International Journal of Environmental & Science Education
(2014), *9*, 329-345

What Can Influence Students' Environmental Attitudes? Results from a Study of 15-year-old Students in France

Florence Le Hebel
Université Lyon1, UMR ICAR Ens Lyon, Lyon 2, CNRS

Pascale Montpied
CNRS, UMR ICAR Ens Lyon, Lyon 2, CNRS

Valérie Fontanieu
Ifé, Ens Lyon

Received 6 July 2013; Accepted 8 January 2014

Doi: 10.12973/ijese.2014.218a

The purpose of this study is to investigate the environmental attitudes (EA) in the population of 15-year-old French students and, to check if the French student population presents similar EA categorization as described in the different models in the literature (e.g. the Model of Ecological Values, Wiseman & Bogner 2003). The second aim of this study is to identify the different factors influencing students' EA. We analyse the results of the questionnaire-based Relevance of Science Education Project carried out in France in 2008 as a part of a wider international comparative study ROSE (Relevance Of Science Education). The hierarchical ascendant classification of data from 2124 French students led to three main classes reflecting three different environmental attitudes showing a high resonance with the 2-MEV scale (Wiseman & Bogner 2003). The Model of Ecological Values (2-MEV) is defined with two orthogonal dimensions, Preservation and Utilization. Ecological Values are determined according to an individual's position on two orthogonal dimensions, one dimension reflecting conservation and protection of the environment (Preservation) and another dimension reflecting the utilization of natural resources (Utilization). Our results show links between students environmental attitudes and students' level of interest in learning about specific environmental topics, their practice of extra-curricular activities linked to nature and students' value priorities in different dimensions of their future work. We discuss the implications of these results for the teaching of environmental issues, and for instance, we argue that EA concept could be explained to fifteen-year-old students to encourage them to take into account the diversity of views towards the environment of others, and to position themselves in this diversity of attitudes. They could be aware that for instance, individuals can support

environmental issues for different reasons, and consequently may respond to different appeals.

Key words: environmental attitudes, extra-curricular activities, value priorities, large-scale survey, interests in science topics

Introduction

Developing students' knowledge and awareness of environmental issues has never been such an important goal of science education as now. But this teaching must be based on knowledge of students' attitudes to the issue of environmental protection (Schreiner & Sjoberg, 2005). Diversity in human traditions, religious and spiritual approaches, and philosophical directions may lead to different views of nature and the environment, and consequently to diverse motivation and attitudes towards the environment (Cooper & Palmer, 1998). Only after understanding the relationships between the attitudes that people have towards the environment and the factors that influence these attitudes, will we be able to propose a way of teaching that could have a chance of improving the public's attitudes towards nature. The main purpose of this study is to investigate the environmental attitudes in the population of 15-year-old French students and the possible links between students' attitudes towards the environment and other factors, such as students' interest in learning different science-related topics, their practice of specific extra-curricular activities, and their priorities in different dimensions of their future job. In France, environment education is found in the curriculum from primary to secondary school and is cross-disciplinary.

Our study takes place within an international survey project ROSE "Relevance of Science Education" developed by S. Sjoberg (http://www.ils.uio.no/english/rose). Although the ROSE questionnaire is not specifically designed to measure Environmental Attitudes, this questionnaire has the rare advantage of gathering information about students' opinions of school science and science-related issues in general, including environmental issues, and at the same time, several other factors that have a bearing on their attitudes to science and technology and their motivation to learn science and technology. We led this international survey in France.

Review of Literature

First, we propose a brief review of Environmental Attitudes (EA) assessments in the literature. Our aim is to check if the French student population presents similar EA categorization as described in the different models in the literature. In the second part, we present results from previous studies about factors influencing EA, as this is the aim of this present work.

Environmental Attitudes

EA have been defined as "the collection of beliefs, affect, and behavioural intentions a person holds regarding environmentally related activities or issues" (Schultz et al., 2004). Although, this three-component model remains the traditional view of attitude structure, new theoretical approaches prefer to conceptualise attitudes as evaluative tendencies that can both be inferred from and have an influence on beliefs, affect, and behaviour (Milfont & Duckitt, 2010). There are hundreds of EA (and the related ideas of concern, beliefs, worldviews, values, perception, awareness, etc.) measures available based on different conceptual and theoretical frameworks (see review in Milfont & Duckitt, 2010). The first psychometrically and conceptually sophisticated instrument to assess pro-environmental worldviews is the New Ecological Paradigm (NEP) scale developed and revised by Dunlap et al. (1978, 2000). The NEP scale proposes EA view as an unidimensional construct ranging from the unconcerned about the environment at the low end to the concerned at the high end. In this view, an individual can either

have a pro-environmental or anti-environmental perspective but not both. Thompson and Barton (1994) have categorized EA as rooted either in a concern for Humans (Anthropocentrism) or living things (Ecocentrism). In another perspective, Schultz (2001) proposed three correlated factors of egoistic (concern for the self), altruistic (other people), and biospheric concerns. Wiseman and Bogner (2003) pointed out a problem inherent in the common use of environmental perception and attitude instrument measuring first-order factors only. This led them to the development of a Model of Ecological Values (2-MEV) with two orthogonal dimensions, Preservation and Utilization. Ecological Values are determined according to an individual's position on two orthogonal dimensions, one dimension reflecting conservation and protection of the environment (Preservation) and another dimension reflecting the utilization of natural resources (Utilization). Each of these two higher-order factors consists of several primary factors; Intent of Support, Care with Resources, and Enjoyment of Nature combine under the higher-order factor of Preservation, while Altering Nature and Human Dominance combine the higher-order factors of Utilization (Bogner & Wiseman, 1999). This 2-MEV allows individuals to have a high score on Preservation, indicating a strong desire to protect environment, but at the same time believe that the primary purpose of the environment is to benefit Humans thus giving a low score on Utilization. Johnson and Manoli (2011) propose a Revised 2-MEV scale for use with 9-12-year-old children.However, the dimensionality of environmental attitudes and the nature of the dimensions are still being discussed (e.g. Munoz et al., 2009).

