A Comparative Analysis of the Science Curricula Applied in Turkey between 2000 and 2017

Ahmet Turan Orhan[1]

[1] Sivas Cumhuriyet University, Faculty of Education, Turkey

Correspondence: Ahmet Turan Orhan, Sivas Cumhuriyet University, Faculty of Education, Turkey

Received: October 24, 2018 Accepted: November 7, 2018 Online Published: November 20, 2018

doi:10.5430/ijhe.v7n6p13 URL: https://doi.org/10.5430/ijhe.v7n6p13

Abstract

This study aims to conduct a multidimensional analysis of the 2017 Science Curriculum taking the previous three curricula into account. The document analysis technique, which is a qualitative research method, was used. The Science curricula of 2000, 2005, 2013 and 2017 were analyzed in detail for this purpose. The 2017 Science Curriculum, which is one of the last four curricula, was described and interpreted by discussing its important qualities as well as the similarities and differences between this curriculum and the other curricula. In addition, it was found out that the Science curricula used between 2000 and 2017 were in line with the Ohio Competency-Based Science Model. The skills included in these four curricula, the contents used to have skills acquired, the materials used to equip students with the skills, and the conditions where the acquisitions are expected to be used are pointed out in this study taking into account the key elements included in the Competency-Based Science Model. We think that the findings of this study are important as they reveal the general points of view and consistency of the curricula rather than showing their superiorities or shortcomings in relation to each other.

Keywords: science lesson, curriculum, science education, content analysis

1. Introduction

A curriculum is an experience mechanism encompassing all activities related to teaching a lesson that is planned to be acquired by individuals in and out of school. Curriculum development is a set of dynamic relationships among the four key elements of a curriculum: objectives, content, learning experiences, and evaluation (Demirel, 2010). Curriculum evaluation and development activities are continuous and important activities all over the world (Kelly, 2009). Curriculum development efforts in Turkey started with the proclamation of the Republic and increased in a systematic way after the 1950s (Gözütok, 2013). That is because ensuring continuity in curriculum development depends on evaluation of curricula on a regular basis (Kurt and Erdogan, 2015). Hjalmarson (2008) points out that curricula wear down in time and the contents must be changed in accordance with the characteristics of students, teachers, schools, and societies in order to prevent them from wearing down. As the Science lesson, which is one of the primary lessons of the Turkish education system, wears down in time, they have been subjected to evaluations, developments, and changes.

The dates of the Science curricula that have been put into use since the proclamation of the Republic are 1924, 1926, 1938, 1948, 1969, 1974, 1977, 1992, 2000, 2005, 2013, 2017, and 2018. The information given in Nature and Goods lessons in the early years of the Republic was organized under the name of Nature Knowledge in 1936. The name of the lesson was changed to Science and Nature Knowledge in the curriculum prepared in 1962. It was changed to Natural Sciences in the curriculum prepared in 1968, and this name was used until 2005. Then the curriculum was called Science and Technology, and it has been called Science since 2013. The teaching styles, visions, as well as suggested methods and techniques were changed in most of these curricula (Yurdatapan, 2011). One of the most important changes started with the curriculum that was put into practice in 2000. Raising science-literate individuals has been one of the primary goals of Science teaching for a long time (AAAS, 2005; OME, 2005). This goal has been included in curricula in Turkey since 2000, and raising science-literate individuals has been mentioned as the primary goal in the curricula prepared in 2005, 2013, and 2017 (MEB, 2000; 2005; 2013; 2017). Changes that started in 2000 and were referred to as reforms in the curriculum (Henson, 2015) have constituted the foundation of Science teaching for 18 years.

Science, which is one of the primary lessons at middle schools, is one of the fields containing science and scientific information most, and it aims to provide students with real life skills. New statements about learning and teaching as well as rapid developments in information and technology make it necessary to change the contents of this lesson so that it can keep up with real life. Each curriculum change is based on some reasons by authorities. The reasons for the changes made in the last Science curriculum in Turkey are as follows: raising more competent future generations, development plans, action plans of former governments, results of international exams, reports prepared by various national and international institutions and organizations, and results of scientific research (MEB, 2017).

