradigm in which are placed in the treatment of Environmental Education and if they present and design methodological strategies consistent with the paradigm of complexity.

### 2.2. Sample

The total sample of participants were 58 teachers in the province of Seville, specifically 27 men and 31 women, from different educational levels (Primary Education, Secondary Education, Bachelor and Higher Education) aged between 22 and 60 years old. The subjects to be taught are very diverse: Pedagogy and Teaching (university studies), Educational Guidance, Mathematics, Technology, Physical Education, Driver Education, Language, Geography and History, Natural Sciences, Philosophy, Music, and finally, we have had to create another group called "Several Primary" in which are included those participants who teach various subjects in Primary Education.

Table 1. The total sample of participants.

	Pedagogy - Teaching	9
	Educational Guidance	4
Subject taught	Mathematics	6
	Technology	3
	Physical Education	6
	Driver Education	1

	Language	7
	Geography and History	3
	Natural Sciences	8
	Philosophy	1
	Music	2
	Several Primary	8
	Pedagogy - Teaching	9
	Educational Guidance	4
Age	20 ≤ 30	9
	31 ≤ 40	18
	41 ≤ 50	19
	51 ≤ 60	12
Educational Level	Primary	20
	Secondary/ Bachelor	26
	Higher Studies	12
Gender	Men	27
	Women	31

### 2.3. Analysis

Quantitative techniques, we have used as a tool for collecting information a questionnaire consisting of questions that contain different intent. That is why in its formulation it has referred to the possibility of obtaining open answers and rating scale. With open response items it intended that participants respond without having established any kind of option. In the case of the categorized ones was used an attitudes scale Likert type. This questionnaire combined two types of framing questions, being 41 items of Likert scale and 7 open questions, being a total of 48 questions/items.

The main constructs that we have proposed in reference to environmental education are the concepts of: Environmental Education and Methodological Strategies. They are presented in a more concrete way in the specifications table. In this table we develop the five core dimensions of the study, as well as descriptors and indicators. The criteria that determine integration dimensions and indicators are based on previous studies on the subject, Romero (2014), Ruiz, Sánchez, Jaramillo & Tamayo (2005). Teaching thinking in natural science teachers. *Science Teaching*. Extra number. VII Congress; (Zelaya & Campanario, 2001; Rebollo, 1998).

For the analysis of the questionnaires, we made use of the SPSS program that has allowed us to evaluate some statistical data. To do this, we have selected certain items that make up the central categories of research. So that, the selected items, we measured the media, the mode, the median, and the frequency and percentages reflected in graphs and ciclogrames, which has enabled us to present a distribution of values.

As for the qualitative techniques, we have used a semi-structured in depth interview consisting of 12 questions. They have carried out a total of 4 interviews.

Participants are:

- Biologist, Professor of Didactics of the environment (University studies)
- Professor of Art (Secondary Education)
- Professor of Language (Primary Education)
- Professor of Environmental Sciences who is studying the Master Environmental Educator.

For the analysis of the interviews, we conducted a descriptive-interpretive discourse analysis, with the creation of a system of codes and categories and relying on coding techniques and procedures, establishing nodes and / or categories provided by the N-VIVO software for analysis.

Table 2: Table of categories

Categories	Code	Subcategories	Description	Quest numb
Environmental Education	CEA	Conception of Environmental Education	It is about knowing how our interviewees conceive Environmental Education.	1,2
	SEA	Situation of the environmental education	It refers to what our interviewees say about the current situation of the environmental education, as well as those needed changes.	3
Methodological strategies	CDEA	Conception of the didactics in the EE	It refers to what our participants say about methodological strategies more chords to be used in the practice of the EE in the classroom.	4,5
	CP	Conception of Paradigm	It refers to the meaning of paradigm that our interviewees described.	9
Paradigm	CPCC	Conception about the Scientific-classical paradigm	It's knowing the conceptions that our participants keep about the scientist-classical paradigm.	10
	CPC	Conception about the paradigm of complexity	It's knowing the conceptions that our participants keep about the paradigm of complexity.	11