Factors Influencing Environmental Attitudes

Some theoretical approaches try to explain the origins of individual as well as cross-national differences in environmental attitudes (see review in Franzen & Meyer, 2010), but there is still, for instance, an unresolved debate in environmental sociology as to how a nation's wealth as well as individual prosperity is related to environmental concern. Some research focuses on sociodemographic effects such as age and gender. Empirical studies find that women display higher environmental concern than men even after controlling for their income or educational background (e.g. Zelezny et al., 2000).

Many previous studies focus on the development of environmentally sensitive attitudes in youth, and on the effectiveness of various experiences, media, and programmes in developing these attitudes (e.g. Eagles & Demare, 1999; Tikka, Kuitunen & Tynys, 2000; Bogner, 2000).
In their study of 6th-grade students, Eagles & Demare (1999) find that positive attitudes towards the environment correlate with talking about the environment at home, watching nature films and reading about the environment. Tikka, Kuitunen and Tynys (2000) find that students who feel concerned about environmental issues participate in many nature-related activities. Other studies as for instance Palmer et al. (1998), Chawla (1998), Korhonen and Lappalainen (2004), indicate that positive experiences with nature in childhood are amongst the most significant life experiences in the formation of EA. Studies in environmental education point out that teaching in outdoor settings as natural areas for instance develops pupils environment awareness and has a positive influence on pupils' EA (Bogner 1998, 2000, Bogner & Wiseman, 2004; see for a review, Erdogan, Usak, & Bahar, 2013).

Some studies investigate the possible influence of values or beliefs (see review in Kasser, 2011). Neither membership of any given religious denomination, nor the intensity of religious participation seem to be linked to environmental concern. Among values, altruism is a possible candidate for the association with concern for the environment (Stern & Dietz, 1994). In their study obtained from university students in 14 countries, Schultz and Zelezny (1999) try to make links between environmental attitudes and value priorities from Schwartz's model of universal human values (1994), consisting of 10 human values types (Self-Direction, Stimulation, Hedonism, Achievement, Power, Security, Tradition, Conformity, Benevolence, Universalism) ordered along two major axes: openness to change vs. conservation and self-enhancement vs. self-transition. Results show that ecocentric attitudes (corresponding to strong Preservation and

weak Utilization in the 2-MEV) were significantly related to universalism (positively) and power (negatively).

Links between school science and EA have already been found in previous research (e.g. Tikka et al., 2000; Karpiack & Baril, 2008), showing for instance that students who chose biology majors evidenced higher environmental concern. In their analysis of PISA science 2006 data, Boeve-de-Pauw and Van Petegem (2010) show correlation between students performances in science and students EA. Our first aim is to find out if French students' responses from a representative sample of 15-year-old students can show a similar categorisation of EA as described in one of the different models in the literature presented above. In our second part, we investigate if there is any relation between possible categories of students' EA and:

- students' practice of specific extra-curricular activities,
- students' degree of interest in learning environment-related topics
- students' value priorities in different dimensions of the future work they would like to do.

Methodology

The Questionnaire

As mentioned above, we used in this study the questionnaire ROSE (downloadable from http://www.ils.uio.no/english/rose) consisting of 250 items, most of which are divided into seven item groups: "my out-of-school experiences", "what I want to learn about", "my future job", "me and the environment", "my science classes", "my opinions about science and technology" and "myself as a scientist". For the French version, we added 43 background questions concerning home as well as questions concerning attitudes about taught sciences (mainly derived from the OECD Programme for Student Assessment PISA questionnaire) "me and my strategy for learning Sciences", "me and my family about technologies and sciences", "me and my confidence in my work in sciences". The questionnaire mostly consists of closed questions with a five-point Likert scale, including "no-opinion" modality. In this article, we focused mainly on students' answers to items about the environment. According to the designers of ROSE questionnaire (Schreiner, 2006), the development of most of the items (item 1 to item 14) in the section "Me and my environment" (consisting of 18 items) is inspired by literature on alienation, powerlessness and meaninglessness (e.g. Seeman, 1972) and measurement scales reviewed in Measures of Social Psychological Attitudes (Robinson et al., 1991). The last four items (item 15 to item 18) are related to quasi-religious views on nature and whether protection of nature is a goal in itself. These items are adapted from an international survey on values and environment (Skjak & Boyum, 1993). The authors (Schreiner, 2006) argue that the responses to the items will give information about some cultural values of the students, as well as about their empowerment for environmental action.

The Sample

The ROSE target population in France was the cohort of 15-year-old French pupils. In order to obtain a sample representative of the disparities in French schools, the French Ministry of Education randomly chose 126 different schools in the data base, taking into account different criteria such as secondary school /college (as repeating a year is common in France) and vocational schools. Nine categories of schools were distinguished according to the criteria described above, the types of school and their characteristics (private/public, Educational Priority area or not). First, schools were randomly chosen from each category of schools, and a class was selected in each school. In order to respect the part of each group in the whole population, a weight was attributed to each respondent according to two criteria:

- the weight of the category of schools including the students' school.
- the number of students' answers from the class to which the student belongs compared to the whole number of students at the same level in the school.

All the schools did the questionnaire on line. The data were collected in 2008 on a server using the Modalisa software and we obtained 2124 completed questionnaires (104 schools). In our study, 51.7% of answers are from girls, 48.3% from boys. The average age of this final student sample is 14.8 years (SD =0.89).

The Statistical Procedure: Multiple Factorial Analysis (MFA) and Hierarchical Ascendant Classification

Students were invited to indicate their degree of agreement using a five-point Likert-type scale (Agree, low agree, low disagree, disagree, no opinion) to 18 statements about environmental problems (section D of the ROSE questionnaire). We then study how the students having particular orientations about environmental problems, react to questions about their interest in learning about environment related topics within the section "What I want to learn about", about their out-of school activity related to nature or environment within the section "My out-of-school" activities and about their value priorities in different dimensions of their future work within the section "My future job".

