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RESEARCH REPORT

Trends in Environmental Education Images of Textbooks from Western and Eastern European Countries and Non-European Countries

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Textbook analysis is seen as a major element for studying environmental education addressing pupils, image analysis being rather relevant when studying textbooks written in 11 languages. We analysed 25 textbooks from 14 countries addressed to 14–16-year-old pupils, focusing on: (1) local and foreign/global images; (2) urban/rural and nature images; (3) negative impact, human management, and the beauty of nature; and (4) men and women in images with negative and positive impact. We distinguished some trends between Western (WEc) and Eastern (EEc) European countries and non-European countries (NEc). In contrast to textbooks from EEc and NEc, which tend to show the beauty of nature with little human influence, WEc textbooks tend to exhibit more images of urban/rural landscape, of human negative impact and of human management, expressing an anthropocentric view of the environment. Men are usually more present in textbook images than women. However, some images exhibiting more women than men could be found in textbooks from WEc and EEc, but never in NEc. In negative impact pictures, men are more often present than women but NEc women are never present in such images. Women are more frequent than men in positive impact images. Results suggest that textbooks from EEc and NEc should give more emphasis to human management and urban/rural images, whereas those from WEc should give more attention to the beauty of nature. A balance in the presence of men and women in images should be a matter of greater concern by all textbooks' authors and publishers.

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Concepts of Environmental Education and Sustainable Development

The concept of environmental education (EE) has emerged with dominant reductionism programmes and education oriented primarily to the conservation of basic resources. William B. Stapp and his colleagues (1969) have defined and proposed two major objectives of EE focused on (1) community environment and its associated problems, and (2) the role of the citizens of all ages in working towards the solution of these problems. This earlier concept of EE was adopted by the world community at the Tbilisi Intergovernmental Conference on EE in 1977 (UNESCO, 1980), assuming EE as a process aiming at promoting people aware of and concerned about the global environment and its associated problems, and developing attitudes, motivations, knowledge, commitment, and skills to work individually and collectively towards solutions of current problems and the prevention of new ones.

Although the concept of EE varies slightly under different conditions and in response to local situations, in general it focuses on (1) awareness and sensitivity about environmental and environmental challenges; (2) knowledge and understanding of environmental issues at a variety of levels, ranging from local to global and including understanding of different influences, either natural or human ones; (3) attitudes towards the concern for the environment and the systems of values underlying such attitudes, helping to maintain the environmental quality; (4) skills to mitigate and solve the environmental problems; and (5) active participation in existing environmental-related programmes (Palmer, 2003).

In 1987, the United Nations World Commission on Environment and Development issued the Brundtland report, 'Our Common Future', which proposes some advances towards sustainability, i.e. sustainable development (SD), or development that meets 'the needs of the present without compromising the ability of future generations to meet their own needs' (WCED, 1987, p. 12). It includes three dimensions (environmental responsibility, economic return, and social development) and five areas for SD: (1) economic growth; (2) equity, *i.e.* a fair allocation of resources to sustain growth; (3) more democratic systems; (4) adoption of lifestyles within the planet ecological means; and (5) population levels within the productive potential of ecosystems. Despite its commendable objectives, the Brundtland Report (WCED, 1987) has been subject to some criticism from those who claim that development is too often associated to economical growth, assuming the economic development cannot be allowed to go on degrading the environment (Lélé, 1991). A widely used concept of SD has been defined as 'improving the quality of life while living within the carrying capacity of supporting ecosystems' (Jacobs, 1996, p. 26).

The Conference in Rio de Janeiro emphasized the significance of sustainable development in Agenda 21 (UNESCO, 1992). This document calls for a reorientation of EE and introduces the principle of sustainability and the need to apply it to

economic, social, and environmental aspects. Sauvé (1996) summarizes in two ways the multiple views regarding how EE should be linked to SD: (1) adding SD objectives to existing EE goals, and (2) ultimating goals of SD to EE. The latter is close to education for SD (Sauvé, 1996) and the concept of SD as systematic, long-term utilization of natural resources ensuring the accessibility of these resources for future generations has been largely accepted (Salīte, 2002; Salīte & Klepere, 2003).

Environmental education nowadays intends to provide people with an understanding of their natural and cultural environment and to enable the development of new rules, practices, and values, encouraging the sustainable use and development of natural resources and the improvement of quality of life for all living beings (Obara et al., 2009). Responsible environmental action requires serious reasoning about environmental issues. Drummond and Marsden (1999) discuss two alternative and extreme positions on sustainability, grounded on two philosophical positions, anthropocentrism, and ecocentrism, respectively, soft and hard sustainability. The main task of soft sustainability is prevention of catastrophe for human society accepting science and modern technologies and intergeneration distribution treated separately, aversion lower environmental risk. The main task of hard sustainability is promotion of society in harmony with supporting ecosystems and questions science for seeking alternative technologies.

For Salīte (2002) the anthropocentrism stresses the significance of human beings and capability of humans to understand and control natural processes in a desirable direction. In this view, the focus is on the development of normative criteria for energy connections between humans and the environment, such as the monitoring of human actions, the calculation of human impact on nature. The latter, the ecocentrism, is looking for ways of creating cohesion with human life and life-supporting systems, as complementary components within the ecosphere. Here the focus is on the psychological–ethical relationship between humans and nature, i.e. it undertakes studies on the aims, values, attitudes, and humans' actions. Both levels of seeking solutions for problems of SD have been gradually adopted as typical approaches to education and in the consciousness of society but, gradually, the ecocentrism recognition has been increasing (Filho, 2000; Postman, 2006; Salīte, 2002). Furthermore, Dawe and Ryan (2003) insist that SD is definitely anthropocentric and thus unable to dissolve the false barriers between the human sphere of economic and social activities and the ecological sphere that sustains these activities (Sneddon, Howarth, & Norgaard, 2006). After all, only the needs of (present and future) humans are considered in its definition (Postman, 2006).

The Role of Images in Textbooks on Environmental Education

Textbooks are cultural artefacts which participate in the cognitive and social organization of knowledge (Lebrun, 2007). They translate national programmes guidelines which are the expression of national education policies. Textbooks are used by teachers with a double function: as a national programme (or syllabuses) guideline and as a didactical resource (Carvalho, Jourdan, Gonçalves, Dantas, & Berger,

2009). Thus, the textbook analysis turns out to be a relevant tool for studying socio-cultural determinants of environmental problems, in particular the school-related ones.