Results obtained in national and international exams are among the significant reasons for curriculum changes made in Turkey. Results of exams such as PISA (Programme for International Student Assessment) and TIMSS (Trends in International Mathematics and Science Study) along with high school and university entrance exams that are held centrally are taken into account while making changes in curricula. The decreasing interest in numerical fields due to the low success especially in Science and Mathematics lessons has been the primary cause for updating and changing curricula.

As for the main behaviors included in Science curricula for students, the vision of the curricula prepared in 2000, 2005, 2013, and 2017 is to provide science literacy (MEB; 2005; 2013; 2017). In line with this vision, the aim is to turn students into science-literate individuals who question, make effective decisions, solve problems, are confident, open to cooperation, able to communicate, and perform lifelong learning with sustainable development awareness and to provide them with scientific knowledge, skills, positive attitudes, perceptions, and values, psychomotor skills, and an understanding of the relationship between science, technology, society, and environment. Individuals with these skills are expected to use scientific process skills effectively. These objectives of the last four curricula are in harmony with the elements of The Ohio Competency-Based Science Model based on the National Science Education Standards determined in Ohio, the USA in 1994. This model is based on four key elements: a) inquiry b) knowledge c) conditions d) applications.

This model coincides with the key elements of the Natural Sciences Curriculum dated 2000, Science and Technology Curriculum dated 2005, and Science curricula dated 2013 and 2017 (MEB, 2000, 2005; 2013; 2017). Scientific inquiry, which is the first element of this model, includes “process skills” and “mental habits”.

When we look at the Science curricula and the contents processed during learning experiences, we observe that scientific process skills are emphasized, and the main approach of the curricula is to provide students with these skills. The second dimension of the model is “scientific knowledge”. This model discusses basic science branches and dimensions of the information possessed by these branches (Haney, Czerniak and Lumpe, 1996). According to this model, a suitable content is necessary to provide students with certain skills. As it can be seen in the model, a science-oriented content must be offered so that scientific process skills and other mental skills can be gained. The third dimension of the model called conditions for learning science tries to find a way for providing students with these skills and contents. The approaches and efforts employed for teaching these skills to students theoretically coincide with contemporary applications. The last element of the model is related to how and where students will use these skills. In this sense, the Science curricula that are still in effect in Turkey are in line with the Ohio Competency-Based Science Model. The present study analyzes the key elements of this model and discusses the answers to the following questions through the contents of the four curricula applied between 2000 and 2017:

1. What skills are targeted?
2. What contents must be included for students to gain the targeted skills?
3. What mentalities/models/methods/techniques are used to provide students with the contents?
4. In what situations is the acquired knowledge expected to be used?

In light of these questions, we think that it may be useful to conduct a comparative analysis on the key elements of the Science curricula prepared in 2000, 2005, 2013, and 2017 and to emphasize them from a holistic point of view. It is acknowledged that the findings are important as they reveal the points of view and consistency of the curricula in general rather than showing their superiorities or shortcomings relative to each other.

2. Method

The document analysis, which is a qualitative research method, was used in this study. The document analysis method is used for reaching sources serving the research purposes and determine the data that will be obtained (Çepni, 2007). Document analysis includes in-depth analyses of documents related to study subject/s (Yıldırım and Şimşek, 2011). Furthermore, it requires a systematic analysis of available records and documents as a source of data (Karasar, 2007). Natural Sciences/Science and Technology/Science curricula applied at middle schools between 2000 and 2017 were analyzed in this study.

2.1 Data Collection

The data were obtained from the Science curricula given in the Table 1.

Table 1. 2000, 2005, 2013, and 2017 Science Curricula

Year	Name of the Curriculum
2000	Primary Education Natural Sciences (Grades 4, 5, 6, 7, and 8) Curriculum
2005	Primary Education Science and Technology (Grades 4, 5, 6, 7, and 8) Curriculum
2013	Primary Education (Primary schools and middle schools) Science (Grades 3, 4, 5, 6, 7, and 8) Curriculum
2017	Science Curriculum (Primary school and middle school; Grades 3, 4, 5, 6, 7, and 8)

2.2 Data Analysis

The data obtained from the curricula were analyzed through content analysis. Content analysis is conducted with the aim of finding concepts and relationships that can explain the collected data (Yıldırım and Şimşek, 2011). Chen, Manion and Morrison (2007) state that content analysis is an analysis consisting of text regulation, classification, comparison as well as making theoretical inferences from texts. The content analysis method was used in the present study because it contributes to the study systematicity, enables analysis of four different curricula, and provides information that can reveal unknown aspects of the research problems (Gökçe, 2006). For this purpose, the data were tabulated with hidden content codification in order to determine whether the Science curricula applied between 2000 and 2017 reflected answers regarding four sub-problems and whether the curricula were consistent in general.