Table 3: SpecificationsTable

Dimensions	Descriptors	Items	Indicators		
			Complex approach	Intermediate approach	Classical-traditional approach
Environmental Education	Conception of Environmental Education	1, 5, 25, 33,	Conceiving the importance of environmental education from a holistic, complex and multidimensional approach.	Conceiving the importance of environmental education from a one-dimensional approach (education in the natural environment)	Conceiving Environmental Education from a reductionist, mechanical and simplistic approach.
	Situation of the environmental education	2, 3, 4, 12, 16, 22, 23, 30, 31	Knowing the situation in which environmental education is and contemplate necessary changes to be made around it from a complex and holistic approach.	Knowing in a reduced and fragmented way the current situation of environmental education as well as those necessary changes.	Knowing little or nothing the situation of environmental education and the necessary changes.
Methodological strategies	Conception of the didactics in the EE	6, 7, 8, 10, 11, 13, 15, 26, 28, 29,	Know and use those more consistent methodological strategies to achieve quality EE.	Show little interest in learning about and use those more consistent methodological strategies to achieve quality in EE.	Lack of interest, and even refusal to know and employ those methodological strategies more chords to achieve a quality EE.

			Complex and innovative approach of teaching.		Traditional and classic learning approach.
	Conception about the Scientific-classical paradigm	20, 32, 39	Know and identify the reductionism and maquinismo that comes from classical scientific paradigm.	Maintaining a neutral and conciliatory stance with classic scientific paradigm.	Maintain a scientific perspective of empirical-inductive and cumulative nature. Relying on the Cartesian paradigm
Paradigm	Conception about the paradigm of complexity	9, 14, 18, 19, 24, 34, 35,	Knowing the main ideas of the paradigm of complexity and identify the contributions that provides Environmental Education. Dialectic perspective, interactive, systemic and globalization. Predominant indiciario model.	Know certain general aspects of the paradigm of complexity	Maintain a negative conception and/or rejection of the paradigm of complexity.

**3. Results**

In relation to the participant teachers conceptions maintains about Environmental Education, we find the following:

- There is a large majority that considers the social sphere is not always included, or at least not provided the importance of this, in the treatment of EE in the various disciplines or fields of study.. The approach from which the EE is working in classrooms, depends largely on the way in which the teacher teaches and the department in which is included conceive it.
- We also found that a majority of respondents believe that the EE should be a mainstay in the curricular programming of the entire education system. However, it also should be noted that half of our respondents (scores 4 + 5) consider that there is still a predominance of fragmentation, simplification and reductionism in curriculum planning EE.
  - We emphasize the clear tendency to consider the environmental problems of our time can be understood in isolation, as well as the inclination to consider that professionals in EE we specialize in some of the environmental problems to achieve greater management of content and teaching, considerations somewhat opposite to those who from this study have been developing.
  - There is a diversity of conceptions of the EE and make reference to the possibility that these vary in function of the previous studies and/or the field coming. However, we note that he stays on certain occasions a conception of the EE directly related to protection and conservation of nature.
  - The majority of our participants considered that in curriculum planning the EE is continues to maintain the classical paradigm.

In relation to the conceptions that participating teachers maintained on methodological strategies in the practice of environmental education, folowing:

- There is a widespread tendency to consider that in the classroom is continued understanding student assessment, as the result of assimilated knowledge given by the teacher and textbook.
- Another of the highlights is the tendency to consider by the participating teachers that "what to teach" is very important, but most important is "how to teach". However, we check in the discourse of our respondents who continues to use the textbook as a primary tool in school educational practice and evaluation.

