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A Comparative Study of the Subjects on Ecosystem, Biological Diversity and Environmental Problems in Turkish Science Curriculum with the International Curricula *

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ABSTRACT

In this study, Turkey's Science Curriculum 2013 was compared with that of the other countries (England, Ireland, Finland, Canada, New Zealand, and USA (New Jersey and Massachusetts)) that produced above the average results in TIMSS (1995, 1997, 2003 and 2007) exams in subjects on Ecosystem, Biological Diversity, and Environmental Problems. In terms of vision, the curricula of Finland and England lay greater emphasis on the 'environment'. "Technology-society-environment" relations are emphasized in only Turkey's Curriculum. Understanding and discovery of the natural world, gaining environmental knowledge, and man-environmental relations are included in Turkey's curriculum in terms of aims. Besides, there has been an emphasis on the development of sustainable natural resources in Turkey's curriculum; whereas biological diversity is excluded just as in the curricula of Finland, England, New Zealand, Ireland, and New Jersey. The goals related to the man-environment interaction are included in the curricula of Turkey; whereas, those related to the mutual relationship between other living things are not considered. This indicates that Turkey's curriculum is anthropocentric. There have been variations in the composition of curricula of different countries compared with Turkey's curriculum, in terms of organization of the subjects such as ecosystem, biological diversity, and environmental problems. There is no separate course in Turkish curriculum as in Finland, and no different learning strand as in the science curriculum of Ireland and New Jersey province of the USA. In the curricula under study, while there is one subject in a country's curriculum, others may not have the same. Some of the countries determined the topics by giving importance to their local needs or adopted approaches that prevent learning environment as an integrated and universal subject. In order to overcome these deficiencies, it is imperative to design a universal environmental education.

Keywords: Science Curriculum, Environmental Education, Comparative Study, Ecosystem, Biological Diversity, Environmental Problems

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INTRODUCTION

The environment is one of the most vulnerable factors because of the continuous interaction between man and other living and non-living things. It is very crucial to protect the nature from the exploitations of human beings and other creatures that share the life together (Kiziroğlu, 2001). There are serious problems that arise due to the unethical exploitation of the nature by human beings, just for their benefits. Nature has an inherent ability to renew itself; and ecological problems that are understood lately have even existed centuries ago (Kocataş, 2010).

Environmental problems and their effects first gained prominence and subsequently entered the agenda of politicians, educators, and scientists in the 1970s, and gained international extent in the United Nations Human's Environment Conference held in Stockholm in 1972. To develop environmental education, UNESCO conducted a study in 136 countries, to gather essential information in 1975. Thus, environmental education was discussed in a global extent. This study asserts that environmental education is insufficient both in terms of quantity and quality. After these investigations, International Environment Education Program (IEEP) was devised with the help of UNESCO and United Nations Environment Programs' (UNEP) collective study. "Intergovernmental Environmental Education Conference", with the cooperation of UNESCO and UNEP, was held in Tbilisi, in 1977. In this conference, environmental education's quality, aims, and pedagogic aspects were determined, both at the national and international level (Ünal & Dımışkı, 1999).

According to Tbilisi Declaration (1977), environmental education should provide information and awareness about the environment in society, developing positive attitudes toward the environment, both understanding and developing skills for solving environmental problems and at the same time actively applying these solutions. The European Union Council (1988) asserted that the environmental education should aim to raise awareness in the society about the problems in this field and also potential solutions and active involvement of individuals in protecting environment and being sophisticated in using natural resources carefully and rationally. European Parliament supported this approach by emphasizing the role of schools and teachers in the application and development of education and policies at all levels containing environmental aspects of all the fields in 1993 (Stokes, Edge & West, 2001). All these developments made the environmental education to be introduced in the curricula from the early stages and put it into application.