In our study of French students' environmental attitudes , due to the high number of modalities to project, according to Camiz and Pagès (2006) method, we first proceeded to a multiple factorial analysis (MFA) using the SPAD software (http://eng.spad.eu). MFA permits us to consider simultaneously initial qualitative data and quantitatively coded data. For the quantitative coding, we applied respectively the coefficients 1, 2, 3, 4 and 2.5 to the modalities "Low disagree", "disagree", "Low agree", "agree" and "no opinion". Then, we proceeded to a hierarchical ascendant classification from factorial axes obtained with MFA on two groups of data: original qualitative data and their coding in quantitative data.

The hierarchical ascendant classification leads to a partitioning of individuals in different classes. To consider if a modality of each item is or is not a characteristic feature for a specific class, the SPAD software proposed a statistical significance test of comparison of proportions. We consider all results statistically significant when the p-value ≤ 0.001.

In a ROSE questionnaire section, students were invited to indicate what they "want to learn about", by responding to a series of 108 diverse statements. Again, responses were made using a five-point Likert-type scale ranging, in this case, from "not interested" to "very interested". Among the 108 statements, several ones (11) relate to environmental topics. For the 11 environment-related topics statements on which students indicate their learning interest, we regroup the responses at the two poles of the Likert scale and consider in each class determined above the number of individuals stating either their willingness or unwillingness to learn about these 11 selected environment-related topics. We explore the possible links between environmental attitudes found in the French student population and students' responses to items concerning their interest in learning different environment-related topics, by using SPAD software and considering all results statistically significant when the p-value ≤ 0.01. We use the same analysis for the 16 nature-related activities statements selected among the 61 statements in the section "my out-of-school activities". In this section, we decide to preserve the poles "never" and "often". We proceed similarly in another section of the Rose questionnaire, where students were invited to indicate "how important are the following issues for their potential future occupation or job" by answering a series of 26 statements, each with a five-point Likert scale from "Not important" to "Very important". We select the 14 items meant to describe students' value priorities (Schwartz, 1994) in different dimensions of their future work and again, we consider only statistically significant results (the p-value ≤ 0.01).

Results

EA Categorisation of French Students

We proceed to a hierarchical ascendant classification using the responses to the 18 statements about environmental problems. It led to four main classes. In this paper, we first focus on the three main classes. In Table 1, for the 18 statements relating to "Me and the environmental challenges", we reported modalities (Low disagree, Disagree, Low agree, Agree, No opinion) characterising the three main classes 1, 2 and 3. We considered that a modality was a characteristic feature for a class when the p-value (reported in bold in Table 1) < 0,001.

Individuals in class 1 (23.8%) preferentially chose modalities reflecting lack of concern for environmental issues and a general belief that problems in this area have been exaggerated (statements 3, 8 and 10). Most of the students in class 1 indicate a low degree of support for items describing a personal involvement and an intent of support (statements 1, 5 and 9). They chose modalities indicating a general feeling that they can not influence environmental protection (statements 6 and 12) and that somebody else should solve the problems (statements 4, 11 and 13). On the contrary, students in class 2 (39.7%) and class 3 (30.1%) chose modalities expressing a high awareness about environmental Preservation and a tendency to become involved and to make personal sacrifices for environmental protection. Answers from students in class 3 indicate a particularly strong concern with environmental issues and deep willingness for personal engagement towards environmental issues. For statements related to the protection of nature, students in class 2 chose modalities expressing respectively low agreement and disagreement with the assertion that nearly all human activity is damaging to the environment, and that animals have the same right to life as people (statement 15). On the contrary, students in the third class show the highest level of support for animal life, even if it could save human lives in medical experiments (statements 15, 16) and for the environment prejudice related to nearly all human activity (statement 17). Furthermore, they see the natural world as something sacred that should be left in peace (statement 18). Students in class 3 assign intrinsic value to the whole environment, which is a sufficient reason for protecting it, contrary to individuals in class 2 despite their positive attitude towards environmental issues.

According to these results, we suggest that individuals from the three main classes could be placed in some of four quadrants of the two-dimensional construct, the 2-MEV scale, used in the Theory of Ecological Attitudes (Wiseman & Bogner, 2003). Indeed, individuals from class 1 express a low concern for environmental issues and low motivation to get involved in solving environmental problems. They obtain a low score on items that we can relate to primary factors of intent of support or care with resources combined under the higher-order factor Preservation. At the same time, they obtain high scores to items related to the Utilization of Nature. Indeed, their answers are favourable to human dominance or to the right to alter the environment. So, we did not find any ambiguity in placing this first class of students in the quadrant (PRE-UT+) in the 2-MEV scale, meaning that these students have apathy towards conservation issues and a view of nature as a source of natural resources to be used for the benefit of human development. On the contrary, the links between the second and third classes obtained with the hierarchical classification are less straightforward. There is no doubt that individuals in these two last classes express a higher awareness about environmental issues and motivation to get involved in environmental protection, they both show a high score on Preservation. But the distinction between the second and the third class is based on the last four assertions. Students from class 2 state that the environment has to be protected, but at the same time, they believe that the primary purpose of nature is to benefit Humans, resulting in a high score on utilization as well (PRE+UT+). On the contrary, students from class 3, think that Humans do not remain the most important life form and do not have the right to alter the environment. Such a low score on Preservation and a low score on Utilization (PRE+UT-) might be expected of a strong

environmentalist. In France, 93.6% of 15-year-old students express one of these main EA. The fourth class corresponds to students who answer "no opinion" for most of the 18 statements.

Links between EA and Students' Interest in Learning about Environmental Topics

In Table 2, we reported the percentages in the classes 1, 2 and 3 previously determined, concerning the crossed-analysis between the EA orientation and the responses on the interest to learn the 11 environment-related topics statements that we selected among the 108 statements included in the section « what I want to learn about » in the questionnaire.

The responses « disagree » and « agree » correspond to the addition of respectively the two positive choices and the two negative choices on the Likert scale within each class of students. These totals are not representing the percentages compared to what is obtained in the overall population, but within each class.

