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Environmental culture in High-School Students. Case study of Environmental Education at the High-School Level in Campeche

Cultura ambiental en estudiantes de bachillerato. Estudio de caso de la educación ambiental en el nivel medio superior de Campeche

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Abstract

This paper offers an analysis of the situation presented by environmental education at the high-school level, by means of a case study done in the municipality of Campeche. There was performed exploratory research which combined quantitative and qualitative methods to diagnose high-school students' level of environmental culture, as well as the type of environmental education they receive. The results indicate that students have a low level of environmental awareness, and lack the necessary knowledge and skills with which to make environmentally-friendly changes in their lifestyles. Although they show an interest in environmental issues, both their institutional context and their teachers' low level of qualification operate as factors that discourage the students. The results allowed us to identify windows of opportunity *for* environmental education in the light of the students'

positive attitudes, their interest in learning sustainable practices, and the importance of the school as a source of information on the environment.

Key words: Environmental education, sustainable development, high-school education, Mexico

Resumen

El trabajo analiza el estado que guarda la educación ambiental en el nivel medio superior, mediante el estudio de caso del municipio de Campeche. Se realizó una investigación de carácter exploratorio que combina métodos cuantitativos y cualitativos para diagnosticar el grado de cultura ambiental de los estudiantes de preparatoria y el tipo de educación ambiental que reciben. Los resultados indican que los estudiantes poseen un nivel de cultura ambiental bajo y carecen de los conocimientos y habilidades necesarias para realizar cambios ambientalmente favorables en sus estilos de vida. Aunque manifiestan interés por la temática ambiental, tanto el contexto institucional como el bajo nivel de habilitación de los maestros operan como factores que desincentivan a los alumnos. Los resultados permiten identificar ventanas de oportunidad para la educación ambiental a la luz de las actitudes positivas de los alumnos, su interés por aprender prácticas sustentables y la importancia de la escuela como fuente de información ambiental.

Palabras clave: Educación ambiental, desarrollo sustentable, educación media superior, México

I. Introduction

The environmental crisis is arguably one of the greatest challenges facing humanity in this century. The change in climate, the loss of biodiversity, environmental deterioration, the emergencies produced by natural disasters, and the shortage of water, among other problems, are a daily reality that is changing the existing patterns of life and compromising the expectations of future generations (Nelleman and Corcoran, 2010). The manner in which the environmental crisis is confronted will be decisive in determining the quality of life to which present generations can aspire, and the possibilities of life for future generations. The margin of action, however, is not very wide; experts believe that within decades we will have reached the point at which the changes in ecosystems are irreversible (Leadley *et al*., 2010).

Historically, the economic and social development of Mexico has been associated with increased poverty, marginalization and social exclusion, as well as a progressive deterioration and depletion of the natural resource base, high levels of environmental pollution, and serious ecological degradation processes (National Commission for the Knowledge and Use of Biodiversity [CONABIO][*], 2006; Vega,

* For ease of reference, where the names of organizations have been translated from the Spanish, their acronyms have been retained as given in that language. In the case of international organizations which have commonly-used acronyms in English, those acronyms have been used.

2001). A move toward more sustainable patterns of development has become an urgent need for the country (National Development Plan [PND] 2007). Reversing the deterioration of the environment requires in the first place, a society whose members have a level of education that will empower them to act on an individual and collective basis in the integrated solution of environmental problems (Caride and Meira, 2000). For over two decades there have been implemented in the country, various proposals for incorporating environmental education into the National Education System (Secretariat of Environmental and Natural Resources [SEMARNAT], 2006) as an essential and permanent component. However, no one knows to what extent these educational strategies now in function are contributing to the development of environmentally-responsible citizens, since there have been few studies made on the subject.