The data related to the questions included in the study were classified in three steps. In the first step, the researchers analyzed the curricula independently of each other in terms of the qualities possessed by the four elements of the Ohio Competency-Based Science Model. In the second step, they analyzed the data of other researchers independently and checked their accuracy. In the third step, the researchers gathered and discussed the data on which they had different opinions and they negotiated until they reached a consensus. With these activities, procedures related to the reliability of the study were completed. The "Reliability Level = Agreement / (Agreement + Disagreement) x 100 formula was applied to the coding performed by two researchers in order to ensure reliability of the data. The agreement percentage between the two researchers was determined as 88% in that analysis. Miles and Huberman (1994) state that 70% or higher agreement is enough. In the next step, the researchers compared their data and accepted the findings on which they reached a consensus to increase the reliability level of the data (Büyüköztürk, Akgün, Karadeniz, Demirel and Kılıç, 2008). As for the validity of the study, the researchers aimed to ensure content validity of the data based on the Ohio Competency-Based Science Model, which has been used for years.

3. Findings

This section highlights the qualities of the Natural Sciences/Science and Technology/Science curricula focused on in the study.

3.1 Findings Related to Main Qualities of the Science Curricula

Table 2. Descriptive statistics related to the grades, units, and numbers of acquisitions included in the curricula

Curriculum Year	Curriculum Title	Grade	Unit	Learning Domain	The Number of Acquisitions	Weekly Course Hours
2000	Natural Sciences	4, 5, 6, 7, 8	21	-	576	3
2005	Science and Technology	4, 5, 6, 7, 8	37	4	974	4
2013	Science	3, 4, 5, 6, 7, 8	42	4	330	4
2017	Science	3, 4, 5, 6, 7, 8	47	5	325	3/4

According to Table 2, the name of Science lessons changed twice in the last 18 years. It was called Natural Sciences in 2000, Science and Technology in 2005, and Science in 2013, and it has become one of the lessons whose name changed most. The curriculum prepared in 2005 had the highest number of acquisitions with 974 acquisitions, while the curriculum with the lowest amount of acquisitions is the 2017 curriculum with 325 acquisitions. The number of units is the highest in the 2017 curriculum and lowest in the 2000 curriculum. The main reason for this is that the subjects were not organized as topics/learning domains in the 2000 curriculum. In other words, the 2000 curriculum is different from the other curricula in terms of unit-formation. The 2000 curriculum included a total of 21 units, while the 2005 curriculum included a classification of "learning domains" in addition to units. These learning domains were: Living Organisms and Life, Matter and Change, Physical Phenomena, Earth and the Universe. The "learning domain" section was changed to "subject area" in the curriculum prepared in 2013. These areas in the 2013 curriculum have the same titles as the learning domains in the 2005 curriculum. The "Living Organisms and Life" subject area was changed to "Living Organisms and Living" in the 2017 curriculum. Furthermore, the "Science and Engineering Applications" subject area which was not included in the previous curricula was added as of the fourth grade. As a result, the 2017 curriculum included five subject areas.

Another difference in the curricula is about the grade in which the Natural Sciences/Science and Technology, and Science lessons start. The science lessons started in the 4th grade in the 2000 and 2005 curricula when the primary education lasted for eight years and first half of that education lasted for five years. Science lessons were called Science as of 2013 when the mandatory education was increased to 12 years and a 4+4+4 system was adopted, and these lessons started in the third grade. In other words, these lessons that were given in the 4th to 8th grades until 2013 were expanded to cover the period from the 3rd to the 8th grade. The weekly hours of Science lessons are different among the curricula. The 2000 curriculum included 3 class hours while the 2005 curriculum had 4 hours for all grades. They were organized in a way that the first half of the eight-year education included three hours and the second half included four hours as of 2013. Following these general findings, the findings related to the sub-problems of the study are listed below:

Table 3 shows the findings related to the question "What skills are targeted in the curricula?".

