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Degree of Knowledge on Ecological Consciousness Among Secondary Education Teachers in the Northeast of Spain

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Abstract

Since the early sixties, national and international organizations have increased their efforts to provide better environmental education and ecological consciousness, although despite these efforts, a lack of attitudes and concepts was detected among students from secondary education of Spain. This lack of attitudes among students may be due to deficient concepts passed on from their teachers. Within this framework, the objective of this study is to evaluate the ecological consciousness level possessed by the teachers. The results of this study show that over 97% of the teachers possess enough knowledge on ecological consciousness concepts related to the syllabus from secondary education. It is essential to facilitate the evolution of society and its future generations, those on which the future and the development of nature and the world depend.

Keywords: Ecological consciousness; Secondary education; Degree of knowledge of teachers

1. Introduction

Environmental (or ecological) consciousness is addressed in terms of the level of endorsement for the so-called new environmental (or ecological) paradigm. This paradigm associates environmentalism to a general eco-centric worldview that emphasizes humanity's need to establish a balance with nature, the existence of limits to the growth of human societies and questions humanity's right to rule over the rest of nature [1]. Ecological consciousness is not a recent matter, as since the early sixties, national and international organizations such as the United Nations increased their efforts to provide better environmental education and ecological consciousness by promoting different programs, conferences and seminars [2]. In this era, different books and reports were published establishing a turning point for ecological consciousness. These books and reports are "Silent spring" [3], "The limits to grow" [4] "The Closing Circle: Nature, Man, and Technology" [5] or "The small is beautiful" [6]. In Spain, the development of conferences and programs related to environmental education started in the seventies. The Spanish history of environmental education is summarized in the "Libro blanco de la educación ambiental en España" published in 1999 [7]. The efforts made by the Spanish government were not in vain, since the Spanish population is aware of the need to protect the environment and that it should be above economic development in terms of priorities. Furthermore, consumer habits of the Spanish population can be defined as pro-ecological [8]. Despite these efforts, a lack of attitudes and concepts was detected in students from secondary education in the northeast of Spain. This lack of attitudes among students may be due to deficient concepts passed on by their teachers.

1.1 Theoretical framework

Environmental education and different studies were analyzed in order to establish a theoretical framework. These studies focused on the teacher and their work in the classroom or their influence on their students' knowledge. To establish the state of the matter (bibliographic research), we found that previous research related to the teachers looked into their initial training [9], the beliefs and deficiencies of the primary school teachers as a critical point for the implementation in the curriculum [10] or the evolution on the teacher's practice and formation in a long-term study [11]. There are studies where the author analyzed the teaching model and suggested a proposal for environmental education [12], as well as other works where, different strategies for environmental education were gathered [13]. The present study analyzes the concepts related to the environmental education and ecological consciousness of the teachers in the secondary education in Spain. The level was measured according to the concepts defined for the students in the formal education, which are in turn laid out by the central government. The legislation for the work presented is the "Ley Orgánica de Educación 2/2006" [14], a law which indicates the capacities that students have to acquire during their formal education. These capacities for secondary education are defined and collected in the "Real Decreto" 1636/2006 [15] at a national level and by the DOCV 112/2007 [16] at a regional level. Within the defined framework, the goal of the present study is to assess the ecological consciousness level of biology and geology teachers in secondary schools in the northeast of Spain - in the province of Castellón, which is divided into eight districts (Figure 1).

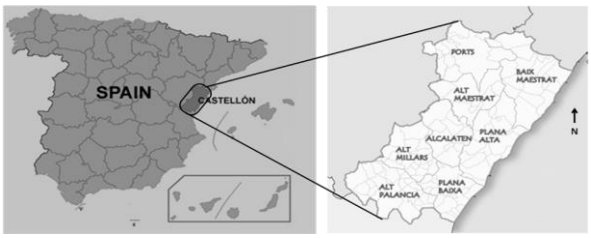

Figure 1: Geographical location and districts of the province of Castellón (North-eastern Spain).

2. Objectives

The aim of this study is to assess the ecological consciousness level of biology and geology teachers in secondary schools in the northeast of Spain, and to investigate whether the level of ecological consciousness correlates to different parameters such as gender, the type of secondary school, the teachers' academic level and when they studied their degree. This evaluation seeks to determine if the teachers' knowledge is enough to teach the concepts and knowledge related to this topic in the subject of biology and geology.