In the Countries of European Union, environmental education is taught as a separate lesson at the primary levels (Belgium- Flemish Region, Finland, France, Greece, and Spain) or as a part of another lesson, mostly as a science lesson, (Belgium-Flemish and Wallonia Regions, Denmark, Spain, France, Greece, Ireland, Luxemburg, Holland, Portugal, Sweden, England, and Scotland) or as an interdisciplinary theme (Austria, Germany-Bavaria and Thuringia Districts, Denmark, Finland). In some countries, more than one approach is used simultaneously (Stokes, Edge & West, 2001). In the elementary curriculum, there is no elective or compulsory lesson under the name of environmental education, however, in the secondary curriculum there is only an elective lesson in Turkey. Environmental education is taught with several objectives in different units of biology, social studies, and science lessons.

Teaching the subjects, with greater emphasis, of ecosystem, biodiversity, and environmental problems which is the basic concept of the environmental education, should be undertaken as science lessons. The structure of science curricula and the importance of its teaching vary from country to country. For example, in Finland, a frame curriculum is prepared containing the general terms of a subject under the name of "National Core Curriculum" for the elementary level. Science lessons in this frame curriculum are given the following names: for grades 1-4, "Environmental and Natural Studies"; for grades 5-6, "Biology and Geography", "Physics and Chemistry"; for grades 7-9, "Biology",

"Geography", "Physics", and "Chemistry" (Finnish National Board of Education, 2004). However, in Irish program it has been observed that history, geography, and science curricula are organized under the name of "Social, Environmental and Scientific Education". In this integrated curriculum, even science, history, and geography are taught separately; and there is an emphasis to maintain coherence (Ireland National Council for Curriculum and Assessment, 1999). The science curriculum of New Jersey, USA was prepared based on "National Science Education Standards" (New Jersey Department of Education, 1998). The curriculum of Massachusetts, USA is called as "Science and Technology/Engineering Curriculum Framework" (Massachusetts Department of Education, 2006).

The studies show that students' conceptual understanding (Adeniyi, 1985; Aydın & Coşkun, 2010; Brehm, Anderson & DuBay, 1986; Boyes & Stanisstreet, 1997; Boyes & Stanisstreet, 2001; Boyes, Stanisstreet & Papantoniou, 1999; Bozkurt & Cansüngü, 2002; Griffiths & Grant, 1985; Hogan, 2000; Munson, 1994; Özkan, Tekkaya & Geban, 2004; Prokop, Tuncer & Kvasnicak, 2007; Selen Darçın et al., 2006, vb.), knowledge level (Atasoy & Ertürk, 2008; Erduran Avcı & Darçın, 2009; Gökdere, 2005; Uluçınar Sağır, Aslan & Cansaran, 2008; etc.) and also their attitude (Atasoy & Ertürk, 2008; Erdoğan & Uşak, 2009, Uluçınar Sağır, Aslan & Cansaran, 2008, etc.) are inadequate about environment and environmental problems even though Environmental Education is being imparted since 1970s. Atasoy and Ertürk (2008) pointed out inadequacy in the environmental educations' content and quality by the following examples: the contents of lessons do not address environmental issues; the contents of both syllabus and course books do not fulfill the aims and objectives of environmental educations; insufficient educational techniques in schools; practical education was given less importance than theoretical and rote learning. Gökdere (2005) summarized the shortcomings of an effective environmental education, contradictions in expressing objectives and principles in the curricula. Environmental education cannot be imparted successfully with lack of appropriate materials in schools and inexperienced teachers in the field of environmental education. Besides, curricula should be rich in terms of habitat, energy resources, environmental pollution; and rich materials should be provided in order to teach specific topics to secondary school students. These remarks pointed out deficiencies in curricula on environmental education.

