Science Textbooks Analysis For Environmental Education

Hikmet SÜRMELİ[1], Mehtap YILDIRIM[1], Fatma ŞAHİN [2]

Abstract

Environmetal issues and problems getting raise and changing in recent years. Students need to be educated to be conscious, sensbile about these issues. Environmental education has an important role to reach this mission. To give an effective environment education school science textbooks are major sources for teachers and students.

The purpose of this study is to investigate the environmental issues in science texbooks visually and conceptually. This study include content analysis of which concepts were presented and how visuallity extent in science texbooks used in grade 6-8 in the last three science and technology curriculum. For the results, number of concepts and percentages of pictures were calculated and implications were done.

Key words: Science eucation, environmental education, science textbooks

Özet

Son yıllarda çevresel konular ve problemler giderek artmaktadır. Öğrencilerin bu konularda bilinçli ve duyarlı olmaları için eğitilmeleri gerekmektedir. Çevre eğitiminin bu misyonu gerçekleştirmede önemli bir rolü vardır. Etkili bir çevre eğitimi vermek için ders kitapları öğretmenler ve öğrenciler için temel kaynaklardır.

Bu çalışmanın amacı fen dersi kitaplarındaki çevre konularının görsel ve kavramsal olarak araştırılmasıdır. Bu çalışma, son üç Fen ve Teknoloji müfredatında 6-8'inci sınıf fen

[1]Research Assistant, Marmara University, Ataturk Educational Faculty, Department of Primary Education

[2] Professor, Marmara University, Ataturk Educational Faculty, Department of Primary Education

kitaplarında hangi kavramların yer aldığı ve görselliğin ne kadar verildiğinin analizini içermektedir. Sonuçlar için, kavramların sayıları ve resimlerin yüzdeleri hesaplanmış ve yorumlanmıştır.

Anahtar kelimeler: Fen eğitimi, çevre eğitimi, fen kitapları

I. INTRODUCTİON

The importance of teaching environmental issues within science curriculum is getting more important. As human beings are within a struggle in the environment causes certain environmental problems, it is important having conscious individuals in solving such problems. Erol (2006) suggested that the easiest way to cope with the changing environmental conditions and environmental problems is that growing up sensible generations about environmental problems. This may be possible with an effective environmental education (Alım, 2006). Many studies have suggested that environmental education enhances critical-thinking, problem-solving, and effective decision-making skills (Disinger, 1983; Ramsey, 1993). Oğuz et al (2004) stated effect of environmental education. According to their views education *about* the environment concerns the cognitive understanding including the provision of information on environmental issues and the teaching of appropriate technical and intellectual skills; education *in* the environment constructs real-life situations based on inquiry learning; education *for* the environment promotes well-being as its goal. In addition to these views environmental education offers a conceptual richness. It introduces not only new science subject matter but also new and useful social and cognitive skills (Ramsey, 1993). Moreover environmental education can be a tool to shape social responsibility and thus it can be the bridge between science education and social responsibility (Oğuz et al., 2004).

It is important to make students gain an awareness of important environmental concepts and become aware of their social environment. Researchers suggested that students should obtain these awareness in their primary education (Alım, 2006; Görümlü, 2003). One of the research findings suggested that the successful integration of ecology and social studies in sixt grade programme offers students a chance to become aware of themselves and their immediate surroundings, both in the classroom and in the community (Crippen, 1971). Yılmaz et al (2002) suggested that environmental education should be provided to the students at all educationel levels. The important information they suggested for students are environmental facts, their contribution to environmental problems and also of the steps to be followed to save the nature requires, the studies regarding the current knowledge levels of the students on the environment. However, according to these reseachers studies' results with secondary school and university students in order to determine the knowledge levels of students, environmental education was not sufficient. Another research results support these finding. The results of this study showed that the primary school students' had misconceptions in their minds concerning greenhouse effects (Bozkurt and Cansungu, 2002).