The level of high-school students' environmental culture can be a good indicator of the extent to which progress has been achieved in environmental education, now that high school is the training area responsible for seeing that young people just beginning to exercise their rights and obligations as citizens acquire the knowledge and skills that will enable them to make the informed and responsible decisions that will integrate them satisfactorily into the country's economic development. In addition, high-schoolers are in the process of constructing their own vision of the world, and are making far-reaching decisions about their lives and their environment.

This paper aims to contribute to the generation of information about the situation concerning environmental education at the high-school level, and its contribution to the environmental training of high-school students, through a case study done in the municipality of Campeche. The state of Campeche stands out nationally for its biological diversity, the degree of conservation of its ecosystems, and for having more than one third of its territory designated as a protected natural area (CONABIO, 2007). However, it is also characterized by a marked lag in social development, and by the high level of poverty among its people (National Council for the Evaluation of Social Development Policy [CONEVAL], 2007). It presents, as well, a complex set of environmental problems generated by the exploration and extraction of petroleum, the economic development of coastal areas, the over-exploitation of natural resources, and the expansion of its agricultural frontier (Bustillos, 2000).

II. Methodology

Fieldwork was conducted during the months of May through September, 2007. There was performed an exploratory investigation that combined quantitative and qualitative methods to: a) diagnose the degree of environmental culture possessed by the municipality of Campeche's high-school students; b) analyze the type of environmental education they receive; and c) describe the institutional context within which the educational process is carried out. For the purposes of this work,

environmental culture is understood as the set of attitudes, behavioral intentions and environmental knowledge possessed by a person (Kibert, 2000).

The study area was limited to the city of Campeche, located in the northern portion of the state of the same name, and in which lies the state capital. The municipality has an area of 1,317 square miles, and a population of 238,850 inhabitants, which represents 6% of the state's area, and 32% of the total population (National Institute of Geography and Statistics [INEGI], 2006). According to data provided by the State Department of Education, just over a third (37%) of the total number of high school students in the state (28,128 students) are concentrated in the city of Campeche.

2.1 Diagnosis of the level of environmental culture

A questionnaire on environmental culture was designed by adapting the instrument used in the Wisconsin Environmental Literacy Survey modified for adults (Kibert, 2000). This instrument has been used in several countries diagnosing the of environmental culture level (Hsu and Roth, 1998). The questionnaire included five sections: 1) General information (place of birth, socioeconomic status, age, gender, area of knowledge of vocational interest), 2) Attitudes (predisposition to respond to environmental problems); 3) Behavioral intentions (frequency with which they carry out environmental activities), 4) Environmental knowledge (basic ecological concepts and knowledge of environmental issues); and 5) Importance of education for sustainable development (quality of environmental education and its importance for society).

Sections regarding attitudes and behaviors include 15 questions each, using a Likert scale. The section on knowledge consists of 15 multiple-choice questions with four possible answers each, of which only one is correct. Finally, the last section consists of ten questions, nine of which are designed to assess the degree of agreement on the importance of education for sustainable development, and an open question concerning how environmental education can be improved.

The questionnaire was applied to a simple probabilistic sample based an official list of high schools in the municipality of Campeche, taking the *bachillerato*[**] high school groups as the sample. The sample was made up of 60 groups, in 16 high schools of the municipality, making a total of 1,158 students surveyed.

2.2 Environmental culture index

Each section of the environmental culture questionnaire was analyzed separately, so as to obtain an index of attitudes, behaviors and knowledge. To this end, the values of a Likert scale, were codified, assigning a value of 0 to the least-desired

** Mexico has various types of high schools: the College of Bachelors (cobach); the federal high school, which offers the bg (bachillerato [General High School diploma], the subjects of which composed the sample studied in this paper), and the bi (International High School diploma); there is also the tecnológico, or technical high school.

option, and a value of 4 to that most desired from an environmental point of view. In the section *Knowledge,* a value of 4 was assigned to a correct answer, and a value of 0 to an incorrect one. Thus, the lowest possible value for each section was 0, and the highest, 60. The scores obtained in each section were added up to obtain an Index of Environmental Culture (ICA), for which the highest possible value was 180, and the lowest, 0. The scores obtained were evaluated using a rating scale of from 1 to 10.