Similar findings have been observed in a number of studies on the comparison of Turkish curriculum with others. Cebesoy and Dönmez Şahin (2010) observed that Turkey's science curriculum seemed very limited in terms of environmental objectives when compared with that of Ontario and hence the environmental content should be revised. Şahin and Özata (2007) found that Turkey's curriculum, in terms of aims and goals, when compared with Ireland's curriculum, is deficient on the goals of dignifying living things besides human, and there are additional learning strands about the environment in the curricula of Ireland and New Jersey, USA. Taşar and Karaçam (2008) observed that the aim of Turkey's curriculum is expressed clearer than that of Massachusetts, USA even when the subjects are similar, and the number of objectives in Turkey's curriculum is more. The number of objectives as learning strands in physical phenomenon, matter and change are more in Turkey's curriculum than that of Massachusetts'; and the number of objectives in learning strands on living creatures and life, earth, and the universe is less. Eş and Sarıkaya (2010) asserted that conceptual content is rich in Turkey's curriculum. This study is assertive of the aims of Turkey's curriculum when the insertions are done with regards to the information and communication technologies, effects of human actions on the environment, and the importance of safety in scientific and technological activities. Özata Yücel (2010) compared the science and technology curriculum of Turkey in 2005 with those of Finland, Canada, New Zealand, Ireland and the states of New Jersey and Massachusetts, USA in terms of goals and content. There is significant

resemblance in terms of goals and content; however, there is a deficiency in the subjects of Environment and Health in Turkey's curriculum.

All these studies were conducted on the literature dealing with the comparison of curricula in general. In these studies, Taşar and Karaçam emphasized (2008) the strand of reorganizing earth and universe, whereas Özata Yücel (2010) drew attention to deficiencies in the environment and health. Thus, deficiencies in the base of the subject are clearly understood. Hence, this study is conducted not only to discuss the comparison of the curriculum in general, but also to realize comparison studies at the level of concept and the subject. This study will help make improvements in the curricula in terms of contribution. However, subject based comparison studies were not found in literature. It is important to recommend vital modifications by determining the shortcomings in each unit by evaluating the curricula (Erden, 1998). Comparison studies are some of the approaches to evaluate curricula. It not only gives an idea about similarities and differences in the curricula of various countries but it also gives an idea of the development and upgradation of the curricula.

The aim of this study is to evaluate the status of Turkish Science and Technology curriculum by comparing the Turkish Science and Technology Program with that of Finland, England, Canada, New Zealand, Ireland, and the provinces of the USA (Massachusetts and New Jersey), in terms of ecosystem, biological diversity, and environmental problems. Thus, it is aimed to draw attention to deficiencies in Turkey's curriculum and to suggest recommendations to overcome them and improve the curriculum. The main aims of the study can be enumerated as follows:

1. What are the differences and similarities of Turkey's science curriculum, in terms of vision with that of Finland, England, Ireland, Canada, New Zealand and the provinces of the USA (Massachusetts and New Jersey)?
2. What are the differences and similarities in Turkey's science curriculum with these countries in terms of goals?
3. What are the differences and similarities in Turkey's science curriculum with these countries in terms of content?

METHODOLOGY

Document analysis, one of the qualitative research methods, including analysis of the written material contains information of the target phenomenon, was used in this study (Yıldırım & Şimşek 2008). In order to make a comparison in primary science curricula, countries that scored above the world average at TIMSS exams 1995, 1997, 1999, and 2003, Finland, England, Ireland, Canada, New Zealand, and the provinces of the USA (Massachusetts and New Jersey), were selected. The curricula of these countries were acquired from the websites of the concerned Ministries and through correspondence with the relevant institutions.

In the comparison of curricula, visions, goals, and content were considered as unit of analysis. In comparison of content, organization of content, units, and objectives in these units were considered as sub-unit of analysis.

In the study, curricula were read primarily, given the meaning and coded. Coding was done by considering concepts of ecosystem, biological diversity, and environmental problems that were emphasized in each units of analysis. Then, the determined units of analysis were compared in tables; similarities and differences of the chosen curriculum were determined with Turkey's curriculum. Comparison was done with great care by researchers, and edited by another science education specialist.

FINDINGS

Comparison of the Visions

When the curricula of different countries are analyzed in terms of vision (Table 1), we see an emphasis on the awareness of relationship between individual-environment, dignifying livings and non-livings, behaving in a responsible way to protect and improve the environment in the curricula of Finland and Ireland, and diversity of creatures and positive and negative effects of science and technology in England's curriculum. When other countries' curricula are analyzed in terms of aims, no emphasis is observed on the environment or its protection. Science literacy is emphasized in Turkey's curriculum. According to the science curriculum, a science literate individual should have the abilities, such as scientific knowledge, skills, positive attitude, perception, values, and psychomotor skills related to technology-society-environment. Besides, as far as science literate individuals are concerned, it has been emphasized that the resources should be used economically in "Science-Technology-Society-Environment" learning strand.