Textbooks have become one of the main resources for what is taught in schools and how science is delivered. Textbooks can be accompanied by supplementary materials such as educational software, teachers' manuals, and other curriculum materials (Hooghoff, 1993). Researchers defined the lists of important items that commities use in science textbook selection include such items as content accuracy, clear definition of terms, end of chapter questions, pictures and diagrams, in-text laboratory activities (Chiappetta, Sethna & Filman, 1993).

Science texbooks are teaching aids and they often form the topic outline of the curriculum and contain significant amount of the information addresses in the classroom (Chiappetta et al,

1993). Studies on science textbooks showed that mathematics and science classes and the way that they are taught are enormously influenced by textbooks (Budiansky, 2001; Holliday, 2003). Most of the teachers use textbooks as their primary source of curriculum and lessons. Especially, new teachers use this assigned textbook as their content outline and story line for their courses (Chiappetta et al, 1993).

As environmental education has an importance for science courses, science textbooks have an importance for effective environmental education in science lessons. Therefore to present environmental issues more effectively science textbooks' visual and conceptual frame is also importants. However, in their studies Hamm and Adams (1989) found that less than 2% of sixth and seventh grade science textbooks contain content that dealt with environmental issues.

In the last 15 years Turkish primary science curriculum has been changed three times. During this time environmental issues and problems were raised and changed al over the world. On account of environmental issues are presented in the science textbooks in Turkey, it is important to find whether presenting environmental issues were changed conceptully and visually in these textbooks.

II. METHODS

The purpose of this study is to investigate the environmental issues in science texbooks visually and conceptually. This study include content analysis of what concepts were presented and how visuallity extent in science texbooks used in grade 6-8 in the last three science and technology curriculum.

- Which concepts about environmental education are available in grades 6-8 science texbooks used for 1992, 2000, 2004 curriculum?

- How visuality extent about environmental education in grades 6-8 science textbooks used for 1992, 2000, 2004 curriculum?

In this study for data colection science textbooks in grade 6-8 were used. Textbook were chosen considering 1992, 2000, 2004 science and technology education curriculum. For each curriculum three science textbooks (used in 6, 7, 8 grades) were chosen recommended by Ministry of Education. The textbook analysis were done in two sections. In the first section, textbooks were analysed according to number of concepts related to environmental education such as environmental problems, air pollution, ecosystem, protection environment etc. The number of concepts concerning environment in each textbook were counted. In the second section to determine visual frame of textbooks, figurative typology generated by Clément was used (Clément 1996, citation, Yıldırım, 2007). Using this typology extent of pictures related to environmental education were measured to find their covering area. After finding percentages and calculations, results of the textbook assessment were transferred into tables and interpreted.

III. FINDINGS

a.The results of concept analysis

Science textbooks were analysed according to number of concepts related to environmental education. The results of these analysis shown below.

Table.1. The frequency of concepts related with environmental issue in 1992, 2000 and 2004 science textbooks

Concepts	Ferequency		
	1992	2000	2004
Environmental problems			
Environmental pollution			
Protection of environment			
Unpolluted environment			
Air pollution			
Water pollution			
Soil pollution			
Destruction of forest			
Sound pollution			
Ecosystem			
Biological diversity			
Population			
Habitat			
Species			
Food chain and Food net			
Extinction of organisms			
Avalanche			
Nuclear waste and nuclar pollution			

Scale	
0	
1-5	
6 -10	
11-20	
21-30	
31 -40	
40 and plus	

According to the table 1, among the science textbooks (grade 6,7,8,) prepared for 1992 curriculum, it was found that *air pollution* and *ecosystem* (with 21-30) are the most mentioned concepts. However, it was also found that the concepts of *unpolluted environment*, *destruction of forest, sound pollution, extinction of organisms, biological diversity, habitat, population, species, nuclear waste and nuclear pollution* and *avalanche* are not mentioned in these textbooks.