First, we observe that, for each statement, the percentage of students declaring that they want to learn about each selected environment-related topics is respectively lower in class 1, class 2 and class 3. Students from class 1, class 2 and class 3 respectively express an increasing interest in learning environment-related topics, including issues with bearing for the globe and issues of individual interest. Secondly, findings indicate that the level of interest in learning environmental topics differs according to the topic. For instance, students in the three classes declare low interest in statements about benefits and possible hazards of modern methods of farming (e.g. statements 6, 9). On the other hand, they all express more interest in learning topics related to clean air and safe drinking water, how to protect endangered species of animals, the dangers of mobile phones or new sources of energy (statements 3, 5, 7, 8, 11). In another section of the ROSE questionnaire "my science class", students answered to what extent they agree with the statement "School science has increased my appreciation of nature". Students in class 3 indicate a higher degree of agreement with this item (57.5% of positive answers) compared to those in class 1 (36.0% of positive answers) and class 2 (36.0% of positive answers).

Links between EA and Extra-Curricular Activities Practice

Our data, reported in Table 3, suggest that we can relate the three classes to the practice frequency of some extra-curricular activities linked to nature. All the statements show statistically significant results except the assertion "made compost of grass, leaves or garbage". Students from class 3 more often declare practising extra-curricular activities linked to nature than students from class 1 and 2, except for few statements such as 'participated in hunting" or "participated in fishing". The frequency of extra-curricular activities linked to nature is not very different for students from classes 2 and 3.

Links Between EA and Students Personal Value Priorities ın Different Dimensions of Their Future Work

All results reported in Table 4 are statistically significant. We found that students from class 1, expressing apathy towards the environment, significantly display a higher degree of agreement to items related to values like Power in the Schwartz value instrument (1994), as for instance "earning lots of money", "controlling other people" or "becoming famous" than those from classes 2 and 3. On the contrary, the latter answer more positively to items related to values like Benevolence (ex: "helping other people") or Universalism (ex: "Protecting the environment"). Likewise, students from class 3 express a higher support than others to items related to Self-direction (ex: "working with something that fits my attitudes", "making my own decisions"). Results for students in classes 2 and 3 do not differ so much in this section of the questionnaire.

Table 1. Students' responses about environmental challenges (%) obtained for the three main classes resulting from a hierarchical ascendant classification
Statement modalities characterising the different classes are reported in bold

	Class 1 : 23.8%					Class 2 : 39.7%					Class 3 : 30.1%				
	LD	D	LA	A	No	LD	D	LA	A	No	LD	D	LA	A	No
1. Threats to the environment are not my business	21.3	**42.3**	**21.2**	**11.0**	4.3	48.3	**45.3**	4.3	0.3	1.8	**81.4**	13.7	1.9	2.0	1.0
2. Environmental problems make the future of the world look bleak	11.6	28.4	36.3	14.1	9.7	6.8	**35.7**	**39.9**	8.5	9.0	**13.6**	13.7	36.3	**31.7**	4.7
3. Environmental problems are exaggerated	4.5	26.7	**45.7**	**17.7**	5.4	12.5	**54.5**	21.4	2.4	10.1	**42.8**	38.6	11.0	4.5	3.1
4. Science and technology can solve all environmental problems	9.6	39.3	**33.5**	**13.7**	4.0	13.8	**52.6**	18.1	4.5	10.9	**24.7**	43.7	18.4	6.8	6.3
5. I am willing to have environmental problems solved even if this means sacrificing many goods	**10.6**	**32.9**	40.6	9.0	6.9	2.9	12.5	**62.2**	14.7	7.6	2.7	2.2	42.9	**50.1**	2.2
6. I can personally influence what happens with the environment	**19.6**	**35.5**	28.9	8.1	8.0	6.7	**24.3**	**48.4**	9.2	11.4	9.5	13.3	**45.4**	**26.2**	5.8
7. We can still find solutions to our environmental problems	**6.8**	**18.3**	55.0	16.9	2.9	0.7	4.6	**65.6**	26.2	2.9	0.9	3.6	38.7	**53.2**	3.6
8. People worry too much about environmental problems	5.7	24.7	**42.3**	**22.7**	4.7	12.9	**58.1**	20.4	2.6	6.0	**56.2**	33.3	5.8	3.7	1.1
9. Environmental problems can be solved without big changes to our way of life	8.0	31.6	**41.1**	**15.3**	4.1	13.3	**43.2**	29.3	4.6	9.5	**35.8**	30.2	20.0	9.8	4.3

	Class 1					Class 2					Class 3				
	LD	D	LA	A	No	LD	D	LA	A	No	LD	D	LA	A	No
10. People should care more about protection of the environment	2.9	**13.8**	**59.7**	20.2	3.4	0.3	1.2	**55.3**	41.4	1.8	0.2	0.5	6.8	**91.8**	0.8
11. It is the responsibility of rich countries to solve the environmental problems of the world	11.6	28.4	**36.4**	**20.2**	3.4	19.0	**40.5**	26.1	5.7	8.6	**22.4**	27.4	23.7	**20.7**	5.8
12. I think each of us can make a significant contribution to environmental protection	**5.5**	**19.1**	**56.4**	15.7	3.3	0.5	1.8	**51.3**	44.9	1.4	0.2	0.7	15.3	**83.3**	0.2
13. Environmental problems should be left to the experts	4.6	31.6	**39.4**	**19.7**	4.7	24.2	56.9	**9.1**	1.7	8.0	**58.6**	35.0	3.6	1.0	1.8
14. I am optimistic about the future	7.1	20.3	**41.2**	**21.9**	9.5	5.5	21.8	**44.7**	9.1	18.8	**16.4**	**24.5**	30.5	**17.2**	11.5
15. Animals should have the same right to life as people	**15.6**	**27.9**	33.3	16.2	6.9	12.9	**24.5**	31.9	10.7	**20.0**	5.5	12.0	31.0	**42.6**	8.9
16. It is right to use animals in medical experiments if this can save human lives	16.0	**26.1**	**31.9**	**18.4**	7.4	18.9	20.4	**32.0**	10.5	**18.1**	**38.5**	22.2	21.9	6.6	10.8
17. Nearly all human activity is damaging to the environment	8.3	**33.3**	36.1	14.1	8.1	9.3	43.3	**31.1**	3.3	13.0	3.9	17.0	**44.5**	**28.8**	5.7
18. The natural world is sacred and should be left in peace	4.0	**14.3**	42.6	32.2	6.9	4.0	**14.3**	**42.6**	32.2	11.2	0.1	1.2	21.8	**75.0**	1.8

(LD: Low Disagree; D: Disagree; LA: Low agree; A: Agree, No: No opinion).