Most of the studies on textbook analysis have focused on the text analysis but iconic information has been considered as authenticating what the text is about (Pinto & Ametller 2002; Pozzer & Roth, 2003). In contrast to the need for interpreting and understanding the complex textual language, pictures are autonomous systems of communication that do not simply reproduce reality but produce images of reality which are bound up with the interests of the social institutions (as school) within which the pictures are produced, circulated, and read (Kress & van Leeuwen, 1996). Therefore, they are a suitable tool for the assessment of semantic contents and hence to create specific types of order, relations, and identities within the pedagogic and the more general communicative discourse (Dimopoulos, Koulaidis, & Sklaveniti, 2003). Image analysis turns out to be rather relevant when analysing textbooks from 14 countries with 11 different languages.

Images that appear in the textbooks have a major importance in the construction of pupils' conceptions, and they serve to wake emotions and actions. It has been claimed that some images are better memorized than the corresponding text (Korfiatis, Stamou, & Paraskevopoulos, 2004; Myers, 1990; Pozzer & Roth, 2003) and that they have had an important role in the environmental wakeup since the 1960s (Seppanen & Valiverronen, 2003). For example, images of the human–nature relationship might be given in two oppositions (Schroeder, 2007): 'people apart from nature' and 'people as a part of nature'. The former represents a belief that human beings are somehow different or separate from the natural world. This view implies that the presence of people in images, their artefacts and activities give a negative impact by diminishing the naturalness of the environment. Therefore, nature is seen as having an intrinsic order, harmony, or beauty, in a world where humans are absent. It represents the belief that human beings belong to the natural world and they live and cooperate with nature, not necessarily destroying it. Some authors (Korfiatis et al., 2004; Schultz, 2000) have shown that people who see themselves as more connected to nature score higher on measures of ecocentric concern and lower on measures of utilitarian or anthropocentric perspective with respect to environmental problems. In addition, Schultz, Shriver, Tabanico, and Khazian (2004) have found that believing in oneself as being included in nature varies in different cultures and may be influenced by situational and environmental factors, for example, people who live in large cities and are distanced from the natural world might see themselves as less connected to nature. Similarly, Hernández, Hidalgo, Salazar-Laplace, and Hess (2007) have found that place attachment and place identity in natives and non-natives is an affective factor for sensibility and deeper looking into environmental problems.

A great deal of theoretical uncertainty exists regarding gender differences in environmental concern that can be seen in three perspectives: (1) difference in sensitivity of gender to environmental problems; (2) social roles of gender; and (3) gender equality in education (Glaschi, 2000; Leach, 2003; MacDonnald & Hara, 1994;

Mepham, 2008; Sørensen, 2007). Gender parity and gender equality in education mean different things: reaching parity should be considered as a first-stage measure of progress towards gender equality in education (UNESCO, 2003). In the past, textbooks tended to exhibit gender stereotypes (Glaschi, 2000) but in the last two decades the educational systems of most countries have been centring their action against discrimination or inequalities of any order (Leach, 2003). This surveillance includes text and images in school textbooks. In the present study we analysed the presence of men and women in images associated to environmental issues.

Objectives and Methodological Approach

Environmental education embraces four important issues (Caravita et al., 2008): (1) *ecosystems*, particularly related with the dynamics of systems; (2) *biodiversity*, as a central concept in the comprehension of evolution and of the policies of control and ecological management; (3) *pollution*, as the introduction of contaminants causing harm to the environment; and (4) the *use of resources*, which are important topics involving values and beliefs, and that are central in the education for a sustainable future. In the present study we analysed these four important EE topics in textbooks of 14 countries from Western Europe, Eastern Europe, and outside Europe.

Furthermore, the textbook analysis focused the five dimensions required to reach environmental sustainability (Sachs, 1993): *spatial*, *economical*, *ecological*, *social*, and *cultural* dimensions. The (1) *spatial dimension* incorporates a balanced configuration of the local *versus* global and urban/rural *versus* natural environment; (2) the *economical dimension* looks at the human management of resources; (3) the *ecological dimension* involves research and measures not only to reduce resources consumption but also to intensify resource saving technologies, in order to define rules allowing an appropriate environmental protection; (4) the *social dimension* aims at reducing distance between life pattern of social groups; and (5) the *cultural dimensions* cover the acknowledgement of the peculiarity of each ecosystem, culture, and local history. In this study we carried out quantitative and qualitative analyses of images on the topic EE in textbooks of 14 countries, having focused on: (1) local and foreign/global images; (2) urban/rural and nature images; (3) negative impact, human management, and the beauty of nature; and (4) men and women in images with negative and positive impact.

The present study was developed within the large European project BIOHEAD-CITIZEN (FP6, STREP CIT2-CT-2004-506015; Carvalho, 2004) involving 19 countries: 13 European countries (Cyprus, Estonia, England, Finland, France, Germany, Hungary, Italy, Lithuania, Malta, Poland, Portugal, and Romania), five African countries (Algeria, Morocco, Mozambique, Tunisia, and Senegal), and one from the Middle East (Lebanon). The aim of this project is to deepen the understanding of how different aspects of citizenship can be promoted through biology, health and environmental education. It is intended to improve the understanding across different disciplines and across different countries, specifically aiming at identifying key issues for improving the transmission of science knowledge in the

perspective of reinforcing the link between science and education and contributing to a better citizenship in a knowledge-based society (Carvalho, 2004). Two main approaches have been carried out in this project: one, seeking teachers' and future teachers' conceptions about biology, health and environmental issues and, the other, looking at the same issues in current school textbooks in the same countries.

For the design of the BIOHEAD-CITIZEN grids to be applied in textbook analysis, four precise subtopics of EE being exemplar of interactions between science and society and challenges in citizenship were chosen. They were: Pollution, Use of Resources, Ecosystems, and Biodiversity (Caravita et al., 2008). These grids of analysis were the result of a collective and international work carried out by researchers from all the countries involved in the project. For the grids construction, a sample of textbooks from all countries was analysed in a project meeting, and an initial version of the grids was built. Then, in each country, these grids were pre-tested on at least one textbook. The final version of the grids took into account the results of this pre-test (Carvalho et al., 2009; Tracana, 2009; Tracana, Ferreira, Ferreira, & Carvalho, 2008). This final grid was applied by each team in its country textbooks. The problem of subjective interpretation in this kind of qualitative analyses was controlled by having two analysts applying separately the grids and cross-checking the findings afterwards.