It can be seen from this table (1) that in the grade 7 science textbook prepared for 2000 curriculum the most frequently mentioned concept is *ecosystem*, the second one is *species* and the third one is *environmental problems*. Besides, the concepts of *destruction of forest, unpolluted environment, population, habitat, avalanche, nuclear waste* and *nuclear pollution* are not mentioned in this textbook.

Similarly, as can be seen from the table, in the (grade 7) science textbook prepared for 2004 curriculum the most frequently mentioned concept is also *ecosystem*. On the other hand, second and the third mostly mentioned concepts are *biological diversity* and *environmental problems.* In contrast, the *concepts of avalanche* and *nulear waste* are not mentioned in this textbook.

From the results of this table, it was found that, in science textbooks prepared for 2004 curriculum the concept of *environmental problems* mentioned more frequently than science textbooks prepared for 2000 and science textbooks prepared for 1992 curriculum. Compared with 2000 and 1992 curriculum, in the 2000 science textbooks the concept of *environmental problem* is more frequently mentioned. However, the concept of *environmental pollution* has the same frequency in science textbooks prapered for 1992 and 2000 curriculum, but it is one of the least mentioned concept in science textbook prepared for 2004. In contrast, the concept of *environmental protection* is the most mentioned concept in science textbooks prepared for 2004 curriculum, it is the least mentioned concept in science textbook prepared for 1992 curriculum. It is also slightly mentioned in science textbooks prepared for 2000 curriculum. The concept of *unpolluted environment* is less mentioned in science textbooks prepared for 2004 curriculum but is is not mentioned in science textbooks prepared for 1992 and 2000 curriulum. *Air pollution* is the most mentioned concept in science textbooks prepared for 1992 curriculum, however comparing with 2000 curriculum, it is mentioned more frequently in

science textbooks prepared for 2004 curriculum. Similarly, water and soil pollution are the most mentioned concept in science textbooks prepared for 1992 curiculum, however the frequency of this concept is same in science textbooks prepared for 2000 and 2004 curriculum. On the other hand concept of forest destruction is slightly mentioned in curriculum in science textbooks prepared for 2004 curriculum, but it is not mentioned in science textbooks prepared for 1992 and 2000 curriculum. *Sound pollution* is also not mentioned in science textbooks prepared for 1992 curriculum and it has the same frequency in science textbooks prepared for 2000 and 2004 curriculum. Concept of *ecocystem* is most mentioned in science textbooks prepared for 2000 and 2004 curriculum, but it is slightly mentioned in 1992 curriculum. *Biological diversity* is the most mentioned concept in science textbooks prepared for 2004 curriculum, it is also slightly mentioned in 2000 curriculum, but it is not mentioned in 1992 curriculum. Similarly *population* and *habitat* are the most mentioned concepts in science textbooks prepared for 2004, but it is not mentioned in 1992 and 2000 curriculum. Species is also the most mentioned concept in 2004 curriculum, it is slightly mentioned in 2000 curriculum but it is not mentioned in 1992 curriculum. Food chain and food net are the most mentioned concepts in 2004 curriculum, it is slightly mentioned in 2000 and 1992 curriculum. The concept of extinction of organisms is mentioned in 2004 curriculum, it is slightly mentioned in 2000 curriculum but it is not mentioned in 1992 curriculum. Similarly, avalanche, nulear waste and nuclear pollution concepts are slightly mentioned in 2004 curriculum but is not entioned in 1992 and 2000 curriculum.

b. The result of picture analysis:

For each curriculum pictures, photographs and drawings related to environmental issues were determined from the science textbooks and surface of each picture was calculated. Pictures were examined under four main concept which were; scenic, biological diversity,

pollution and problems and environmental protection. The result of the picture analysis are shown in Table 2 and Table 3.