Table 2. Students' views on what they want to learn about according to their Environmental Attitudes

	Class 1		Class 2		Class 3		p-value (Khi2)
	disag.	agree	disag.	agree	disag.	agree	
1. The ozone layer and how it may be affected by humans	61.1	35.0	45.6	50.2	30.8	66.4	0.000
2. The greenhouse effect and how it may be changed by humans	61.1	35.7	49.7	44.0	33.7	64.4	0.000
3. What can be done to ensure clean air and safe drinking water	47.8	47.0	30.1	66.6	17.5	80.7	0.000
4. How technology helps us to handle waste, garbage and sewage	57.1	40.6	51.1	44.3	37.4	59.9	0.000
5. How to protect endangered species of animals	34.2	62.5	23.6	73.0	7.1	92.2	0.000
6. Organic and ecological farming without use of pesticides and artificial fertilizers	65.7	29.7	57.7	34.0	40.2	55.6	0.000
7. How energy can be saved or used in a more efficient way	46.7	50.1	35.9	59.0	20.7	76.8	0.000
8. New sources of energy from the sun, wind, tides, waves, etc.	45.8	47.5	38.3	57.0	23.1	74.5	0.000
9. Benefits and possible hazards of modern methods of farming	66.9	27.2	65.3	27.4	52.0	44.6	0.000
10. How people, Animals, plants and the environment depend on each other	56.5	38.9	43.1	50.5	40.0	55.4	0.000
11. The possible radiation dangers of mobile phones and computers	37.1	58.9	33.4	63.3	25.9	72.0	0.000

Note: "No opinion" scores are not reported in this table.

In summary, our results allow us to categorize most of the French 15 year old student population (93.6%) in three main classes related to the 2-MEV scale. Student interest in learning environment-related topics is linked to students' Preservation and Utilization scores. The high frequency of extra-curricular activities linked to nature practice is related to students' attitudes showing high Preservation and low Utilization scores. Students expressing apathy towards the environment show values related to power in the different dimensions of their future work, whereas students from the two other classes express the same values as Benevolence and Universalism.

Table 3. Practice frequency of extra-curricular activities related to nature for French students according to their Environmental Attitudes

	Class1		Class2		Class 3		p-value (Khi2)
Statement	never	often	never	often	never	often	
Tried to find the star constellations in the sky	53.1	9.5	40.6	9.2	32.7	16.3	0.000
Collected different stones or shells	23.0	14.5	8.5	19.4	7.5	30.3	0.000
Watched (not on TV) an animal being born	46.2	12.0	58.1	5.6	45.1	10.8	0.000
Cared for animals on a farm	46.8	12.9	43.9	9.1	35.4	19.7	0.000
Visited a zoo	10.5	12.8	6.5	14.6	6.3	22.3	0.000
Milked animals like cows, sheep or goats	57.7	7.0	67.0	3.2	61.7	4.6	0.000
Read about nature or science in books or magazines	37.2	10.9	23.1	15.6	14.2	25.4	0.000
Watched nature programmes on TV or in a cinema	31.4	14.1	16.9	12.1	10.2	30.0	0.000
Collected edible berries, fruits, mushrooms or plants	29.9	17.0	19.9	19.2	15.9	27.5	0.000
Participated in hunting	63.5	11.0	77.2	5.1	78.7	6.8	0.000
Participated in fishing	33.5	17.8	35.5	12.0	35.0	15.8	0.000
Planted seeds and watched them grow	38.0	10.9	32.4	8.6	25.0	13.2	0.000
Made compost of grass, leaves or garbage	64.1	9.1	61.8	8.0	54.2	13.2	0.010
Put up a tent or shelter	18.3	19.6	14.8	20.8	11.7	25.7	0.000
Sorted garbage for recycling or for appropriate disposal	32.8	18.9	19.0	35.2	11.4	46.9	0.000
Taken herbal medecines or had alternative treatments	52.8	11.4	55.3	9.7	46.6	16.0	0.000

Note: "No opinion" scores are not reported in this table.

Discussion

Research Perspectives

Our data in France are globally consistent with the international ROSE results showing a similar pattern of responses as in the other industrialized countries (Vasquez & Manassero, 2004; Schreiner & Sjoberg, 2005; Jenkins & Pell, 2006; Trumper, 2009). Indeed, French students, like those in other western countries, seem to have a lower level of concern for an involvement in environmental problems and motivation for action compared to students from developing countries. French results showing that students' level of interest in learning environmental topics differs according to the topic are consistent with previous studies using ROSE questionnaire as for instance in Norway (Schreiner, 2005) or other large-scale studies as PISA science (OCDE, 2006). We propose, as Bybee (2008) suggests, that one probable reason has to do with the presentation of issues in the media and educational programs.

Table 4. Links between students' future job priorities and Value-items from Schwartz' values instrument (1994) according to students' environmental attitudes.