3. Methodology

The methodology used in this study is related to science education from the point of view of the social sciences. These methodologies are mainly experimental and statistics. In this study, first of all, an extended bibliographical research was carried out in order to establish the theoretical framework. Secondly, the questionnaire to evaluate the ecological concepts was created. When the questionnaire was completed, the data was collected in order to process the results and analyze them to extract the study's conclusions.

3.1 Questionnaire

In order to collect the data for a research study, one of the most popular methods is to collect answers from a questionnaire. Its elaboration must be reliable with the purpose to obtain, in a systematic and objective way, all the information from the studied population about the variables under investigation [17]. Different bibliographic resources-like scientific papers, books and reports-were analyzed to establish a real framework of the treatment of environmental concepts in high schools in order to develop the questionnaire as closely as possible to the reality of the high schools. Data for this research was obtained from a questionnaire of the teacher population in the province of Castellón (Spain). There were 69 valid questionnaire answers obtained from the 82 high schools there are in the province of Castellón. The centers surveyed are random and independent to maintain the objectivity of the methodology. Data was collected in the academic year 2012. In order to preserve their identity, both the questionnaire and the data collected were dealt with anonymously.

First of all, the questionnaire was tested by experts to detect potential comprehension errors or questions that were invalid for the object of the study. The questionnaire consisted on multi-choice and open-ended questions-where the teachers can elaborate on their knowledge briefly-, with the purpose to extract as much information as possible about the theoretical knowledge level on the topic of ecological consciousness. This type of questionnaire is the

most objective way to obtain the information because personal experiences do not influence the analysis of the data. The information collected through the eighteen questions which make up the questionnaire, allows us to rank the teachers according to the results they obtained. These questions were also correlated with different parameters such as gender-masculine or feminine-, the type of secondary school where the teacher came from-state or non-state high school-, their academic level-teachers with a PhD or without- and the year when they studied their degree.

In order to preserve the objectivity, impartiality, and coherence of the data, a correct systematization is needed. For this reason, a correct elaboration and correction of the questionnaire is the first step. In addition, teachers write their answers in standardized answer sheets which are identical for all members of the studied population, thus reaching an optimal standardization and systematization of the data collected. Once the data is collected, the next stage is to proceed to analyze it. This analysis is a statistical approach under the point of view of the social sciences [18]. Several programs for statistical analysis are available for the different areas. The standardization of statistical methods has led to the appearance of different statistical packages. In this study two of them were used: Statistical Package for Social Sciences (SPSS) and the R programming language. The reasons for using various programs are the different options and characteristics of each of them. SPSS is a broad, user-friendly system and is useful for descriptive statistics, but when an exhaustive statistical analysis is needed, it has limitations. The R programming language offers a wide range of statistical and graphics tools and, because of it being a programming language, the user can define their own functions [19]; R is more robust than SPSS and offers more guarantees in the hypothesis contrast.

4. Results and Conclusion

The results of this study show that over 97% of the teachers possess enough knowledge on ecological consciousness concepts related to the syllabus from secondary education. This level is not related to the gender, the type of secondary school where teachers come from their level of education or the year when they studied their degree. In conclusion, this is a first approach to the reasons why we must evaluate teachers from the secondary school. It is essential to evaluate the ecological consciousness level of teachers in the high school, as well as facilitating the evolution of society and its future generations, those on which the future and the development of nature and the world depend.

4.1 Statistics

Statistics is defined by the Medical Subject Headings (MeSH) thesaurus as the science and art of collecting, summarizing, and analyzing data that is subject to random variation. The two broad categories of summarizing and analyzing data are referred to as descriptive and inferential statistics [20]. Descriptive statistics are used to estimate characteristics of the population in question, while inferential statistics are used on a sample to obtain conclusions based on descriptive statistics of the sample [21]. Both types of statistics were used as well as different statistical programs, as explained in the previous section.