Table 1. *Emphasis on the Vision of Science Curricula in Ecosystem, Biological Diversity, and Environmental Problems*

Turkey	To be literate in science.
Finland	Ensuring awareness of the relationship between the individual-environment and emphasizing responsibility, both for the protection of nature, and for being individuals taking responsibility for sustainable life.
England	Pupils observe, explore, and ask questions about living things, materials, and phenomena. They learn about a wider range of living things, materials, and phenomena. They think about the positive and negative effects of scientific and technological developments on the environment and in other contexts.
Ireland	Cultivating an appreciation and respect for diversity of living and non-living things, enabling detection of problems and participation in discussions for sustainable development and behaving in an environmentally responsible way.
New Zealand	Students generate and test ideas and observe, investigate, and model, in order to develop scientific knowledge, understanding, and explanations.
Canada	To bring up all students as literate in science.
New Jersey (USA)	All students should know and learn sufficient science in order to undertake duties of citizenship, acquainted with knowledge and determining skills
Massachusetts (USA)	For being productive participants in intellectual and civil life in American society and if they needed education in this strand for their future, students should gain researching skills of fundamentals, besides the subjects of knowledge for research.

Comparison of the Goals

When the goals of the above countries' science curricula are analyzed (Table 2), understanding and comprehension of the natural world are found to be included in the curricula of Turkey and Finland; and goals related to knowledge acquisition about the environment in that of Turkey, England, Ireland, and Canada are found included. There are goals related to discovering the nature is also included in the curricula of England and Turkey. The curriculum of New Jersey, USA, shows a striking feature by laying emphasis on the concept of 'environment as a system'.

Table 2. *Goals of Science Curricula Related to the Ecosystem, Biological Diversity and Environmental Problems*

Turkey	Gaining fundamental knowledge on the science of environment. Solving problems by adopting both scientific research and scientific process during the discovery of nature and understanding the relation between man and environment. Recognizing interaction between individual, environment, and society, raise consciousness about bringing the sustainable development in society, economy, and natural resources.
Finland	Students' understanding of natural, artificial environment, themselves, others, diversity of living creatures, and the interaction between human and environment. Preface to evolution, fundamentals of ecology and human body and understanding vital functions. Gaining the skill of observing and exploring the nature.
England	Students use their knowledge about living things to describe the basic conditions that animals and plants need in order to survive. Recognizing that feeding relationships exist between plants and animals in a habitat, and describe these relationships using food chains and terms. Providing easy explanations for changes in living things [for example, diet affecting the health of humans or other animals, lack of light or water altering plant growth]. Identifying ways in which an animal is suited to its environment. Recognizing that there is a great variety of living things and understand the importance of classification. Understanding that different organisms found in different habitats because of differences in environmental factors. Describing some of the causes of variation between living things. Explaining that the distribution and abundance of organisms in habitats are affected by environmental factors. Constructing models [for example, food webs, and pyramids of numbers] to show feeding relationships, and explain how these relationships affect population size. Predicting the short-term and long-term effects of environmental change on ecosystems and use their understanding of such systems to justify their predictions.
Ireland	Developing an interest and curiosity about the exploration and study of living things in the world. Developing knowledge and understanding of scientific ideas through the study of living things. Exploring the influence of scientific and technological developments in environment. Understanding of the interdependence of a wide variety of living things and their environments during the exploration of environmental reflections of human actions. Recognizing the importance of conserving habitats and environments. Understanding that all life now and in the future depends on the sustainable development of the planet. Becoming actively involved in the discussion, exploration, and resolution of environmental issues.
New Zealand	Understanding the processes of life and appreciating the diversity of living things. Understanding how living things interact with each other and the non-living environment. Understanding the processes that drive changes in groups of living things over long periods of time and be able to discuss the implications of these changes.
Canada	Developing students' understanding of the environmental context of science and technology.
New Jersey (USA)	Gaining students' understanding of the structure, characteristics, and basic needs of organisms and the diversity of life. Developing and understanding of the environment as a system of interdependent components affected by human activity and natural phenomena.
Massachusetts (USA)	----