Statement	Value-items*	Class 1		Class 2		Class 3		p-value (Khi2)
		disag.	agree	disag.	agree	disag	agree	
Working with people rather than things	benevolence	27.8	66.7	16.8	75.5	18.8	75.9	0.000
Helping other people	benevolence	17.2	78.9	8.2	89.6	6.6	91.9	0.000
Working with animals		42.8	52.3	49.7	44.2	31.1	65.5	0.000
Working in the area of environmental protection	universalism	38.6	55.6	31.0	62.0	18.5	63.8	0.000
Using my talents and abilities	Self-direction	12.7	85.4	5.6	92.8	5.2	93.7	0.000
Making my own decisions	Self-direction	10.7	87.7	5.9	93.1	4.9	94.2	0.002
Working with something I find important and meaningful	Self-direction	16.4	81.3	5.6	91.5	4.3	93.9	0.000
Working with something that fits my attitudes and values	Self-direction	13.0	84.6	4.4	93.8	5.0	94.0	0.000
Developing or improving my knowledge and abilities	Achievement	14.0	82.5	6.8	92.3	5.1	93.4	0.000
Coming up with new ideas	Self-direction	26.6	69.8	16.0	79.5	16.0	81.8	0.000
Earning lots of money	Power	10.2	87.2	14.0	82.8	20.3	78.8	0.000
Controlling other people	Power	30.9	65.2	51.0	44.3	55.4	39.8	0.000
Becoming famous	Power	39.0	56.9	59.0	33.6	61.7	34.8	0.000
Becoming 'the boss' at my job	Power	26.4	68.6	45.3	48.5	48.1	48.8	0.000

** Value-items from Schwartz values instrument (1994)*
"No opinion" scores are not reported in this table.

We interpret high scores obtained in France in the ROSE study, expressing for instance interest in learning topics related to energy saving or new sources of energy, as reflecting partly the substantial media communication devoted to these subjects in France. Prelle & Salomon (1996), investigating the reasons why the students perceived certain issues as more serious than others, found that for some topics such as "threats to wildlife", the reasons given were emotional, whereas for topics as the ozone layer they were more factual. They conclude that no simple model, cognitive, social or moral, seemed likely to explain why students feel differently about different issues.

According to Jenkins and Pell (2006), given the diversity of the education systems and curricula among the participating industrialized countries, the commonality of findings is particularly noteworthy and suggestive of the powerful influence of social, rather than narrowly

educational, factors in shaping attitudes. French data in other sections of ROSE questionnaire, show that students from class1, showing apathy towards environment are less positive about learning sciences at school compared to other students expressing a strong support to environment preservation. They globally find that sciences they learn at school are not interesting, will not be helpful for their future and does not increase their appreciation of nature (Le Hebel et al., 2011).

In our study, the students expressing a strong support to environment preservation and who find that school has increased their appreciation of nature are also the students the most interested on learning many science topics and positive about the importance of school for their future, come from the most educated social class (Bourdieu & Passeron, 1970) where their awareness on environment has already been developed. Some studies have reported a positive relationship between parents levels of education and the students' environmental knowledge and attitudes (e.g. Péer, Goldman, & Yavetz, 2007). In France, considering that the science curriculum is not largely focused on environmental education, we can hypothesize that school in France might not play a major role on students EA. Moreover, our results show the extra curricular influence on students' EA. Our results are consistent with previous studies showing the importance of extra-curricular activities practice linked to nature or environment (Eagles & Demare, 1999; Tikka, Kuiten & Tynis, 2000). Likewise, Hutchison (1998) shows that students having a tendency to become involved in the environment and to make personal sacrifices, have environmental views related to early life experience. In France, a study shows that the practice of extra-curricular activities is linked to the sociocultural level of students' family (O'Prey, 2004). A study in Canada (Rahm, 2006), shows that students from disadvantaged families have a lower access to scientific extra-curricular activities. These results show the importance of the role that school could play in developing extra-curricular activities linked to environment accessible for all students. Our results are consistent with other Environmental Education studies showing the important influence of extracurricular activities or non-formal educational activities on the development of students environmental awareness (e.g. Dresner & Gill, 1994; Ajiboye & Silo, 2008; Erdogan & Usak, 2009). Some researchers propose that teaching and learning outside the classroom, in outdoors and natural aereas with direct nature experiences (Bogner, 1998; Palmerg & Kuru, 2000) can have a positive influence on the future environmental attitude of children, even a short out-door learning experience (Bogner, 1998; Prokop et al., 2007). Otherwise, our study points out links between personal values and EA. Our results are consistent with others studies (e.g. Schultz & Zelzeny, 1999), showing that Students expressing apathy towards the environment show values related to power in the different dimensions of their future work, whereas students from the two other classes express values as Benevolence and Universalism,

Nevertheless, none of the studies tried to estimate the relative importance of the different factors (school, extra curricular, personal values, etc.) on students EA. To go further in this research, we propose to proceed to student interviews in order to try to specify that point because interviews allow us to have both a global approach and to go deeper into specific aspects.

Limitations of Our Study

We are aware in our work of the limits of the ROSE questionnaire (number of items) related to the measure of EA, using only a part of the scale developed by Bogner and Wiseman (1999) in the 2-MEV. Nevertheless, we think that our results have a high resonance with this model, and we argue that our data make sense compared to previous studies in the ROSE project (Schreiner & Sjoberg, 2005; Jenkins & Pell, 2006) and studies about environmental attitudes (e.g. references in Rickinson, 2001; in Zelezny et al., 2000). Moreover, the assertions in the environmental section of the ROSE questionnaire expressing EA are formulated without causal explanation or reasoned consequences, which should be a part of the reasoned attitudinal construct (Fazio, 2007).

Furthermore, as the questionnaire consists mostly of closed questions, we may only have access to a part of the information about students' interest in learning, extra-curricular activities,

etc. For instance, there may be other environment-related topics or issues that may interest students more than those proposed in the ROSE questionnaire. Another limitation of this part of our study is that our work does not include the full scales of Schwartz's universal values measure (1994).