Table 3. Findings related to the common and curriculum-specific skills targeted in the curricula

Elements	Curricula			
	2000	2005	2013	2017
Academic/scientific success	X	X	X	X
Active learning/participation	X	X	X	X
Research-inquiry	X	X	X	X
Scientific process skills	X	X	X	X
Scientific thinking/thoughts	X	X	X	X
Science literacy	X	X	X	X
Safe study	X	X	X	X
Communication skills	X	X	X	X
Decision making	X	X	X	X
Career awareness	X	X	X	X
Curiosity	X	X	X	X
Learning how to learn	X	X	X	X
Problem solving	X	X	X	X
Healthy life skills/habits	X	X	X	X
Having initiatives	X	X	X	X
Appreciation	X	X	X	X
Creative thinking	X	X	X	X
Scientific communication	X			
Transferring science to life	X			
Interest in Science	X			
Personal rights and freedoms	X			
Constructive thinking	X			
Alternative interpretation		X		
Science and technology literacy		X		
The nature of Science and Technology		X		

Logical decision making	X	
Learning styles	X	
Becoming a role model	X	
Technological problem solving	X	
Studying without assistance	X	
Mental objectivity	X	
Reasoning		X
Key competence		X
Competence in science/technology		X
Digital competence		X
Critical appreciation		X
Empathy		X
Aesthetic awareness		X
Developing potential powers		X
Innovative thinking		X
Good management skills		X
Self-realization		X
Introducing yourself		X
Personality integrity		X
Cultural awareness		X
Cultural persistence		X
Intercultural interaction		X
Mathematical competence		X
National and universal values		X
Negotiation		X
Coping with prejudice		X
Self-control/self-management		X
Making suggestions		X
Planned study		X
Concretization ability		X
Social/citizenship competence		X
Socioeconomic development		X
Social skills		X
Historical awareness		X
Spatial thinking		X
Reconciliation		X
Communication in a foreign language		X
Helpfulness		X
Creating a life philosophy		X
Reconstruction		X
Preparation for adulthood		X
Efficient use of time		X

Table 3 shows that the number of acquisitions aimed for students with the Science curricula between 2000 and 2017 is very high. We can say that most of these skills are related to daily life. All curricula aim to teach skills such as thinking skills, curiosity, receiving appreciation, healthy life, and active learning in addition to skills such as academic success and science literacy that are specific to the field. The skills included in only one curriculum were concentrated in the 2017 curriculum, while no additional skill was added to the 2013 curriculum. As the 2005 curriculum was a technology-based curriculum, we observe that it mostly focused on skills related to this theme. It was found out that many skills were included in the 2017 curriculum in connection with the competence concept. Furthermore, that curriculum included cognitive skills and values education.

The Table 4 shows the findings related to the question "What contents must be included for students to gain the targeted skills?".

Table 4. Findings related to the common and curriculum-specific skills covered in the curricula

Elements	**Curricula**			
	2000	**2005**	**2013**	**2017**
Astronomy	X	X	X	X
Scientific process skills	X	X	X	X
Biology	X	X	X	X
Environment	X	X	X	X
Relationship between science and technology	X	X	X	X
Science-technology-society-environment	X	X	X	X
Physics	X	X	X	X
Real (daily) life problems	X	X	X	X
Chemistry	X	X	X	X
Organized, testable, objective and consistent information		X		
Basic scientific concepts, principles, laws and theories		X		
The nature of technology		X		
Social change and transformation			X	
Technological change and transformation			X	
Science and engineering applications				X
National, moral, cultural values				X
Engineering and design				X
Artistic, literary and cultural activities				X
Sociology				X
Earth sciences				X

According to Table 4, the contents included in the curricula applied from 2000 until 2017 in order to provide students with the targeted skills are highly similar. It was found out that the common field contents of all curricula included "the relationship between science and technology" and "science-technology-society-environment" subjects in addition to the basic "astronomy, biology, physics, chemistry" subjects. It is striking that the technology subject was adapted to the course contents in all curricula in addition to the basic fields of science. When we look at the contents that were included only in one curriculum, we see that there is no content that was included in the 2000 curriculum but excluded from the other curricula, and the highest number of new contents were added to the 2017 curriculum. It is observed that all curricula have highly similar contents, and this is in line with the general structure of the Science lesson.