The factors emphasized in the curricula of different countries viz. interaction between living things with each other and interaction with the non-living environment, in the curricula of Finland, England and New Zealand; the relation of science-technology-environment, in

that of England, Ireland and Canada; biological diversity, in that of Finland, England, Ireland, New Zealand and New Jersey, USA; the relation of ecology and evolution, in that of Finland and New Zealand and environmental responsibility and sensibility, in that of Ireland, are not included in the goals of Turkey's curriculum (Table 3).

Table 3. *Headlines that Emphasizes Countries' Goals*

	Turkey	Finland	England	Ireland	New Zealand	Canada	USA (Massachusetts)	USA (New Jersey)
Learning and understanding the natural world	+	+	-	-	-	-	-	-
Interaction between living things with each other and with the non-living environment	-	+	+	+	+	-	-	-
Interaction between human and environment	+	+	-	+	-	-	-	+
Interaction between Science, Technology, Society and Environment	-	-	+	+	-	+	-	-
Environmental problems, environmental responsibility	-	-	-	+	-	-	-	-
Sustainable development of the planet/natural research	+	-	-	+	-	-	-	-
Environmental knowledge	+	-	+	+	-	+	-	-
Biological diversity	-	+	+	+	+	-	-	+
Interaction between Ecology and Evolution	-	+	-		+	-	-	-

In brief, goals of Turkey's curriculum focus mainly on the subject of ecosystem and the curricula of Finland, England, and New Zealand on the ecosystem and biological diversity. However, in the Canadian curriculum it has been observed that there is equal emphasis on the ecosystem, biological diversity, and environmental problems.

Comparison of the Contents

The contents of the subjects, on ecosystem, biological diversity, and environmental problems in the science curricula of all the countries are compared. While there is a separate course called Environment and Nature Studies for grades 1-4 in Finland's curriculum; there is a different learning strand called Environmental Sensibility and Awareness in Ireland's curriculum; and "Environmental Studies", in the curriculum of New Jersey, USA. In the learning strand of Living World, one unit is dedicated for each grade, in the curricula of England and New Zealand. There is no different learning strand in Turkey's curriculum. In some of the subjects, the objectives related to the environment are included. Most of the information is presented in the units of "Man and Environment Relations" for 7th graders and in "Livings and Energy Relations" for 8th graders. However, most of the information related to the environment is randomly placed in different units (Table 4).

Table 4. *Units on Ecosystem, Biological Diversity and Environmental Problems in the Science Curricula of different countries.*