Implications for The Teaching of Environmental Issues

In his study, Schultz (2000) attempts to activate different environmental concerns using a perspective-taking manipulation, and he provides evidence that environmental concerns are malleable across situations. Our results showing the role of extra-curricular activities in students' attitudes towards the environment are consistent with Schultz' study (2000) suggesting that any activity that reduces a student's perceived separation between self and nature will lead to an increase in that student's environmental concern. Schultz (2000) underlines the role of environmental education programs evoking empathy towards the environment and the feeling of interconnection with nature that would lead to environmentally relevant attitudes. Although we do believe that developing programmes promoting nature discovery can benefit all students, our position is different from authors advocating the teaching of promoting empathy towards the environment. We argue that fifteen-year-old students are able to perceive these different EA. The EA concept could be explained to students. They could then firstly appreciate the diversity of views towards the environment and also position themselves in this diversity of attitudes. We agree with Ashton and Watson's work (1998) advocating 'critical affirmation' encouraging students to take into account the views of others. For instance in our study, students could understand that individuals from classes 2 and 3, who both support environmental issues but for different reasons, may respond to different appeals. They could then think about distinctions in the design of messages to encourage environmental conservation behaviour. They could also be able to perceive if their school textbook tends to defend for instance an ecocentric or anthropocentric perspective (Tracana & Carvalaho, 2010). This kind of education in critical thinking represents a challenge to curriculum developers and teachers. Forgetting in environmental teaching to take into consideration the diversity of students showing different attitudes toward the environment will lead to fail to the development of scientific literacy for each citizen and students engagement in environmental preservation.

Acknowledgements

This project is supported by region Rhone Alpes (Cluster 14) and the French Ministry of Education (DEPP Direction de l'Evaluation, de la Prospective et de la Performance). We are grateful to our colleagues from the DEPP, IFE (Institut Français de l'Education) for the informatics support and to the schools, students and teachers who made possible to collect the data.

References

Ajiboye, J.O., & Silo, N. (2008). Enhancing Botswana children's environmental knowledge, attitudes and practices through the school civic clubs. *International Journal of Environmental & Science Education, 3*(3), 105-114.

Ashton, E., & Watson, B. (1998). Values education: A fresh look at procedural neutrality. *Educational Studies, 24*(2), 183-193.

Boeve-de-Paw, J., & Van Petegem, P. (2010). A cross-national perspective on youth environmental attitudes. *The Environmentalist, 30*(2), 133-144.

Bogner, F.X. (1998). The influence of short term outdoor ecology education on long term variables of environmental perspective. *The Journal of Environmental Education, 29*(4), 17-14.

Bogner, F.X. (2000). Environmental perceptions of Italian and some European non-Mediterranean pupil populations. *Fresenius Environmental Bulletin, 9*, 570-581.

Bogner, F.X., & Wiseman, M. (1999). Toward measuring adolescent environmental perception. *European Psychologist, 4*, 139-151.

Bogner, F.X., & Wiseman, M. (2004). Outdoor ecology education and pupils' environmental perception in Preservation and Utilization. Science Education International, 15, 27-48.

Bourdieu, P. & Passeron, J.C. (1970). La reproduction sociale. Eléments pour une théorie du système d'enseignement. Paris : Editions de Minuit.

Camiz, S. & Pagès, J. (2006). Application de l'analyse factorielle multiple pour le traitement de caractères en échelle dans les enquêtes. In Lavallée, P. & Rivest, L.P. (Eds.), Méthodes d'enquêtes et sondages: Pratiques européenne et nord-americaine, Dunod.

Chawla, L. (1998). Significant life experiences revisited: A review of research on sources of environmental sensitivity. *Journal of Environmental Education*, *29*(3), 11-21.

Cooper, D.E. & Palmer, J.A. (1998). Spirit of the environment: religion, value and environmental concern. London: Routledge.

Dresner, M., & Gill, M. (1994). Environmental education at summer nature camp. Journal of Environmental Education, *25*(3), 35-41.

Dunlap, R. E. & Van Liere, K.D. (1978). The new environmental paradigm. Journal of Environmental Education, *9*, 10-19.

Dunlap, R. E., Van Liere, K.D., Mertig, A. & Jones, R.E. (2000). Measuring endorsement of the New Ecological Paradigm: a revised NEP scale. Journal of Social Issues, *56*, 425-442.

Eagles, P. & Demare, R. (1999). Factors influencing children's environmental attitudes. *Journal of Environmental Education*, *30*, 33-37.

Erdogan, M. & Usak, M. (2009). Curricular and extra-curricular activities for developing environmental awareness of young students: A case from Turkey: Odgojne Znanosti. Educational Sciences, *11*(1), 73-85.

Erdogan, M., Usak, M. & Bahar, M. (2013). A review of research on Environmental Education in non-traditional settings in Turkey, 2000 and 2011. *International Journal of Environmental and Science Education*, *8*(1), 37-57.

Fazio, R.H. (2007). Attitudes as object-evaluation associations of varying strength. *Social Cognition*, *25*(5), 603-637.

Franzen, A. & Meyer, R. (2010). Environmental Attitudes in Cross-National Perspective: A multilevel Analysis of the ISSP 1993 and 2000. European Sociological Review, *26*, 219-234.

Hutchison, D. (1998). Growing up green: Education for ecological renewal. New York: Teachers College Press.

Jenkins, E.W. & Pell, R.G. (2006). "Me and the Environmental Challenges": A survey of English secondary school students' attitudes toward the environment. International Journal of Science Education, *28*(7), 765-780.

Johnson, B. & Manoli, C. (2011). The 2-MEV Scale in the Unites States: A measure of Children's Environmental Attitudes Based on the Theory of Ecological Attitude. The Journal of Environmental Education, *42*(2), 84-97.

Karpiak, C.P. & Baril, G.L. (2008). Moral reasoning and concern for the environment. Journal of Environmental Psychology, *28*, 203-208.

Kasser, T. (2011). Human Identity and environmental Challenges. Keynote at the NARST Annual International Conference, Orlando, USA.

Korhonen, K. & Lappalainen, A. (2004). Examining the environment awareness of children and adolescents in the Ranomafana region, Madagascar. *Environmental Education Research*, *10*(2), 195-216.

Le Hebel, F., Montpied, P., & Fontanieu, V. (2011). *Students' environmental attitudes: their interest in science-related topics and out-of school activities*. Paper presented in NARST Conference, Orlando, USA.