Table. 2. Ratio of pictures related to environmental issues in science textbooks

	Total number of pictures, percentage, Surface area (cm^2)			Photograph		Drawings	
Programme	Number	%	Total surface area in unit (cm^2)	Number	cm^2	Number	cm^2
1992	25	23	1986,25 cm^2	10	851,5	15	1134,75
2000	80	27,40	3774,55 cm^2	69	295,8	11	816,75
2004	41	25,25	1890,25 cm^2	35	1702,75	6	187,5

Table.3. Ratio of pictures related to environmental issues in respect to main concepts

	Scene		Biological diversty		Pollution and problems		Environmental protection	
Program	Number (P/D) *	%	Number (P/D)	%	Number (P/D)	%	Number (P/D)	%
1992	2(1/1)	12	3(0/3)	6,18	18(7/11)	69,20	2(2/0)	12,53
2000	9(7/2)	11,88	36(30/6)	47,80	28(26/2)	32,03	7(6/1)	8,30
2004	5(5/0)	30,63	22(16/6)	57,76	14(14/0)	11,61	-	-

* P: Photograph D: Drawing picture

As can be seen from the table 1, there are 25 pictures related to environmental issues in 1992 programme. These pictures have 1986,25 cm^2 (%23 part) area in total surface area of units related to environmental issues. According to this table, these 25 pictures include 15 photographs and 10 drawing. It can be seen from the table 2 that, %12 of these pictures is about scenery, %6.1 is about biological diversity, %69.2 is about environmental problems and environmental pollution and %12.5 is about environmental protection.

According to table 1, there are 80 pictures related with environmental issues in 2000 programme. These pictures have 3774.5 cm2 (%27.4) area in total surface area of units related to environmental issues. These 80 pictures include 69 photographs and 11 drawing, thus it can be said that for this programme photographas were prefered to teach environmental issues. In this programme the most illustrated concept is about biological diversity (%47.8) with 30 photographs and 6 drawing pictures. It is followed with the concepts of environmental problems and pollution (%32) with 26 photographs and 2 drawing pictures, scene (%11.8) with 5 photograhps and 2 drawing, environmental protection (%8.3) with 6 photographs and 1 drawing.

From the table 1, it can be seen that, there are 41 pictures related with environmental issues in 2004 programme. These pictured have 1890,25 cm^2 (25.2) area in total surface area of units. These 41 pictures include 35 photographs and 6 drawing. Among these pictures, the most illustrated concept is biological diversity (%57,7) with 16 photographs and 6 drawing. It is followed with the concept of scene (%30.6) with 5 photographs and environmental problems and pollution (%11.6) with 14 photographs (Table.2). In contrast to 1992 and 2000 programmes, the concept of environmental protection is not mentioned in this programme.

IV. DISCUSSION AND CONCLUSION

In this study it was aimed to evaluate environmental issues in science textbooks prepared for 1992, 2000 and 2004 curriculum visually and conceptually. From the results of this study it was found that the most frequenty mentioned concept among the science textbooks prepared for 1992, 2000 and 2004 curriculum was *ecosystem*. Besides this concept *air pollution* is also mentioned frequently in science textbooks prepared for 1992 curriculum

When the textbooks evaluated in terms of other concepts determined for this study, it was found that frequency of concepts were mentioned differently in science textbooks prepared for 2004 programme.

Comparing other science textbooks prepared for programmes, more concepts were mentioned related with environmental issues in science textbooks prepared for 2004 programme. It can be said that, while the concepts of environmental problems, environmental protection, biological diversity, population, habiat, food chain and food net, extinction of organisms were quiet more mentioned in 2004 programme, same concepts were mentioned fewer in 1992 and 2000 programmes. In contrast, it was found that the concept of air pollution was more mentioned comparing with other concepts in 1992 programme. Beside other concepts, the concepts of avalanche, nuclear waste and nuclear pollution were mentioned in 2004 programme. Thus it can be said that, with this programme the concepts related to enviromental issues were incerased and new concepts were added. However, greenhouse effect which one of the most environmental problem in recent years was not mentioned in this programme and this can be cause misconceptions for students. Bozkurt and Cansungun (2002) was also determined that in 2000 programme information about the issue of greenhouse effect was given in a limited way. Comparing with other programmes, it can be said that 2004 programme can be beneficial for teaching with increasing number of environmental concepts.