Turkey	Travel to the Living World (Grade 3) Structure of the Earth (Grade 3-4) Pollution of Noise and Light in the unit, Learning of Matter (Grade 4) Microscopic Livings and Our Environment (Grade 4) Learn and Travel in the Living World (Grade 5) The Mystery of Earth (Grade 5) Domestic Wastes and Recycle Units in The Unit of Matter (Grade 7) Ecosystem and Biological Diversity in the Unit of Man and Environment Relations (Grade 7) Living things and Energy Relations (Grade 8)
Finland	Organism and living environments (Grade 1–4, Grade 5-6) One's Immediate Environment and Home Region, and the World as human living Environment (Grade 1-4) Biodiversity (Grade 5-6) Diversity of human life and living environments in the world (Grade 5-6) Nature and ecosystem (Grade 7-9) Life and evolution (Grade 7-9) Common environment (Grade 7-9) Substances around us (Grade air, water, soil) (Grade 7-9) Air and water (Grade 7-9)
England	Life processes (Grade 1-6) Humans and other animals (Grade 1-6) Green plants (Grade 1-9) Variation and classification (Grade 1-6) Variation, classification, and inheritance (Grade 7-9) Living things in their environment (Grade 1-6) Growth and nutrition (Grade 3-6) Adaptation (Grade 3-6) Feeding relationships (Grade 3-9) Micro-organisms (Grade 3-6) Adaptation and competition (Grade 7-9)
Ireland	Human Life (For All Grades) Plants and Animals (For All Grades) Environmental Awareness (For All Grades) Science and Environment (For All Grades) Caring for the Environment (For All Grades)
New Zealand	Life Process (Grade 1-7) Ecology (Grade 1-7) Ecology and Evolution (Grade 7) Life, Ecology, and Evolution (Grade 8)
Canada	Habitats (Grade 4), Rocks, Minerals, and Erosion (Grade 4) Weather (Grade 5), Diversity of Life (Grade 6.) Interactions within Ecosystems (Grade 7), Earth's Crust (Grade 7), Water Systems on Earth (Grade 8)
New Jersey (USA)	Diversity and Biological Evolution (For All Grades) Natural Systems and Interactions (For All Grades) Human Interactions and Impact (For All Grades)
Massachusetts (USA)	Characteristic of Living Things (Grade 1-5) Evolution and Biodiversity (Grade 1-2; 6-8) Living Things and Their Environment (Grade 1-2) Rocks and Their Properties (Grade 3-5) Soil, Weather (Grade 3-5) The Water Cycle (Grade 3–5) Adaptations of Living Things (Grade 3–5) Energy and Living Things (Grade 3–5) Classification of Organisms (Grade 6–8.) Changes in Ecosystems Over Time (Grade 6–8)

Table 5. *Comparison of Curricula on the Subject of Ecosystem*

Objectives	Turkey	Finland	England	Ireland	New Zealand	Canada	(USA) Massachusetts	(USA) New Jersey
Living and non-living elements of the ecosystem	+	+	+	+	+	+	+	+
Interaction of the components of the ecosystem	+	+	+	+	+	+	+	+
Flow of energy in the ecosystem and food chain	+	+	+	+	+	-	+	+
Substance cycle	+	+	-	-	Only water cycle	-	Only water cycle	Only water cycle

Subjects related to achieving the objects of the ecosystem such as living and non-living elements of the ecosystem are invariably included in the curricula of all the countries under study. Subjects that discuss the interaction of components of the ecosystem are also included in the curricula of Turkey, Canada, England, Ireland, New Zealand, and USA (New Jersey and Massachusetts). Subjects dealing with the flow of energy in the ecosystem and food chain exist in the curricula of all countries except Canada. However, subjects on the substance cycle are included in the curricula of only Turkey and Finland. Only water cycle is included under the substance cycle in the curricula of New Zealand, and USA (New Jersey and Massachusetts) (Table 5).

Table 6. *Comparison of Curricula on the Subject of Biological Diversity*

Objectives	Turkey	Finland	England	Ireland	New Zealand	Canada	Massachusetts (USA)	New Jersey (USA)
Genetic diversity	-	+	+	-	+	-	+	-
Species diversity	-	+	+	+	+	+	+	+
Ecosystem diversity	-	+	+	+	-	+	+	+
Adaptation/evaluation	-	+	+	-	+	+	+	+
The importance and conservation of biological diversity	+	+	-	+	-	-	-	-
Endangered creatures	+	-	-	-	-	-	-	-

In the curricula of all the countries except that of Turkey, there is an emphasis on the diversities of species and the ecosystem, but genetic diversity of living organisms is not discussed anywhere except for the curricula of England, New Zealand, and Massachusetts, USA. It is also observed that there is a high emphasis on the diversity and the differences of ecosystems (ecosystems of rain forests, savannah, steppe, desert, mountain, oceans, etc.) in Finland's curriculum. The subject of "Biological Diversity and Evolution" is taught in more detail in the curricula of England, New Zealand, New Jersey and Massachusetts. Canada's curriculum includes the limited number of objectives on adaptation. In Turkey's curriculum, the importance of biological diversity, its protection, objectives on endangered creatures, are included (Table 6).