The Table 5 shows the findings related to the question "What mentalities/models/methods/techniques are used to provide students with the contents?".

Table 5. Common and curriculum-specific findings related to how the curricula contents can be transferred to students

Elements	**Curricula**			
	2000	**2005**	**2013**	**2017**
Active student participation	X	X	X	X
Alternative (complementary) evaluation	X	X	X	X
Research-inquiry/analysis	X	X	X	X
Learning/studying in groups	X	X	X	X
Laboratory applications	X	X	X	X
Student-centered applications	X	X	X	X
Teacher guidance	X	X	X	X
Problem solving	X	X	X	X
Project/project-based learning	X	X	X	X
Classroom activities	X	X	X	X
Discussion	X	X	X	X
Lifelong learning	X	X	X	X
Active teacher participation	X			
Brainstorming	X			
Individual requirements	X			
Differences in learning rate	X			
Case study	X			
Constructive-creative method	X			
New and original questions	X			
Doing exercises		X		
Purposeful note-taking		X		
Interdisciplinary connection		X		
Core information		X		
Independent study		X		
Computer software		X		
Direct exploration		X		
Drama		X		
Academic coaching		X		
Interactive sources		X		
Homework		X		
Physical development level		X		
Working in heterogeneous groups		X		
Story telling		X		
Concept map		X		
Personalized learning systems		X		
Classical presentation		X		
Library review		X		
School trip		X		

Learning/student needs		X		
Learning centers		X		
Learning styles		X		
Teacher-centered strategies		X		
Programmed face-to-face teaching		X		
Programmed learning		X		
Spiral approach		X		
Simulation		X		
Technological design cycle		X		
Video presentation		X		
Mental development level				
Information transfer strategy				X
Scientific research approach				X
Values education				X
Critical inquiry				X
Epistemology				X
Group evaluation				X
Innovative thinking				X
Hidden acquisitions				X
Life experiences				X

As you can see in Table 5, applications that make students participate in the learning process are suggested for objectives and contents of the Science curricula. All of the curricula include the constructivist approach, but this is clearly stated only in the 2005 and 2013 curricula, whereas the constructivist approach is mentioned indirectly in the 2000 and 2017 curricula. The findings indicate that especially group work is paid attention in all the curricula in addition to encouraging students to be more active. As for the curriculum-specific applications, it was determined that the 2005 curriculum included many innovations and differences for both teachers and students. The fact that it included a theoretical presentation of the constructivist approach along with a large amount of written texts compared to other curricula caused it to touch upon many new concepts. Furthermore, it was found out that the 2013 curriculum was the continued version of the 2005 curriculum within the scope of this question although this was not clearly stated. It was determined that the 2017 curriculum possessed some characteristics related to teachers and students that were not directly or indirectly included in the other curricula.

Table 6 shows the findings related to the question “In what situations is the acquired knowledge expected to be used?”.

Table 6. Common and curriculum-specific findings related to where and how students will use the acquired knowledge and skills

Elements	Curricula			
	2000	2005	2013	2017
Solving real/daily life problems	X	X	X	X
Learning about/choosing a profession	X	X	X	X
Social contribution	X	X	X	X
Keeping up with new technologies	X	X	X	X
Self-governance	X			
Increasing economic productivity		X		
Future learning needs		X		
Current issues		X		
Raising awareness in the society		X		
Exploring the natural environment			X	
Solution for social problems			X	
Being equal and fair				X
Being a good person and citizen				X
Global competitive capacity				X
Being a happy individual				X
Adapting to the school/environment				X
Participation in the social/professional life				X
Understanding the historical information				X
Being in harmony with the society				X
Increasing life standards				X
Adapting to new technologies				X

According to the Table 6, students taking Science classes in line with all the curricula during their education will use the information and skills they acquire at school to solve daily life problems, make positive contributions to the society, use and develop new technologies. As for the objectives included only in one curriculum, it was found out that the 2017 curriculum had more expectations from students than the other curricula. It was seen that the 2005 curriculum had more expectations from students regarding the use of acquisitions compared to the 2000 and 2013 curricula.