In the present study we used a part of the long grid related to the qualitative and quantitative images analysis (Table 1). To assess the occurrences of each indicator, the grid was applied by noting the page numbers and the quantity of images found in each textbook. The same picture could be analysed in different contexts, for example, one image of 'local' environment could also illustrate human 'negative impact' in rural landscape. All images were examined and grouped into categories according to Table 1: (1) local and 'exotic' (foreign/global) environments; (2) natural (with or without humans) and urban/rural environments; (3) negative impact, human management, and the beauty of nature; and (4) men and women in environments with negative and positive impact.

It was considered to be an 'exotic or foreign/global environment' if the image exhibited clearly fauna, flora, geologic, or geographic pictures of other countries or other world regions than the textbook. 'Natural environments' were images showing nature without the apparent intervention of humans, such as forests, mountains, and marine ecosystems, or pictures/drawings of fauna and flora; 'nature with human activities' when the presence of humans was evident. Images with 'negative impact' included human activities of whatever kind that were represented as causing damage to the natural ecosystems; images with human 'positive impact' included activities portrayed as being environmentally friendly or as direct management in improving the environment, such as reforestation. The number of men and women present in images with negative and positive impact enabled us to evaluate gender peculiarities among textbooks.

For this study we selected textbooks for 14–16-year-old pupils as at this age group children are especially sensitive to environmental problems (Kellert, 1985; Prokop, Tolarovičová, Camerik, & Peterková, 2010; Sivek, 2002). The current textbooks

Table 1. Part of the grid constructed by the European project BIOHEAD-CITIZEN 'Content of images: Humans and Nature' (above) and 'Density of text and images for subtopic' (below) used in the present study

	Images of natural environments	**Images of nature with human activites**	**Urban environment**	**Rural landscapes**	**Human in environments**		
					M	**F**	**M+F**
Images of local environments							
Images of 'exotic' environemnts							
Images illustrating the negative human impact							
Images emphasizing the beauty of nature							
Images illustrating human management of environment							

Chapter devoted to (*title of chapter*)	**Number of pages (*or 1/2 pages*) per part, or number of paragraphs (*specify*)**	***Pages*** **(*pp… to pp…*)**	**Only text**	**Surface of text > surface of images**	**Surface of text = surface of images**	**Surface of text < surface of images**	**Only images**

were selected, when possible, out of the most used ones in schools, but in some countries only one official textbook was available. The corpus of the present study was composed of 25 textbooks from 14 countries: 12 books from Western European countries (WEc)—Finland (2), France (2), Germany (2), Italy (4), Malta (1), and Portugal (1); 6 books from Eastern European countries (EEc)—Cyprus (1), Estonia (1), Hungary (2), Lithuania (1), and Romania (1); and 7 books from Lebanon (3), Morocco (2), and Senegal (2) (see Appendix).

In countries like Estonia, France, Italy, Lithuania, Malta, Portugal, and Romania the four subtopics (Pollution, Use of Resources, Ecosystem, and Cycles and Biodiversity) could be found in the same textbook whereas in other countries (Finland, Germany, Hungary, Lebanon, Morocco, and Senegal) the four subtopics were found in separate textbooks. In this case, when more than one textbook covered complementary the four subtopics, the books were put together for the subsequent analysis, as shown in the results (see Table 2).

Images in Environmental Education Subtopics: Pollution, use of resources, ecosystem and cycles, and biodiversity

Images are powerful tools for learning, giving important opportunities for analysis, discussion, and group activities (Mowat, 2002). In textbooks, images illustrate what is written in the text and, usually, they are better memorized than the text itself (Korfiatis et al., 2004; Myers, 1990; Pozzer & Roth, 2003). The first approach in the present analysis of textbooks concerned the number of pages and images on EE subtopics (Table 2 and Figure 1) as well as the proportion of the surface occupied by text and images per page (Table 3).

The four subtopics (Pollution, Use of Resources, Ecosystem and Cycles, and Biodiversity), targeting 14–16-year-old pupils, were found in textbooks of all countries, except those from Cyprus and Morocco which missed one subtopic, Biodiversity and Pollution, respectively (Table 2). The absence of the today important Biodiversity subtopic in the Cypriot current textbook can be due to the fact that this book was first published a long time ago (in 1999), when this subtopic was not considered as important as it is nowadays, since the concept of Biodiversity was formally introduced in the American Forum of Biodiversity in 1986 (Thompson & Starzomski, 2007). The absence of Pollution in Moroccan textbooks may be due to the low concern given in this country to this issue. None of the textbooks from non-European countries presented the four subtopics (Table 2).

Of the analysed textbooks, those from EEc have more pages (mean = 73.3, Table 2) and more images (95.7) than those from non-European countries (NEc) (60.6 and 72.4, respectively), and WEc (56.3 and 88.0, respectively). In the EEc group, the Cypriot textbook is the one contributing more pages (190) and the Romanian one with more images (348). However the ratio of the number of images and pages (I/P) is the same in both EEc and WEc (1.6), followed by NEc (1.4).

Figure 1 shows that the majority of the textbooks (18) have more images than pages (being the Lebanon-05 textbook the one with higher proportion of

Table 2. Number of pages and images addressing the four subtopics: Pollution (Pol), Use of Resources (UR), Ecosytems and Cycles (EC), and Biodiversity (Bio) in 25 textbooks from 14 countries