2.3 Statistical analysis

The surveys were analyzed by descriptive statistics, using the package SPSS 13. Analysis of mean differences was performed using the Student *t*-test and One-way ANOVA to find significant differences between the level of environmental awareness, and the following variables: 1) gender, 2) type of school, 3) area of vocational interest knowledge, 4) birthplace, and 5) monthly income of the family. Statistical significance was set at $p \leq 0.05$.

2.4 Analysis of the curriculums

Selected in a reasoned manner were six schools considered representative of the high-school education offered in the municipality, depending on the student population served, the type of high school education offered[***], the public or private character of the school, and the environment in which it is located (Table I).

Table I. Characteristics of high schools selected for analyzing the environmental education taught in the city of Campeche

High School	Type of institution	Name of institution	Setting
	Public autonomous	Nazario Víctor Montejo Godoy (Autonomous University of Campeche)	Urban
General	State Public	Campechano Institute	Urban
	Federal public	High School. Module Pich	Rural
	Private	Sor Juana Ines de la Cruz	Urban
	State Public	Campeche School of Science and Technology	Urban
Technological	Federal public	Technological, Industrial and Service Center No. 9	Urban
	Federal public	Technological Center of Oceanological Studies No. 2	Urban
	Federal public	Technological School of Animal Husbandry 15	Rural

We reviewed the curricula of selected institutions, and identified in the contents, the subjects which directly address the interactions that occur in ecosystems, and between the natural and socio-economic. For the purpose of this study, these subjects were called *subjects related to the environment.* A checklist was designed to analyze this by considering the general data of the subject, the content (general, declarative, procedural and attitudinal), activities developed, and assessment criteria.

*** See preceding footnote.

2.5 Description of the educational context

We designed three different guides for semi-structured interviews for administrators, instructors responsible for teaching the subjects related to the environment, and the students who were taking these subjects, respectively, in the pre-selected schools. In the case of administrators, the interview focused on the importance the institution attaches to environmental education, while teachers were questioned about the teaching work and the institutional environment. For students the interview focused on environmental problems and their social impact, as well as the environmental quality of education received.

III. Results

Environmental culture. The general characteristics of the students surveyed are shown in Figure 1.

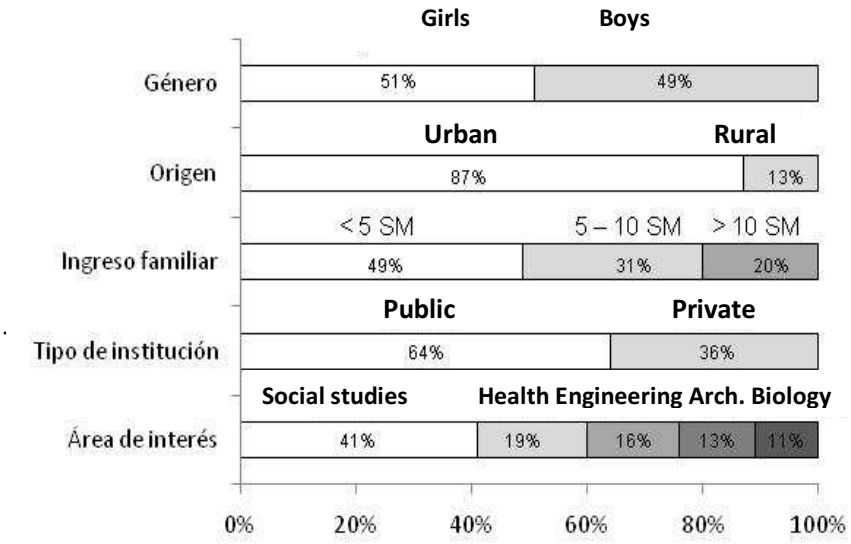

Figure 1. Socioeconomic profile of the student sample
(n = 1,158 students, SM: minimum monthly wage, Arch.: Architecture)

Table II summarizes the scores obtained by students in each component of the ICA.