- We also found a tendency to consider that working an environmental problem in the classroom must separate the different causes or phenomena that cause, believing that the study of each separately allows us to understand it better.
- We note that there is an inclination to consider that resistance to change in the educational treatment of EE, which preserves old models, tends to keep its ineffectiveness still evident even. In this sense, they appear in the statements of the participants, the concepts of fear and ignorance as reasons why not carried out the change we need.
- However, we can see that certain participants if they maintain closer involvement by that change, introducing new strategies and resources in the treatment of EE, as in the case of the dramatization.
- On the other hand, stands the little reflection which is made, both in the classroom along with students, as in the groups of professionals concerning treatment of the EE: few forums, not sharing what I do and learn.
- We put on the table, the importance of keeping in mind that there is no prescription in the treatment of EE and that is what we must adapt to the context and to the group. In this sense, refers to the importance of generating in the classroom, curiosity, dialogue, collaboration and teamwork environments.
- Finally, we highlight the low involvement of certain participating teachers working environmental themes in their subjects, since they refer to the little relationship between the environmental content with your stuff to teach, relegating educational-environmental work above all in elementary school to those matters to which "supposedly" belong, as it is Science.

At last, in an attempt to know the interest and involvement that participating teachers and the educational institutions they belong to, maintain about environmental education, we find the following:

- Teachers participating there is no strong involvement of the institutions in which it is active with the EE.
- The participating teachers are not interested in keeping updated about publications and research regarding the EE.

#### 4. Conclusions

According to the results it is evident that it is necessary to involve teachers in the development of EE, overcoming obstacles detected and favoring immersion in a culture of complexity, allowing an understanding of the EE from holistic and systemic looks.

This necessary reflection on the conceptions could demonstrate the importance of acquiring a complex vision and help improve the foundation and teaching of environmental education, this opens new doors to create new future research studies in the field of EE.

However, although the possession by teachers of a philosophical view and sociologically richer and reflective, closer to complex thinking is much needed, should not lose sight that this does not guarantee that students are to gain a better understanding of environmental education, similar to the known fact that knowledge of the subject teachers to teach, although very importantly, ensures not at all a good learning of it by students (Acevedo y Acevedo, 2012). In all this effect many and complex factors undoubtedly may lose much of the coherence of epistemological discourse when passing the theoretical plane (which is said to do) the development of classroom practice (what it really is done).

In this sense, we can show that a significant number of teachers involved remain concepts with some approach to complex perspectives; however, in many cases, we find certain contradictions between those responses that refer to more abstract aspects of EE, those others that are more explicit and related to the activity in the classroom. We agree, then, with the results of different studies (Solís, R., Martín del Pozo, R., Rivero, G. y Porlán, A., 2013); (García, J.E. y Cano, M.I., 2006); (Rodríguez, F. 2011) and (Solís, C. y Valderrama, R., 2015), when it becomes clear that there is no clear relationship between the conceptions of teachers and those about teaching and learning from it. Some researchers have observed that the alleged correspondence is blurred even more about teaching practice in the classroom.

In this regard, following García, J.E. y Cano, M.I. (2006), It is often given the paradox that there are educators who reject the positivist world view in his understanding of the treatment of environmental problems (they are located in the complex perspective), but they are positivists regarding the learning model used, whereas they adopt psychoeducational models with associative style. Therefore, in our research we check that the conceptual issue of EE seems to be associated with the difficulties of their practice.

In line with this, we highlight that our research we affirmed that some authors as Barrón, A.; Navarrete, A. y Ferrer-Balas, D. (2010) they point out, exposing that the obstacles that teachers continue with a low culture of EE include the absence of collective reflection on these issues and the treatment of the problem of biased way and reductionist (García, J.E., 2004).

Thus, we can see that we continue to have present in many of our actions as educators, clear reflections of the model of simplistic thinking prevailing in our environment. Hence the importance of including the budgets of the paradigm of complexity in EE. It is fundamental piece to understand what are the keys to our decisions and transform our ideas and behaviours in the field of environmental education, a closer approach to the complex worldview perspective.

The insertion of the complexity in the treatment of EE requires modification of content and methods, which affect all subjects across, and include concepts, procedures and attitudes, open methodologies, participative and problematizing (Solís y Valderrama-Hernández, 2015). It requires a new educational language and a different learning, requiring cooperation from all disciplines, teamwork and teacher training.

In short, betting on reformulate environmental education from the paradigm of complexity involves rethinking some forms of understanding. We need to define an open educational model, leaving aside any reductionism and therefore is in continuous dialogue with the environment.

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