Textbooks have an important role for science teachers, because these books include outline of curriculum and they include an important information given in the classrooom. Therefore so many science teachers prefer to use these books in their courses (Chiappetta, Sethna ve Filman, 1993). Considering this, environmental concepts are getting important for science textbooks. Oğuz (2004) tried to find concepts related with environmental issues in 22 grade 6-12 textbooks, issues. In this study, he searched dictionary, page number that include concepts

and activities related with environment issues, and determined that the most frequently mentioned concept was erosion and the least mentioned concept was war technology and he found that textbooks included limited information about environment. In our study, it is satisfactor y that concepts related with environmental issues were getting increased.

Kılıç (2005) argued that textbooks should have visually and conceptually efficient qualification to implement their function for school teaching and pictures, schemas, questions, synopsis and homeworks are increased textbooks' usefulness. In our study, it was found that the ratio of pictures reated to environmental issues were more mentioned in textbooks prepared for 2000 programme in comparison with 1992 and 2004 programme. However, the ratio of pictures related to environmental issues were increased in textbooks prepared for 2004 programme comparison with 1992 programme. In textbooks prepared for 1992 and 2000 programme, it was preferred drawing pictures to photographs. However, in textbooks prepared for 2004 programme it was preferred photographs to drawing pictures.

Sahin and Yıldırım (1999) argued that textbooks shoud have include pictures, graphics which show the topic, should have attraction and so they must support with colourful pictures and photographs. By considering this, it can be said that textbooks prepared for 2004 programme is rich visually and thus it can contribute science instruction.

Pictures examined in this study gathered in four main concepts which were scenic, biological diversity, environmental problems and environmental protection. It was found that in 1992 programme the most frequently covered picture was related with environmental problems and the least covered picture was related with biological diversity. However, it was found that 2000 and 2004 programmes while pictures related with biological diversity was covered more than others, pictureres related with environmental protection was covered less.

In textbooks prepared for 2000 programme, while pictures related to environmental protection were covered with least ratio, in 2004 programme pictures related to this concept was not covered. Whereas, one of the characteristics of a book is pictures in it (Chiappetta, Sethna ve Fillman, 1993) and for effective science teaching visuallity is important. Considering this point, it can be said that, in 2004 programme, pictures related with environmental protection may be included in textbooks. In a study, it was found that university students could not understand environmental issues precisely, they did not have enough knowledge about environmental pollution and they obtained their environmental knowledge from visual and written resources (Yılmaz, et al. 2002). Another study revealed the fact that primary school students did not have enough knowledge about environment education (Morgil, Yılmaz, ve Cingör, 2002).

From the results of this study it was found that comparing with the 1992 and 2000 curriculum, in 2004 curriculum it can be said from the science textbooks that concepts related to environmental issues have been increased, and visuallity has been extended. However there are still conceptually and visually deficiency in this science textbooks. Considering importance of primary school level, and the results of this study, primary school science textbooks have an important role describing environmental issues and understanding their solutions, therefore it is necessary to emphasize contents visually and coneptully sufficiently in these textbooks.

V. RECOMMENDATION

From the results of this study it was recommended that;

- ✓ Environmental education should be given as a separate course rather than taught in science course

- ✓ Students should be taught curent environmental issues, problems and to give students concepts related with their solutions and preventions, environmental education should be built on current environmental problems and solutions.
- ✓ Textbooks should be prepared considering the harmony between pictures and contents.
- ✓ To make pictures more convincing and effective textbooks should include photographs rather than drawing pictures.

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