Table II. Mean scores by component of the Index of Environmental Culture (ICA[****])

Component	Minimum Score	Maximum Score	Mean	SD**
Attitudes	0	60	47.0	6.6
Behaviors	0	60	28.7	9.7
Knowledge	0	60	26.0	8.8
ICA	0	180	101.8	17.3

** Standard deviation

Finally, Figure 2 shows the scores achieved in each ICA component, on a scale of one to ten. Students scored relatively high on Environmental Attitudes (7.8), but low on the components of Environmental Knowledge and Behavior (4.7 and 4.3 respectively). Adding up the three components students got an ICA of 5.6, which would be a failing grade by the standards of the Secretariat of Public Education (SEP).

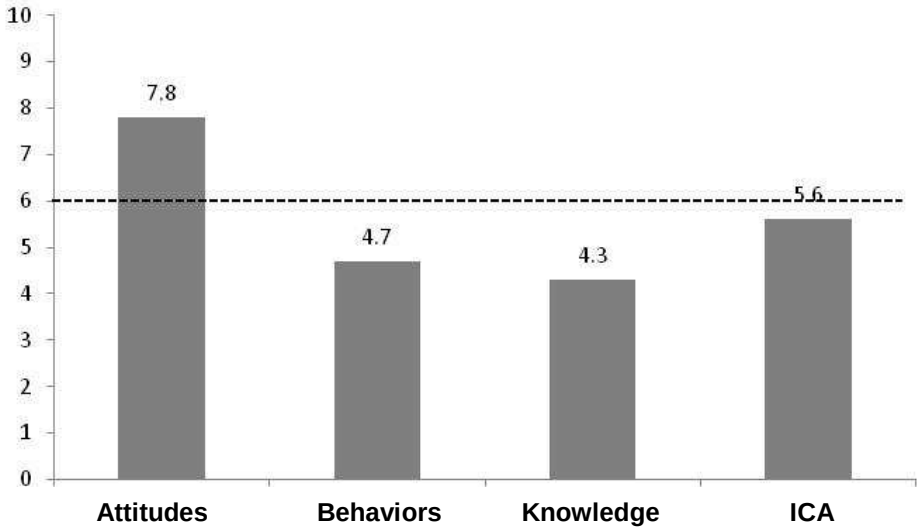

Figure 2. Scores by ICA Components

No significant differences ($p \leq 0.05$) were found with respect to birthplace and environmental culture. However, there were significant differences ($p \leq 0.05$) between the area of student interest and the surrounding culture (Table III), and between the type of school and level of environmental awareness of students (Table IV). Moreover, girls have a significantly higher rating than boys (7.9, $p \leq 0.05$) in the Component Environmental Attitudes (7.7), but the latter have a significantly higher rating (4.9, $p \leq 0.05$) than girls in the Component of Environmental Behaviors (4.7), although these differences are not reflected in the

[****]For ease of reference where the names of organizations have been translated from Spanish, their acronyms have been retained as given in that language. In the case of international organizations which have commonly-used acronyms in English, those acronyms have been used.

global ICA. The Environmental Component of Attitudes also recorded significant differences ($p \leq 0.05$) relative to family income level, the grade decreases (7.9 to 7.5) as the income increases.