Table 7. *Comparison of Curricula on the Objectives of Environmental Problems*

Objectives	Turkey	Finland	England	Ireland	New Zealand	Canada	(USA) Massachusetts	(USA) New Jersey
Effects of human activities on the environment	+	+	+	+	+	+	+	+
Protection of natural resources	+	+	+	+	+	-	-	+
Renewable and non-renewable energy resources	+	-	-	+	-	-	-	+
Local, national, and universal environmental problems	+	+	-	+	Only local	-	-	+
Personal responsibilities about protecting environment	+	+	+	+	-	-	-	+
Natural disasters	+	+	Only earthquake	+	-	-	-	+
Natural changes in the environment	+	-	+	-	+	+	+	+
The effects of some specific chemicals on man and environment	+	+	-	-	-	-	-	-
Light, sound, and space pollution	+	-	-	-	-	-	-	-
Radioactive pollution	-	-	-	-	-	-	-	-

In terms of the subjects on environmental pollution (Table 7), Turkey and Finland have the best supported curricula; whereas New Zealand, the USA (Massachusetts) and Canada have the least supported curricula. While objectives on the effects of human activities on the environment are included in all countries; the one on the protection of natural resources is not included in the curricula of Massachusetts and Canada. While objectives related to the renewable and non-renewable energy resources are included in the curricula of New Jersey, Ireland and Turkey that related to the essential individual and environmental responsibilities, such as protecting the nature were discussed in the curricula of England, Ireland, Finland, Turkey, and New Jersey. Moreover, the effects of specific chemicals on human and environment are given importance in the curricula of New Zealand, Finland, and Turkey. Objectives on the natural changes of environment were included in the curricula of only Finland and Ireland. While there is an objective on the ecologically sustainable development in the curricula of England and Finland, it is excluded in that of Turkey which includes lots of objectives on the economical use of natural resources. While objectives related to the pollution of light, sound, and space are included in Turkey's curriculum, it is not included in the curricula of other countries. Objectives related to radioactive pollution is ignored altogether by all the countries under investigation.

DISCUSSION and CONCLUSION

In terms of visions, emphasis on the environment is dominant in the curricula of Finland and England. On the contrary, the curriculum of Turkey emphasizes only on the relation of technology-society-environment and using natural resources economically to cater to the needs of future generations. Using natural resources economically is not only important for the next generations, but also important to sustain the ecological equilibrium. Consequently, other creatures in the environment are over looked when they are replaced in an anthropocentric point of view, in the frame of the curriculum.

Understanding and discovering the natural world, gaining environmental knowledge, and relations between man-environment are observed in the goals of curriculum in Turkey. Besides, emphasizing sustainable development of natural resources, biological diversity is ignored in gross contrast to the curricula of Finland, England, New Zealand, Ireland, and New Jersey (USA). While goals on human and the environment are included in Turkey's curriculum; the relationship of different creatures with each other is ignored, that points to the anthropocentric view of the Turkish curriculum. An in-depth knowledge of the environment would increase the responsibility and pave way to contribute for the protection and development of the environment. However, there have been goals on the environmental knowledge, but not on environmental responsibility. Concordantly, Tanrıverdi (2009), in her study, pointed to the insufficiency of curricula of primary education in terms of skill, understanding, and value development. Moreover, Özata Yücel and Özkan (2014) pointed to the claims made by science teachers about the curricula that cannot develop a complete awareness and responsibility in students. In one's opinion, this points to a severe deficiency in the science curriculum. To overcome this problem, it is necessary to include goals, and activities to the curricula in order to develop and support the students on their attitude towards the environment, understanding, and value development.