Milfont, T.L. & Duckitt, J. (2010). The environmental attitudes inventory: A valid and reliable measure to assess the structure of environmental attitudes. *Journal of Environmental Psychology*, 30(1), 80-94.

Munoz, F., Bogner, F., Clement, P., & Carvalho, G. (2009). Teachers' conceptions of nature and environment in 16 countries. *Journal of Environmental Psychology*, *29*, 407-413.

OECD (2007). PISA 2006 : Le compétences en sciences, un atout pour réussir, vol 1, OECD, Paris.

O'Prey, S. (2004). Les activités extrascolaires des écoliers: usages et effets sur la réussite. *Education et Formations*, *69*, 89-105.

Palmer, J., Suggate, J., Bajd, B. & Tsaliki, E. (1998). Significant influences on the development of adults' environmental awareness in the UK, Slovenia and Greece. *Environmental Education Research*, *4*(4), 429-444.

Palmberg, I.E., & Kuru, J. (2000). Outdoor activities as a basis for environmental responsibility. *Journal of Environmental Education*, *31*(4), 32-37.

Péer, S., Goldman, D. & Yavetz, B. (2007). Environmental Literacy in teacher Training: Attitudes, Knwledge, and Environmental Behavior of Beginning Students. *Journal of Environmental Education*, 39(1), 45-59.

Prelle, S., & Salomon, J. (1996). Young people's "general approach" to environmental issues in England and Germany. Compare, *26*(1), 91-101.

Prokop, P., Tuncer, G. & Kvasničák, R. (2007). Short-term effects of field programme on students' knowledge and attitude toward biology: a Slovak experience. *Journal of Science Education and Technology*, *16*(3), 247-255.

Rahm, I. (2006). L'accès des jeunes provenant de milieux défavorisés aux activités scientifiques extrascolaires: une question d'équité. Revue des Sciences de l'Education, *32*(3), 733-758.

Rickinson, M. (2001). Special issue: Learners and learning in environmental education: A critical Review of the Evidence. *Environmental Education Research*, *7*(3), 208-318.

Robinson, J.P., Shaver, P.R., & Wrightsman, L.S. (1991). Measures of Personality and Social Psychological Attitudes. San Diego: California: Academic Press Inc.

Schreiner, C. & Sjoberg, S. (2005). Empowered for action? How do young people relate to environmental challenges? In Alsop, S. (Eds.) Beyond Cartesian Dualism. Encountering affect in the teaching and learning of science, Dordrecht: Springer.

Schreiner, C. (2006). Exploring a ROSE-garden: Norvegian youth's orientations towards science – seen as signs of late modern identities. Oslo: Department of Teacher Education and School Development, Faculty of Education, University of Oslo.

Seeman, M. (1972). On the meaning of Alienation. In Finifter, A.W. (Ed.), Alienation and the Social System. New York: John Wiley & Sons Inc.

Schultz, P.W. (2000). Empathizing with nature: the effects of perspective taking on concern for environmental issues. *Journal of Social Issues*, *56*(3), 391-406.

Schultz, P.W. (2001). The structure of environmental concern: concern for self, other people, and the biosphere. *Journal of Environmental Psychology*, *21*, 327-339.

Schultz, P.W., Shriver, C., Tabanico, J.J. & Khazian, A.M. (2004). Implicit connections with nature. Journal of Environmental Psychology, *24*, 31-42.

Schultz, P.W. & Zelezny, L. (1999). Values as predictors of Environmental attitudes: Evidence for consistency across 14 countries. *Journal of Environmental Psychology*, *19*, 255-265.

Schwartz, S.H. (1994). Are there universal aspects in the structure and contents of human values? *Journal of Social Issues*, *50*, 19-45.

Skjak, K.K., & Boyum, B. (1993). Attitudes toward the environment 1993. Bergen: International Social Survey Programme.

Stern, P.C. & Dietz, T. (1994). The value basis of environmental concern. *Journal of Social Issues*, *50*, 65-84.

Thompson S. & Barton, M.A. (1994). Ecocentric and anthropocentric attitudes toward the environment. *Journal of Environmental Psychology*, *14*, 149-157.

Tikka, P.M., Kuitunen, M.T & Tynys, S.M. (2000). Effects of educational background on students' attitudes, activity levels, and knowledge concerning the environment. *The Journal of Environmental Education, 31*(3), 12-19.

Tracana, R.B & Carvalaho, G.S. (2010). Ecocentric emphasis in environmental subtopics (Ecosystems, Pollution and Use of Resources) in textbooks of 14 countries. Paper presented at the XIV IOSTE conference, Bled, Slovenia.

Trumper, R. (2009). How do learners in developed and developing countries relate to environmental issues? Paper presented at the VIII ESERA conference, Istanbul, Turkey.

Turmo, A & Lie, S. (2007). Cross-country comparability of students' self-reports, Evidence from the PISA 2003 study. *Nordisk Pedagogik, 27*, 343-356.

Vasquez, A (2004). Young people views on the Environmental Challenges from Spanish ROSE data. Paper presented at the XI IOSTE conference, Lublin, Poland.

Wiseman, M. & Bogner, F.X. (2003). A higher-order model of ecological values and its relationship to personality. *Personality and Individual Differences, 34*, 783-794.

Zelezny, L.C., Chua, P.P. & Aldrich, C. (2000). Elaborating on gender differences in environmentalism. *Journal of Social Issues, 56*, 443-457.

Corresponding Author: Dr. Florence Le Hebel, ICAR, ENS Lyon, 15 Parvis René Descartes, BP 700, 69342 Lyon, cedex 07, France. E-Mail: Florence.le-hebel@ens-lyon.fr.

Please cite as: Hebel Le, F., Montpied, P., & Fontanieu, V. (2014). What can influence students' environmental attitudes? Results from a study of 15-year-old students in France. *International Journal of Environmental and Science Education, 9*(3), 329-345. doi: 10.12973/ijese.2014.218a