Table III. Scores by ICA Components by area of interest

Variable	N	Attitudes	Behaviors	Knowledge	ICA
Total	1158	Scale 1-10	Scale 1-10	Scale 1-10	Scale 1-10
Biology	127	8.0	5.1*	4.5*	5.9*
Engineering	185	7.8	4.9	4.4	5.7
Health	220	7.8	4.8	4.4	5.7
Social Studies	475	7.8	4.6*	4.3	5.6*
Architecture	151	7.7	4.7	4.0*	5.5*

* Significant difference

Table IV. Scores by ICA Components by type of institution

Variable	N	Attitudes	Behaviors	Knowledge	ICA
Total	1158	Scale 1-10	Scale 1-10	Scale 1-10	Scale 1-10
Public	741	7.8	4.9*	4.4*	5.7*
Private	417	7.8	4.6*	4.2*	5.5*

*Significant difference

The main sources of environmental information for students, according to the percentage of those who mentioned it are: 1) the school (67%), 2) television (64%), and 3) the Internet (40%). Most students rated their teachers as fair with respect to their training and teaching performance. However, students agreed on the need to include more environmental-education courses, and that the courses should include practical aspects, in order to learn specific actions to help improve the environment.

Characteristics of subjects related to the environment. We identified 17 subjects related to the environment in the curriculums of the high schools selected. None has to do with specific areas of environmental education; and only two have sustainable development as a central theme, but are oriented toward production systems, since they are part of the modality of animal husbandry.

In the declarative content, there was observed a bias toward issues related to the structure and functioning of ecosystems, the conservation of natural resources, and pollution and environmental impact; as compared with themes such as sustainable development, environmental education and global change. As for procedural content, it focuses mainly on managing material, human, information and communication resources; and to a lesser degree, it was proposed that there be development of environmental education projects in the school or community setting. Values, attitudes and behaviors were promoted, based on the review of the impact generated by human activities on the environment.

3.1 Educational context

The perception that directors have about environmental education is very shallow, and is basically confined to the conservation of the natural environment, without moving into the social or economic sphere. At the institutional level, environmental education is considered an activity secondary or complementary to the training of students, and the responsibility for it rests solely on the instructors who teach the subjects of Biology and Ecology, whose support depends on the availability of resources and spaces. Thus, the activities or projects carried out in the schools rely heavily on the initiative or the interest shown by the individual teachers. The schools are limited to collaborating with initiatives that the federal and state agencies orchestrate in regard to environmental education, which in practice translates as the environmental-awareness talks given by staff from these agencies, or the participation of students in civic events.

According to the interviewees, the lack of information and specific official guidelines regarding environmental education is the reason why the environmental education of students is not considered a priority in the institutions. As a result, environmental education is not promoted in a way planned into the high schools, either in the school environment as an integral part of the curriculum, or in the management processes of institutional training.

The academic profile of faculty members who teach subjects related to the environment is quite varied. One can find persons with a degree in elementary education and natural science, as well as anthropologists, surgeons, dental surgeons, biologists, agronomists, as well as teachers with master's degrees in education, research methodology and criminology. Most have been teaching these subjects for three to six years, and not one has had any formal training in environmental education, except for short courses and thematic conferences provided by government bodies. The teachers recognize that environmental education is a field with which they do not feel fully identified, since they lack adequate preparation on the subject. For this reason they prefer to view themselves as teachers of ecology, although their faculty position meets the needs of the institutions where they work, rather than fitting their professional profile. However, they all expressed interest in being in the field of environmental education, and are willing to take training if they have the support of their institutions. The teachers believe that environmental education is an important part of the integrated training students should receive, but are of the opinion that within the institution this vision is not shared, and that for that reason they face various limitations, not only terms of money, space and time, but also with regard to cooperation from teachers of other disciplines.

In general terms, the students feel that environmental education is a way of teaching people to conserve and value the environment. However, the concept they have of the environment is limited to nature, and excludes anthropogenic

elements. Students in rural areas are particularly concerned about climate change, deforestation and forest fires, while those living in towns center their attention on the problems of soil, water and air. What interest they may have in matters of the environment depends on the class's activities, the teacher's mastery of the subject, and the usefulness or application of what they acquire as relating to their daily lives. In this respect group activities and those done outside the classroom (such as field trips and excursions) seem to be an important factor in sparking their interest. They also take into account the consistency between the teachers' environmental discourse, and their attitudes and behaviors. Although most students do not participate in environmental activities outside of school, they show interest and a willingness to get involved because they believe that environmental issues are an important part of their academic and personal development. For this they suggest the incorporation of practice in the field, and the promotion of participation by the school community in environmental projects that would go beyond the classroom and the teachers' rhetoric.