	Number of text pages (*P*)					Number of images (*I*)					
Country	Pol	UR	EC	Bio	Total	Pol	UR	EC	Bio	Total	I/P
Western European countries (WEc)											
Malta (1986)	8	4	39	6	**57**	14	12	67	11	**104**	**1.8**
Finland 2004)	59	25	–	–	**84**	137	47	–	–	**184**	**2.2**
Finland (2005)	–	–	18	14	**32**	–	–	30	30	**60**	**1.9**
France (2003)	10	5	5	7	**27**	22	5	5	6	**38**	**1.4**
France(1999)	10	4	33	12	**59**	25	3	9	14	**51**	**0.9**
Germany(1994)	11	7	47	–	**65**	8	19	60	–	**87**	**1.3**
Germany(2005)	–	–	–	19	**19**	–	–	–	54	**54**	**2.8**
Italy-G (2004)	7	2	34	6	**49**	8	2	57	8	**75**	**1.5**
Italy-M (2000)	7	9	28	9	**53**	19	18	63	9	**109**	**2.1**
Italy-B (2004)	20	60	36	18	**134**	31	95	57	20	**203**	**1.5**
Italy-P (2001)	18	18	16	3	**55**	5	9	29	3	**46**	**0.8**
Portugal (2004)	17	8	10	6	**41**	23	8	9	5	**45**	**1.1**
Mean WEc	13.9	11.8	22.2	8.3	**56.3**	24.3	18.2	32.2	13.3	**88.0**	**1.6**
Eastern European countries (EEc)											
Cyprus (1999)	112	23	55	–	**190**	16	24	55	–	**95**	**0.5**
Estonia (2002)	17	4	12	23	**56**	13	2	10	6	**31**	**0.6**
Hungary (2003)	4	–	4	3	**11**	13	–	13	6	**32**	**2.9**
Hungary (2004)	–	22	–	–	**22**	–	37	–	–	**37**	**1.7**
Lithuania(2000)	7	12	11	3	**33**	7	8	15	1	**31**	**0.9**
Romania(2000)	12	3	30	83	**128**	19	9	125	195	**348**	**2.7**
Mean EEc	25.3	10.7	18.7	18.7	**73.3**	11.3	13.3	36.3	34.7	**95.7**	**1.6**
Non-European countries (NEc)											
Lebanon (2001)	–	–	33	15	**48**	–	–	44	23	**67**	**1.4**
Lebanon (2004)	56	–	–	–	**56**	74	–	–	–	**74**	**1.3**
Lebanon (2005)	–	4	–	–	**4**	1	14	–	–	**15**	**3.8**
Morocco-A(2005)	–	9	78	–	**87**	–	29	189	–	**218**	**2.5**
Morocco-S (2005)	–	–	–	57	**57**	–	–	–	12	**12**	**0.2**
Senegal (1986)	5	–	139	15	**159**	4	–	58	35	**97**	**0.6**
Senegal (1996)	–	13	–	–	**13**	–	24	–	–	**24**	**1.8**
Mean NEc	8.7	3.7	35.7	12.4	**60.6**	11.3	9.6	41.6	10.0	**72.4**	**1.4**

Textbook presenting the four subtopics.

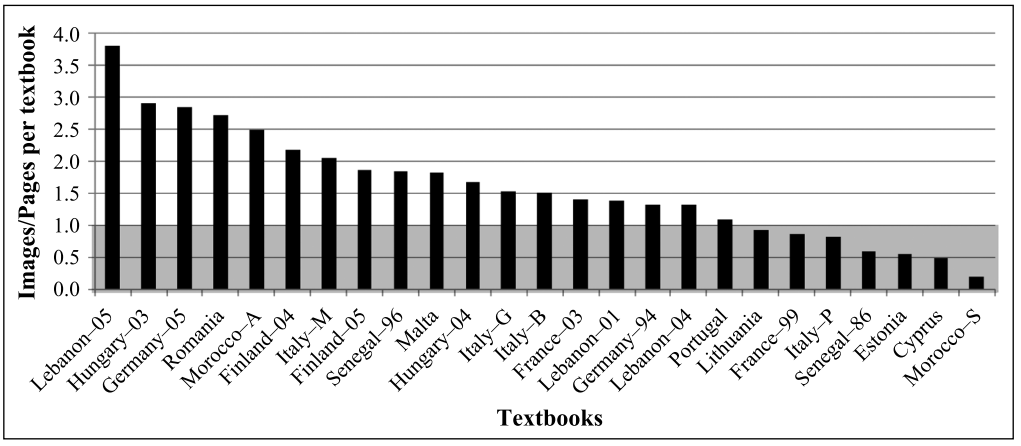

Figure 1. Proportion of the number of images and pages addressing environmental education in 25 textbooks from 14 countries

images: 3.5), whereas only seven (Lithuania, France-99, Italy-P, Senegal-86, Estonia, Cyprus, and Morocco-S) have fewer images than pages. Textbooks from different regions (WEc, EEc, and NEc) are mixed along the axes of Figure 1, showing that there is not a predominance of any region's textbooks about higher or lower I/P ratio. These results, together with those shown in Table 2, indicate that no evident tendency of any region could be found in textbooks as far as the number of pages, images, and I/P ratio is concerned.

We analysed not only the number of pages and images (Table 2 and Figure 1) but also the space occupied by images and text (Table 3). For this, we made three groups concerning the proportion of text and image per page: Group A—text surface larger than image surface; Group B—text surface equivalent to image surface; Group C—text surface shorter than image surface.

Textbooks from WEc, especially Italy and Malta, tend to have a balanced distribution among the three groups A, B, and C (Table 3). In contrast, EEc tend to have higher proportions of Group A (42% for Pollution, 56% for Use of Resources, and 33% for Biodiversity) whereas NEc have higher proportion of Group C (29% for Pollution, 29% for Use of Resources, 25% for Ecology and Cycles, and 32% for Biodiversity). These results indicate that EEc textbooks tend to have the pages occupied with more text than images, in contrast to NEc that tend to have the opposite: more images than text. The WEc distribute text and images more evenly.

Figures exemplify what the text is about and assist students in understanding and making sense. We agree with Pozzer and Roth (2003) when they say that, on one side, the use of few images (as in textbooks: Morocco-S with I/P = 0.2; Cyprus, I/P = 0.5; Estonia I/P = 0.6; Senegal, I/P = 0.6, Table 2 and Figure 1) often does not allow pupils to disclose what really matters and so the message may be missed; whereas on the other side, too many illustrations (as in Lebanon-05 textbook, I/P = 3.8;

Table 3. Proportion of text/image surface per page in each subtopic: Pollution (Pol), Use of Resources (UR), Ecological Cycles (EC), and Biodiversity (Bio)