Gökdere (2005) declared that insufficient and incoherent explanation of aims and objectives of the curricula is another obstacle for an effective environmental education. Özsevgeç and Artun (2012) pointed out that sequencing of objectives in Turkey's curriculum is complicated. Similarly, according to the report of curriculum research and evaluation (2005), science-technology-environment objectives were not presented to the teachers clearly, leading to misunderstandings. It recommended the importance of rearrangement of these objectives; while Özata Yücel and Özkan (2013) pronounced that no significant improvements were made even in the renewed curriculum of 2013. These problems may possibly be due to the distribution of the subject of environment among other topics. There is no separate lesson in Turkish curriculum as that in Finland; and no different learning strand as that in Ireland and New Jersey, USA; hence, this prevents proper distribution of subjects in lessons according to the level of classes. Even environmental education is distributed in various lessons and taught particularly in Science lessons at the beginning of 3rd grade in Turkey. There is a different learning strand on the contents of the lessons on environmental subjects. With the induction of different learning strand and distribution at all levels of classes, there will be both enough extent and structure for environmental education in Turkey. Ecosystem, biological diversity, and environmental problems cannot be considered individually since these three topics are inter-related with each other. Hence, these subjects must be carefully patterned with each other in the education on the environment. The subjects must not always be anthropocentric, but must also include other factors that make up the system as a whole.

Similar objectives have been observed on ecosystem in the curricula of different countries in terms of content. While sustainable development of ecosystem is emphasized in the curricula of Finland and England; it is not included in that of Turkey, but there are lots of objectives related to the economical use of resources included in the curriculum of Turkey.

Turkey's curriculum seemed insufficient in terms of the objectives related to the biological diversity. In a study reported by Cebesoy and Dönmez Şahin (2010), they compared the 2005 curriculum of Turkey with that of Ontario and found that Turkish science curriculum is limited in terms of environmental objectives; and hence the environmental content needs to be increased. Objectives related to the diversity of species were found in the curricula of all the countries except Turkey. Objectives related to the diversity of the ecosystem were included in the curricula of Turkey and New Zealand; whereas those of Finland were rich in terms of diversity of the ecosystem. The subject on evolution which was included in the curricula of England, New Zealand, New Jersey and Massachusetts is not considered in that of Turkey. Adding objectives in order to fulfill these problems will be helpful to comprehend the importance of biological diversity in Turkish curriculum. Besides, objectives related to the importance and protection of biological diversity can be found in the curricula of Turkey, Finland, and Ireland; whereas, objectives related to endangered and extinct creatures were only found in Turkey's curriculum, which is a positive point. The subjects of environmental problems were discussed extensively in Turkey's curriculum. However, no subjects discuss exclusively about environmental problems that, however, were distributed in other subjects.

The curricula of Finland and Ireland included information on near environment to remote environment in all the subjects. In this way, the awareness level of students will increase. However, it was not considered in Turkey's curriculum. Objectives related to environmental problems are devised for students to enable them to recognize problems in their close environment, on the contrary, it is necessary that students recognize global environmental problems as well, since any environmental problem is potential enough to cause harm to the world as a whole. The study conducted by Demirbaş and Pektaş (2009) also supports these findings. According to this study, students respond correctly to the queries on problems related to their daily life but it is difficult for them to respond to other questions correctly. Therefore, it will be very beneficial to reconsider the curriculum in a way that students give importance to remote environment after close environment. Gökdere (2005) determined that in order to fulfill the shortcomings of the information on environment, it is essential to increase systematically the content of the curricula.

When the curricula of different countries were compared with that of Turkey and evaluated in terms of visions, goals, and contents, some deficiencies were observed. The factors, such as inclusion of a subject in one country and exclusion in others, emphasis on local needs, inconsistent titles of subjects, etc., prevent universal and holistic learning of the environment. The base of ecology learning strand concerning the subjects listed below is appropriate to fulfill these deficiencies in the curriculum for the elementary and secondary school students.

1. Nature and Ecosystem
2. Water, Soil, and Air
3. Matter and Energy
4. Biological Diversity
5. Living Things and Their Living Environment
6. Plants and Animals of Near Environment
7. Human and Living Environment
8. Protecting Nature and Environmental Sensibility
9. Environmental Problems
10. Environmental Pollution
11. Science, Technology, and Society

We feel that dividing these subjects according to the level of classes, inclusion in the curriculum of a near to remote environment, the choice and regulation of activities, determination of level and application will be useful. On the other hand, as environmental science and the relevant subjects constitute to systematic information settings related to living things interacting with each other and non-living things, it is clear that reflecting this knowledge in an education method in a holistic way is essential.

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