4.2 Descriptive statistics

To describe the studied population, the secondary education teachers of the province of Castellón (Spain), the SPSS program version 21.0 was used. The province of Castellón, is divided into eight districts, within which a total 69 teachers were surveyed (Table 1). They can be divided by different parameters: type of secondary school where the teacher comes from-state or non-state-(Table 2), by academic level-teachers with a PhD or not-(Table 3), by gender-masculine or feminine- (Table 4) or the year they studied their degree (Table 5).

Districts	**Number of teachers**
Els ports*	3
Alcalatén*	11
Alt millars*	2
Alt palancia*	2
Alt maestrat*	3
Baix maestrat**	9
Plana alta**	15
Plana baixa**	24
Total	69

*inland district **coastal district

Table 1: Number of teachers surveyed in each district.

Type of secondary school	**Teachers surveyed (Pct*)**
State	33%
Non-state	67%
Total	100%

*Pct means percentage

Table 2: Teachers surveyed by the type of secondary school.

Academic level	**Teachers surveyed (Pct*)**
PhD	16%
Non-PhD	84%
Total	100%

*Pct means percentage

Table 3: Teachers surveyed sorted by the academic level.

Gender	Teachers surveyed (Pct*)
Masculine	42%
Feminine	58%
Total	100%

*Pct means percentage

Table 4: Teachers surveyed sorted by gender (masculine or feminine).

Year	Teachers surveyed (Pct*)
Before 1975	14%
1975 - 1995	64%
1995 - 2005	9%
No answer	14%
Total	100%

*Pct means percentage

Table 5: Teachers surveyed sorted by the year they studied their degree.

As can be observed, the sample from the studied population collects all the characteristics from the population, which denotes that the sample is representative. Because of these reasons, the present work represents the beginning for statistical, descriptive or inferential analyses of other sectors of the population with similar characteristics.

4.3 Hypothesis contrasts: correlation with parameters

To achieve the objectives proposed, different hypothesis contrasts, were designed and tested using the R programming language. Before testing the contrasts, the sample was analyzed in order to ensure that it met the conditions for the applicability required for the contrast. The means they were compared using independent t-tests and Analysis of Variance -ANOVA- (indicated on the contrast specifically) and were statistically significant when p-value <0.05. [22-23]. With the purpose of rating and correlating the teachers according to their ecological consciousness level, the proportion of the total questions answered correctly was quantified and studied. The proportion was between 0 to 10, where 0 indicates that the teachers didn't answer correctly to any questions and 10 indicates that the teacher answered all questions correctly. This proportion was used because it is the same that the teachers and the Spanish national education system use to rate and qualify the students, according to which 0 indicates that the student didn't answer any questions correctly, 5 indicates that the student answered correctly half of the questions, therefore passing the course or exam, and 10 indicates that the student answered correctly all the questions. Regarding the general qualifications obtained by the teachers surveyed, only 2.90% of them failed with the questions proposed in the questionnaire, while 97.10% of all teachers passed (Table 6).

Qualifications	Teachers surveyed (Pct*)
Less than 5	2.9%
Between 5 and 7	26.09%
Between 7 and 9	65.22%
Greater than 9	5.80%
Total	100%

*Pct means percentage

Table 6: Qualifications obtained by the teachers surveyed sorted by their qualifications.

Regarding the correlation with the type of secondary school (state or non-state), the contrast proposed answers this question: does the proportion of questions answered correctly by the teachers vary depending on the type of school? In coherence with the results (Table 7), we cannot affirm that the proportion of questions answered correctly by the teachers is statistically different regarding the type of secondary school they teach at. This means that the ecological consciousness level of teachers does not significantly depend on the secondary school where they come from. If we observe the mean of both groups (Table 7), we can see that the mean proportion is greater in state than in non-state secondary schools in this specific situation. What we were expecting was to have a difference, because in Spain, teachers for state schools (for all education levels) have a civil service entrance examination where they have to test their knowledge, which is not the case in non-state schools. This is a good result because it shows that the teachers of both types of secondary schools have the same ecological consciousness level.

Hypothesis contrast			
H_0: $\mu_1 = \mu_2$ H_a: $\mu_1 \neq \mu_2$			
Mean of proportion: type of secondary school		P-value	Greater/less
State	Non-state		
7.46	7.39	0.473	$\geq$

Table 7: Results for the bilateral hypothesis contrast. It indicates the proportion of questions answered by the teachers from the different types of secondary schools (state or non-state), the p-value of the t-tests and if this is greater or less than the p-value established.