IV. Discussion

4.1 Environmental culture of high school students

High school students in the municipality of Campeche have a low level of environmental culture. However, similar studies in the U.S. (Kibert, 2000) and Finland (Tikka *et al*., 2000) appear to suggest that the environmental culture of students in general is in short supply. Unlike the situation with other studies (Kibert, 2000; Tikka *et al.*, 2000; Yilmaz and Hans, 2004) there was found no clear influence of gender on environmental culture. However, it is noteworthy that students of public educational institutions have a level of environmental culture significantly higher than do those studying in private institutions. A first explanation could be derived from differences in the socioeconomic context among young people in public and private institutions, particularly in terms of access to basic goods and services. Although the results of this study show no significant relationship between the socioeconomic level of young people and their environmental culture, it was found that environmental attitudes significantly diminish as family income increases. In urban settings, low income is associated with a more limited access to basic goods and services (e.g. supply of drinking water), a situation that could contribute to making the public-school students more aware of environmental problems, because of the effects these have on their daily lives. Tikka *et al*. (2000) report that urban dwellers living in densely-populated areas, and experiencing the problems associated with this condition, become more environmentally conscious, and adopt more positive attitudes toward the environment. The municipality of Campeche has no densely-populated cities, nor does it present the environmental problems characteristic of large cities; but rather, its population has a serious shortage of public services.

Another factor that may influence the difference in the environmental culture of young people attending public and private institutions has to do with the time

teachers spend in school. The private schools have a significant proportion of teachers hired to give special courses; unlike the public schools, where there are more part-time and full-time teachers. This implies that teachers in the public institutions spend more time there, which allows them under certain circumstances to develop, in complement with their teaching hours, environmental activities more meaningful to young people—a situation hard to find in the private schools, where teachers are limited to following the curriculum during their teaching hours.

Those students with vocational interests in the area of biological sciences demonstrated environmental knowledge and behaviors significantly higher than did their colleagues in other areas of knowledge, presumably because they have greater access to sources of environmental information due to their personal preferences. A similar situation was reported by Ku, Tacu and Eastmond (2007) in a comparison of the level of environmental culture of social-studies students with those taking biology; the conclusion was that the latter have a greater environmental awareness due to the greater number of curriculum courses related to the environment. Although having more knowledge does not guarantee a more responsible environmental behavior, several studies (Christenson, 2004; Ernst, 2007; Hsu and Roth, 1998; Summer *et al*., 2004) indicate a positive relationship between an individual's level of knowledge and his understanding of environmental problems, and the probability of his doing things for the good of the environment.

4.2 Environmental culture in the context of education

An analysis of the young people of Municipality of Campeche's components of the Environmental Cultural Index emphasizes their low level of environmental knowledge, as compared with their high degree of environmentally-favorable attitudes. Thus, students score high on attitude levels, but low on general environmental knowledge; and what is more important, on concrete environmental behaviors. Studies done in Mexico (Fernandez-Crispin *et al*., 2005; Garcia-Ruiz, 2007) report a similar pattern in the attitudes, behavior and environmental awareness of Mexican students. By themselves, positive attitudes do not seem to be sufficient for the achievement of environmentally-friendly actions. In an educational system that emphasizes the rote memorization of information, and focuses on teaching basic ecological concepts, we would expect to see a greater impact of environmental education on the knowledge of environmental problems—which obliges us to question the quality of the environmental education they are receiving. In light of other assessments of overall educational performance in Mexico (National Institute for the Evaluation of Education [INEE], 2009), it seems probable that the low level of environmental knowledge is explained by the lack of teacher-training and the low priority given to environmental education in the national education system.