	Pol	A	B	C	UR	A	B	C	EC	A	B	C	Bio	A	B	C
Country	***N****	%	%	%	***N***	%	%	%	***N***	%	%	%	***N***	%	%	%
Western European countries (WEc)																
Finland (2004)	**137**	45	43	12	**47**	–	60	40	–	–	–	–	–	–	–	–
Finland (2005)	–	–	–	–	–	–	–	–	**30**	–	57	43	**30**	–	–	100
France (2003)	**22**	–	100	–	**5**	100	–	–	**5**	–	–	100	**6**	–	100	–
France (1999)	**25**	40	30	30	**3**	–	100	–	**9**	–	10	90	**14**	–	55	45
Germany (1994)	**8**	–	100	–	**19**	–	100	–	**60**	–	100	–	–	–	–	–
Germany (2005)	–	–	–	–	–	–	–	–	–	–	–	–	**54**	21	32	47
Italy-G (2004)	**8**	100	–	–	**2**	100	–	–	**57**	80	6	14	**8**	83	–	17
Italy-M (2000)	**19**	50	30	20	**18**	75	—	25	**63**	50	19	31	**9**	55	27	18
Italy-B (2004)	**31**	40	30	30	**95**	54	32	14	**57**	50	27	23	**20**	58	25	17
Italy-P (2001)	**5**	60	20	20	**9**	36	18	46	**29**	18	47	35	**3**	33	33	34
Malta (1986)	**14**	67	33	–	**12**	33	–	67	**67**	66	12	22	**11**	40	40	60
Portugal (2004)	**23**	–	–	100	**8**	–	100	–	**9**	–	–	100	**5**	–	100	–
Mean WEc	**24**	34	32	18	**18**	33	34	16	**32**	22	23	38	**13**	24	34	28
Eastern European countries (EEc)																
Cyprus (1999)	**16**	80	20	–	**24**	87.5	12.5	–	**55**	100	–	–	–	–	–	–
Estonia (2002)	**13**	100	–	–	**2**	100	–	–	**10**	25	75	–	**6**	100	–	–
Hungary (2003)	**13**	–	–	100	–	–	–	–	**13**	–	–	100	**6**	–	–	100
Hungary (2004)	–	–	–		**37**	50	50	–	–	–	–	–	–	–	–	–
Lithuania (2000)	7	71	29	–	**8**	100	–		**15**	–	100	–	**1**	100	–	–
Romania (2000)	**19**	–	–	100	**9**	–	100	–	**125**	–	100	–	**195**	–	100	–
Mean EEc	**11**	42	8	33	**11**	56	27	0	**51**	21	46	17	**35**	33	17	17

Table 3. (*Continued*)

	Pol	A	B	C	UR	A	B	C	EC	A	B	C	Bio	A	B	C
Country	***N****	%	%	%	***N***	%	%	%	***N***	%	%	%	***N***	%	%	%
Non-European countries (NEc)																
Lebanon (1999)	–	–	–	–	–	–	–	–	**44**	–	–	100	**23**	–	–	100
Lebanon (2004)	**74**	–	–	100	–	–	–	–	–	–	–	–	–	–	–	–
Lebanon (2005)	**1**	–	–	100	**14**	–	–	100	–	–	–	–	–	–	–	–
Morocco-A(2005)	–	–	–	–	**29**	–	–	100	**189**	–	24	76	–	–	–	–
Morocco-S(2005)	–	–	–	–	–	–	–	–	–	–	–	–	**12**	–	75	25
Senegal (1986)	**4**	100	–	–	–	–	–	–	**58**	64	36	–	**35**	–	–	100
Senegal (1996)	–	–	–	–	**24**	–	100	–	–	–	–	–	–	–	–	–
Mean NEc	**11**	14	0	29	**10**	0	14	29	**42**	9	9	25	**10**	0	11	32

A: text surface > image surface; B: text surface = image surface; C: text surface < image surface; *Number (*N*) of images per textbook and frequency (%) of A, B, and C.

Textbook presenting the four subtopics.

Hungary-03, I/P = 2.9; Germany-05, I/P = 2.8; Romania, I/P = 2.7, Table 2 and Figure 1) may distract attention and students can miss important textual information. Therefore, a balanced presence of images should be expected in textbooks.

However, more important than a quantitative analysis of images in the text is their relevance, meaning, and implication for learning. Such qualitative approach is the matter of the subsequent analysis on human–nature relations, having in mind the five EE dimensions proposed by Sachs (1993): spatial, ecological, economical, social, and cultural dimensions.

Local and Foreign/Global Images

Images representing local and foreign environments may attract pupils' interest and challenge their curiosity and attention for the environment in general, instead of focusing only on their local, regional, or national environment. We considered an image foreign if it exhibited clearly fauna, flora, geologic, geographic, or cultural pictures from other countries or other world regions, for example, Lithuania textbooks show images from Brazil, Burkina Faso, Denmark, Great Britain, and India.

In general, greater emphasis on local images rather than on foreign or global images is given in textbooks (Figure 2): Italy-G, Senegal, Romania, Estonia, Finland, France-03, Italy-P, Malta, Morocco, Portugal, and France-99. In contrast, the Lithuanian textbook is the only one giving much higher emphasis to foreign

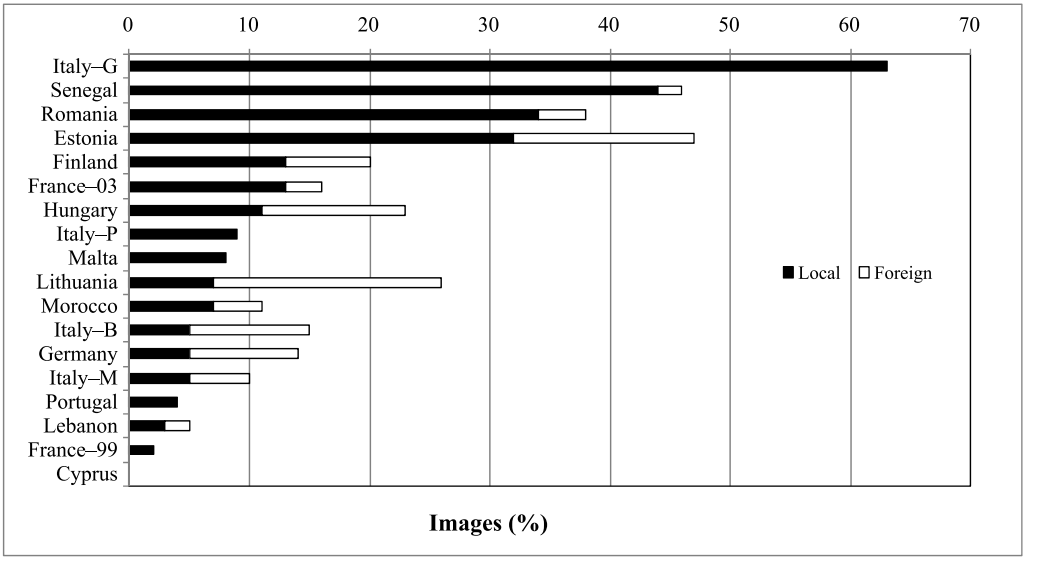

Figure 2. Proportion of local and foreign images exhibited in the four subtopics of environmental education in textbooks from 14 countries

images. The other five textbooks have an equal proportion of local and foreign/global images (Figure 2): Hungary, Germany, Italy-B, Italy-M, and Lebanon.