Regarding the correlation with the gender of the teacher (masculine or feminine), the contrast proposed answered this question: is the proportion of question answered correctly by the teachers different depending on the gender of the teachers? Based on the results (Table 8), we cannot affirm that the proportion of questions answered correctly by the teachers is statistically different depending on the gender of the teachers. This means that the ecological consciousness level of the teachers does not significantly depend on the gender. If we observe the mean of both groups (Table 8), we can see that the mean proportion is greater in men than in women in this specific situation.

Hypothesis contrast			
H_0: $\mu_1 = \mu_2$ H_a: $\mu_1 \neq \mu_2$			
Mean of proportion: gender		P-value	Greater/less
Masculine	Feminine		
7.72	7.24	0.715	≥

Table 8: Results for the bilateral hypothesis contrast. It indicates the proportion of questions answered correctly by masculine and feminine teachers, the p-value of the t-tests and if this is greater or less than the p-value established.

Regarding the correlation with the academic level of the teacher (teacher with or without a PhD), the contrast proposed answered this question: is the proportion of question answered correctly by the teachers different depending on the academic level of the teachers? Based on the results (Table 10), we cannot affirm that the proportion of questions answered correctly by the teachers is statistically different depending on their academic level. This means that the ecological consciousness level of the teachers does not significantly depend on their academic level. If we observe the mean of both groups (Table 9), we can see that the mean proportion is greater in teachers with a PhD than for those without one in this specific situation.

Hypothesis contrast			
H_0: $\mu_1 = \mu_2$ H_a: $\mu_1 \neq \mu_2$			
Mean of proportion: Academic level		P-value	Greater/less
PhD	No PhD		
7.73	7.39	0.246	≥

Table 9: Results for the bilateral hypothesis contrast. It indicates the proportion of questions answered by the teachers, according their academic level (with a PhD or without), the p-value of the t-tests and if this is greater or less than the p-value established.

Regarding the correlation with the year in which the teachers carried out their degree, the contrast proposed answers this question: is the proportion of question answered correctly by the teachers different depending on the year they studied their degree? For this contrast, an ANOVA was performed. Based on the results (Table 10), we cannot affirm that the proportion of questions answered correctly by the teachers is statistically different depending on the year they studied their degree. This means that the ecological consciousness level of the teachers does not significantly depend on the year they studied their degree. But if we observe the mean of the three groups (Table 10), we can see that the greatest mean was obtained by teachers who studied before 1975, the second best is for teachers who studied from 1975 to 1995 and the third best mean is for the teachers that studied from 1995 to 2005. If

we observe the means, it seems that experience helps to consolidate the theoretical concepts that teachers learn during their degrees, but despite this, there are no statistically significant differences to affirm this hypothesis.

Hypothesis contrast				
H_0: $\mu_1 = \mu_2 = \mu_3$ H_a: $\mu_1 \neq \mu_2 \neq \mu_3$				
Mean of proportion: Year of studies			P-value	Greater/less
Before 1975	From 1975-1995	From 1995 to 2005		
7.89	7.32	6.76	0.225	≥

Table 10: Results for the bilateral hypothesis contrast. It indicates the proportion of questions answered by the teachers, according to the year they studied their degree, the p-value of the t-tests and if this is greater or less than the p-value established.

5. Conclusion

The results of this study demonstrate that over 97% of the teachers possess enough knowledge on ecological consciousness concepts related to the syllabus from secondary education. This level is not related to their gender, the type of secondary school where the teachers work at-state or non-state schools-, their level of education-with or without a PhD- or the year when they studied their degree, which correlates to their age. Because of these reasons, we can eliminate false preconceptions about the professionalism of teachers based on their gender, the type of secondary school where they teach, their level of education or their age. In conclusion, this is a first approach to the reasoning as to why to evaluate the teachers from secondary schools. It is essential to evaluate the ecological consciousness level from the teachers in high schools, and it is also essential to facilitate the evolution of society and its future generations, those on which the future and the development of nature and the world depends.

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