Teacher training has historically been a task left hanging in high-school education (Alcantara and Zorrilla, 2009). Traditionally teachers have been limited to vocational training in degree programs related to the subjects they teach. However, this correlation is not usually found in the case of environmental courses,

where the teacher profile is very diverse and little specialized. This, coupled with the lack of an educational strategy for remedying the training deficiencies, suggests that high-school teachers have a low level of qualification. Studies like those of Gutierrez and Garcia (2007), and Ku (2009) point to the close relationship between the teachers' environmental training, and their level of understanding and knowledge of environmental issues. A deficiency in teachers' environmental training produces deficiency in education, which promotes a reductionist view of environmental issues with a clearly conservationist tint, and with little emphasis on the dimensions of social studies, economics and culture in the environmental crisis.

Although environmental education is considered an important issue for both students and teachers, in practice it does not enjoy a priority status in the high school. Institutional constraints in terms of financial, human and logistical resources reduces environmental education to a theoretical question oriented toward sensitizing students on the subject of environmental issues, confined to the classroom, and having little or no relevance to everyday life, or life within the institutional environment, in which there is no promotion of positive practices that would enable schools to become models of environmental behavior. Although students acquire positive environmental attitudes, they do not achieve a deep understanding of the environmental crisis, nor any motivation to modify their behavior (Palmer, 1998).

4.3 Perspective of environmental education at the high school level

The immediate cause of the students' poor performance in environmental culture is their unfamiliarity with the functioning of ecosystems in all their complexity, and their lack of understanding of the interdependence of natural and socioeconomic systems. If they lack basic environmental knowledge, it is difficult to expect a favorable change in their behavior toward the environment. This lack is due to the low priority given to environmental education, which promotes a type of teaching focused on providing decontextualized information, superficial and insufficient. This is particularly disquieting, given that the school is the main source of environmental information for young people.

To raise the level of environmental awareness among young people it is necessary, first, to recognize environmental education as a priority for all actors in the education sector. This implies providing more resources and infrastructure for it, and making it a compulsory subject at all levels of the formal education system, as a transverse axis of knowledge and in the formation of specific curriculum courses.

At the high school level, the Comprehensive Reform of High School Education (SEP, 2008) stipulated by the federal government today is currently a window of opportunity for environmental education, since within the competencies that define the profile of the high school graduate there is included a requirement that students should be able to contribute to sustainable development with responsible actions. It is a breakthrough, in the sense that it suggests a transition from an

environmental education centered on conservation awareness, to an education for sustainability, which implies a paradigm shift. From this perspective, environmental education should have a deeper purpose than environmental conservation, and the sensitization of persons or the promotion of pro-environmental behavior. It must be transformed into a social practice that would encourage the critical analysis of the root causes of environmental problems, so as to become a factor in social change and transformation to achieve sustainability. This is possible only if there is promoted a radical change in teacher-training, so as to enable instructors to create the settings for learning, and to exercise greater efficiency in the use of existing facilities in camps, biological stations, botanical gardens and museums to foster meaningful experiences for students.

Finally there must be consistency between what is taught, and what actually happens in the school environment, in the family and in society. Educating people to do something not perceived as relevant makes no sense. The distance between the rhetoric of environmental education, and social practice in all areas of life is so great, including what happens in the school context, that it discourages young people from changing their behavior. Sustainability as a guiding principle of public policy should be an everyday reality, not merely an element that serves to tone down the contradictions in our scheme of development and our lifestyles. Otherwise we would be missing the opportunity entailed in the two realities identified in this study, the first being that young people consider the issue of the environment to be very important; and the second, that they have favorable environmental attitudes, and are interested in going into more depth in their environmental training. There is, then, an essential requisite for an environmental education that would allow these concerns to be transformed into well-founded decisions and accords consistent with a culture of sustainability.

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