When mainly foreign images are shown, like in Lithuanian textbooks, pupils may get the message that these problems are not so serious in their own environment and, consequently, they may feel that the solution of these problems is of the responsibility of such faraway countries only and that they have no need for action. On the contrary, when pupils realize that the same problems facing their country (local) are evident all over the world (global), they can understand the need for coordinating efforts to provide sustainable solutions.

We think that textbooks for young people at the age of 14–16 years should present local and foreign images in a balanced way so that they get aware of a wider reaching view of the geo–socio–cultural diversity of the world. This balance between local and foreign/global images is important for pupils, since on one hand the local context 'provides the opportunity for generation of local knowledge informing and empowering action' (Gough, 2002a, p. 1212), and on the other hand 'thinking globally' allows 'knowing and caring about the global dimensions and significance of environmental problems and issues' (Gough, 2002b, p. 1218). For example, people can be educated/empowered to act at an individual level (e.g. buying a low CO_2 emission car) to contribute for the prevention of the climate change at global level (Rabinovich, Morton, Postmes, & Verplanken, 2009). The slogan 'Think globally, Act locally' used for the last three decades in EE is associated to the connections between local knowledge or experience and global needs or conditions. Different interpretations of this 'thinking globally' has been a matter of deep analysis by several authors (Gough, 2002a, 2002b; Yencken, 2000), which goes beyond the scope of the present work.

Urban/Rural and Nature Images

We found that urban and rural pictures in textbooks often convey human effects on ecosystems. In contrast, nature is usually presented in the absence of humans, not only in wilderness but also in town green spots and villages, such as public gardens and farms.

Results showed a strict cultural difference between textbooks from all WEc and those from EEc and NEc as far as the presence of urban/rural images versus nature images are concerned. The former countries exhibit more images of urban/rural landscape rather than nature (Figure 3): Italy-G (urban/rural images 61 more times than nature), France-03 (1.1 more times), France-99 (11.5 more times), Malta (3.2 more times), Italy-M (5.6 more times), Portugal (3.3 more times), Italy-B (1.2 more times), Finland (1.1 more times), Italy-P (1.1 more times), Germany (4.0 more times).

In contrast, EEc and NEc present more images showing nature than urban/rural landscapes: Romania (nature 28 more times than urban/rural images), Senegal (15 more times), Estonia (8 more times), Morocco (15 more times), Lithuania (1.5 more times), and Hungary (1.1 more times) (Figure 3).

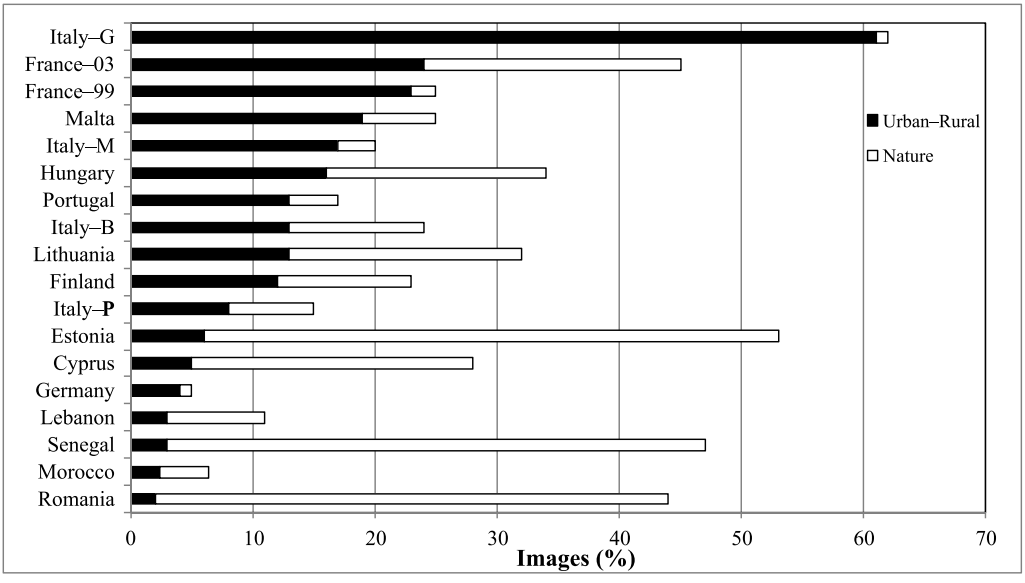

Figure 3. Proportion of urban/rural and nature images exhibited in textbooks from 14 countries

The above-mentioned disproportions of images in textbooks can shape public opinion that nature (predominant in textbooks of EEc and NEc) is the opposite to socio-economic development (European countries) and, as noticed by Rehmann-Sutter (2000), can promote the idea that nature exists and develops by itself without intervention of human beings.

Negative Impact, Human Management and the Beauty of Nature

Images could be classified in four categories: (1) negative impact, images showing environmental damages caused by humans; (2) human management, images showing humans' supervision and improvement of the environment; (3) beauty of nature, images conveying aesthetics messages and expressing implicitly the importance of protecting nature; and (4) neutral images, those images that do not transmit any of the above ideas.

Textbooks of WEc show a large proportion of negative impact (NI) plus human management (HM): Italy-G, France-99, Portugal, Malta, Italy-M, France-03, Germany, Italy-P, and Italy-B (Figure 4). Together, these pictures express the message of the human power over the environment, in both negative and positive senses.

Human management is absent in textbooks from Lithuania, Cyprus, Morocco, and Italy-P expressing only the negative human influence (Figure 4). In these cases, pupils can interpret it as alarming messages suggesting that the environmental disturbance is so deep that this trend cannot be reversed and that humans can do very little or nothing for improving the situation. Images that showed the beauty of

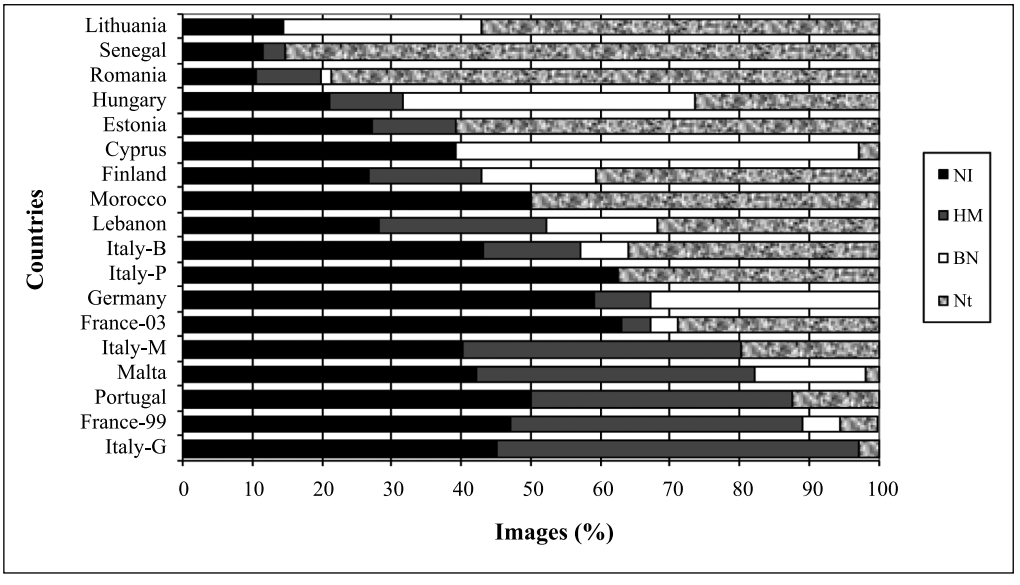

Figure 4. Proportion of the nature and humans in the images of subtopics
Note. NI—Images illustrating the *negative impact* by humans; HM—Images illustrating *human management* of the environment; BN—Images emphasizing the *beauty of nature*; Nt—*Neutral* images

nature (BN) and neutral images (Nt) are dominant in textbooks of Senegal and some EEc: Lithuania, Romania, Hungary, Estonia, and Cyprus (Figure 4).

These results show that textbooks from WEc express an anthropocentric view of environment, highlighting the capability of humans to use and control natural processes in a desirable direction (Salīte, 2002), contrasting with EEc and NEc which tend to show the environment more associated to the beauty of nature, with little human influence.

Men and Women in Images with Negative and Positive Impact

The gender issue must be viewed within a sustainable community where the self-determination of women, as well as men, is important for the well-being of human societies within the well-being of the entire Earth community (UNESCO, 2003). In this study we looked at the presence of humans in EE images, looking particularly at the presence of men and women in negative and positive impact images. Negative images are those referred to above (showing environmental damages caused by humans), positive images are those showing environmental improvement and well-being.

In general, people do not appear frequently in EE images. From a total of 2,136 images, men could be found in 157 images (7.4%) and women in 134 (6.3%), the difference between groups being not statistically significant (t-test: $p > 0.05$). Similarly, there were no significant differences ($p > 0.05$) between the presence of men

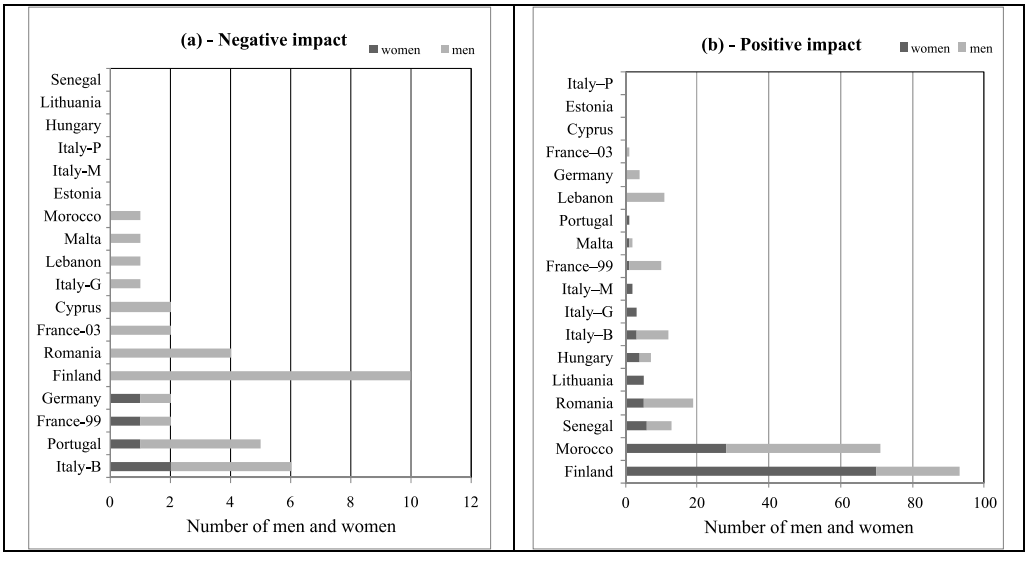

Figure 5. Number of men and women exhibited in images with negative impact (a) or positive impact (b) of textbooks from 14 Countries
Note. the scales are different

(125 occurrences, 5.8%) and women (129 occurrences, 6.0%) in positive impact images. In contrast, considerably less persons could be found in negative impact images and significant differences could be found between gender groups ($p < 0.05$), being more men (32, 1.5%) than women (5 occurrences, 0.4%), transmitting the idea that males, rather than females, are associated to the negative actions towards the environment.

There are some images where persons appear as victims of the degradation of the environment, images exhibiting children playing in nearby polluted rivers or next to dirty and polluted areas of chemical factories.

However, most images expressing the human negative impact on the environment do not include people but only machines and polluted areas, as in the textbooks from Senegal, Lithuania, Hungary, Italy-P, Italy-M, and Estonia (Figure 5a).

Interesting is the case of the Finish textbook that for the negative impact images showed only men (10 occurrences, Figure 5a) whereas for the positive impact showed more women (70 occurrences) than men (23 occurrences) (Figure 5b). Women in negative impact images were found only in WEc textbooks: Italy, Portugal, France-99, and Germany (Figure 5a).

In contrast to NEc, in European (both WEc and EEc) a higher presence of women than men in some pictures could be found: Finland, Lithuania, Hungary, Italy-G, Italy-M, Malta, and Portugal (Figure 5b).

The fact that men are strictly more frequently presented in negative impact images and women in positive impact ones shows a clear association with the social

representation of men and women in society: men with the male active role in society and women with a contemplative view of the beauty of nature.

General Remarks and Conclusions

The analysis of EE images in textbooks of 14 countries enabled us to distinguish some trends between Western and Eastern European countries and NEc. Although no differences could be found in the number of pages, of images, and in I/P ratio between textbooks of the various regions, EEc textbooks tend to have the pages occupied with more text than images, in contrast to NEc that tend to have the opposite, more images than text. The WEc distribute text and images more evenly.

In contrast to the textbooks from Eastern and non-European countries, which tend to show the beauty of nature with little human influence, Western European textbooks tend to exhibit more images of urban/rural landscape (rather than nature), of human negative impact and of human management, expressing an anthropocentric view about the environment and highlighting human power over it, either in destroying and consuming resources (negative impact) or improving the environment by managing it (positive impact).

Men are usually more present in textbook images than women. However, some images exhibiting more women than men could be found in textbooks from WEc and EEc, but never in NEc. In negative impact pictures, men are more often present than women, but non-European women are never present in such images. Women are more frequent in positive impact images than men.

In brief, this study on textbooks addressed to 14–16-year-old pupils suggests that most countries should introduce a better balance between local and global images. Textbooks from EEc and NEc should give more emphasis to both human management and urban/rural images whereas those from WEc should pay attention to the beauty of nature. Furthermore, a balance in the presence of men and women in images (either with negative or positive impact) should be a matter of greater concern by all textbook authors and publishers.

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Appendix. List of Analysed Textbooks

N	Country	Pupils' age	Author(s)	Title	Publisher	Year
1	Cyprus	16–17	Michaelides, A. et al.	Επιστήμη του περιβάλλοντος (Environmental science).	Ministry of education— Cyprus.	1999
2	Estonia	14	Martin, M.	Bioloogia põhikoolile III (Biology for primary school III).	AS BIT	2002
3	Finland	15–19	Happonen, P., Holopainen, M., Sotkas, P., Tenhunen, A., Tihtarinen-Ulmanen, M., & Venäläinen, J.	Bios 1: Eliömaailma (Bios 1: The world of living organisms).	Aalto, V./ WSOY.	2005
4	Finland	15–19	Happonen, P., Holopainen, M., Sotkas, P., Tenhunen, A., Tihtarinen-Ulmanen, M., & Venäläinen, J.	Bios 3: Ympäristöekologia. (BIOS 3: Environmental Ecology).	Aalto, V./ WSOY.	2004
5	France-03	14–15	Chapron, G., Charles, M., Duco, A., Grandouillet, D., Guibert, S., & Schmidt, F.	Sciences de la vie et de la Terre 3^{e}. (Life and Earth Sciences 3^{e}).	Belin.	2003
6	France-99	14–15	Tavernier, R. & Lizeaux, C.	Sciences de la vie et de la Terre 3^{e}. Life and Earth science 3^{e}).	Paris: Bordas	1999
7	Germany	13–14	Bonora,V., Dieterle, A., Görz, G., Gotzler, H., & Libera, W.	Natura 8—Biologie für Gymnasien Bayern (Nature 8—Biology for grammar school, Bavarian edition).	Stuttgart: Ernst Klett Schulbuchverlag GmbH.	1994
8	Germany	14–15	Bonora, V., Dieterle, A., Görz, G., Gotzler, H., & Libera, W.	Natura 9. Jahrgangsstufe, Biologie für Gymnasium Bayern. (Nature 9, biology for grammar school, Bavarian edition).	Stuttgart: Ernst Klett Schulbuchverlag GmbH.	2005
9	Hungary	13–14	Gyuláné, A. & István, F.	A távoli tájak élovilága és az élolények rendszere. (Fauna and flora of far lands and system of the living beings).	Dr. Paál Tamásné.	2003
10	Hungary	16	Makádi, M. & Taraczközi, A.	A Föld, amelyen élünk. (Earth, where we are living).	Hungary.	2001

Appendix. (*Continued*)

N	Country	Pupils' age	Author(s)	Title	Publisher	Year
11	Italy-G	14–17	Gainotti, A. & Modelli, A.	Biologia—Diversità e unità dei viventi Mod A–D (Biology—Difference and unity of the living Mod A–D)	Zanichelli	2004
12	Italy-M	14–17	Miller, K. R. & Levine J.	Il mondo della natura. Il punto di vista della Biologia V ol A-F (The world of the nature. The point of view of the biology)	Edizioni scolastiche, Bruno Mondadori	2000
13	Italy-B	14–17	Boschetti, M. & Fedrizzi, E.	Nuovo Ecosistema Terra. Vol. SA ((New Earth ecosystem. Vol. SA)	Minerva italica	2004
14	Italy-P	14–17	Piseri, A, Poltronieri, P., & Vitale, P.	Vivere. Percorsi modulari di Biologia. Vol.B. I viventi nell'ambiente (To live. Modular Units of Biology. Vol. B. Living beings in the environment.)	Loescher	2001
15	Lebanon	16	Dagher, J., Hajjar, Z., Safi, S., & Sabeh, M.	Life science (science section).	CNDPR.	1999
16	Lebanon	15	Jammal, N., Dagher, J., Ghorayeb, L., Hajjar, Z., Hossari, A., Sabeh, M., & Shbaro, C.	Life science.	CNDPR.	1998
17	Lebanon	14	Lebdeh, D.A., Dakrauh, R., Seif, N.A., & Jarjou, Z.G.	Life and earth sciences.	CNRDP.	2000
18	Lithuania	15–16	Price, G. & Taylor, J.	Biologija. (Biology).	Vilnius: Alma Littera.	2000
19	Malta	13–16	Mackean, D. G.	GSCE biology.	GSCE	1986
20	Morocco-A	15–16	Addak, A., Hamid, A., Hamouch, A., Belaamiri, M., Assassi, N.E., & Jabbar, B.	منهل علوم الحياة و الارض (Almanac in the life and earth sciences)	IMARSSI, arts du 21° sciecle.	2005

Appendix. (*Continued*)

N	Country	Pupils' age	Author(s)	Title	Publisher	Year
21	Morocco-S	15–16	Sadki, A., Mokhlis, A., Elhodaigui, M., Elouardi, M., Khwadji, A., Benabboud, J., Ahguig, A., Bry, M.	المفيد في علوم الحياة و الأرض الجدع المشترك العلمي (The interesting in live and earth sciences)	Dar Attakafa Casablanca	2005
22	Portugal	14–15	Dias da Silva, A., Gramaxo, F., Santos, M. E., & Mesquita, A. F.	Terra, Universo de Vida—2ª Parte. (Earth, Universe of life—2ª Part).	Porto Editora.	2004
23	Romania	14–15	Mihail, A. & Mohan, Ghe.	Biologie—Manual pentru clasa a VIII-a (Biology—Textbook for the 8th class).	Bucuresti: Editura All.	2000
24	Senegal	17–18	Djakou, R. T. & Thanon, S. Y.	Ecologie–Géologie–Afrique intertropicale (Ecology–Geology–Inter-tropical Africa).	Paris: Bordas.	1986
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