Key Elements Model of the Natural Sciences/Science and Technology/Science Lesson			
SKILLS	**SCIENTIFIC KNOWLEDGE**	**CONDITIONS FOR LEARNING SCIENCE**	**APPLICATIONS FOR LEARNING SCIENCE**
Mental Habits	Scientific Content	Strategies	Situations
Academic (science) success	Astronomy	Active student participation	Solving real/daily life problems
Active learning/participation	Biology	Alternative (complementary evaluation)	Learning about and choosing a profession
Research and inquiry	Environment	Research/inquiry/analysis	Making social contribution
Scientific thinking/thought	Physics	Learning/working in groups	Keeping up with new technologies
Science literacy	Chemistry	Laboratory applications	
Safe study	**Information in the Curricula**	Student-centered applications	
Decision making	Scientific process skills	Teacher guidance	
Career awareness	Science, technology, society and environment relationship	Problem solving	
Curiosity	Relationship between science and technology	Project/project-based learning	
Learning how to learn	Real (daily) life problems	Classroom activities	
Problem solving		Discussion	
Healthy life			
Being responsible			
Appreciation			
Creative thinking/thought			
The main question:	**The main question:**	**The main question:**	**The main question:**
What scientific skills of students will be improved?	What scientific contents will it include?	How will students be provided with such knowledge and skills?	How will students use such knowledge and skills?

Figure 1. Key elements of the Natural Sciences/Science and Technology/Science curricula between 2000 and 2017

Figure 1 shows that the Science curricula applied between 2000 and 2017 mostly included applications putting students in center in line with the key elements of the Ohio Competency-Based Science Model. In addition, cooperation is focused on rather than individual learning, and it is considered important for students to learn Science lessons in order to get ready for the daily life. The idea that students must learn through experience is the main point of all four elements.

4. Discussion and Conclusion

Study findings indicate that the Science curricula between 2000 and 2017 have a strikingly large amount of similarities and differences. Detailed analyses highlight qualities present only in one curriculum in addition to common qualities included in all four curricula. As such analyses do not include common points of multiple curricula, this section does not mention qualities other than those common in all curricula.

A comparison of the curricula revealed that the curriculum prepared in 2005 included more skills and contents than the other curricula. The 2005 curriculum is different from the others in that the curriculum text prepared for teachers and students is very long. The 2005 curriculum consisted of 315 pages and had a very intense content compared to the other curricula. From this point of view, we see that the 2005 curriculum had a much broader scope than the other curricula. This is caused by the fact that long explanations were made in the curriculum leaflet in order to notify teachers and other relevant parties about the constructivist approach. Furthermore, different application examples were given in the 2005 curriculum and a lot of additional information was offered to teachers. The 2000, 2013, and 2017 curricula consisted of 105, 60, and 58 pages respectively. Although it is highly difficult to explain the reason why the amount of pages differs among the curricula, we can say that those who prepared the curricula needed to make different types of notification to users of the curricula. Moreover, the fact that the curricula prepared in 2000 and 2005 were applied to grades 4 to 8 while the curricula prepared in 2013 and 2017 were applied to grades 3 to 8 points to a significant difference.

Among the four curricula that were compared, the 2005 and 2017 curricula included the highest number of innovations. The 2017 curriculum is more advanced than the other curricula in terms of curricula contents, expected skills, and qualities regarding where these skills will be used, while the 2005 curriculum is more advanced than the others in terms of applications to be used in order to learn and teach such contents. It was found out that the four curricula had significant differences in addition to having common qualities. We can say that the common features of these curricula are based on the 2000 curriculum. An eight-year compulsory and continuous education program was initiated with a radical change in Turkey in 1997. The curriculum that started to be prepared in line with this development was put into use in 2000. That curriculum was influenced by the constructivist approach, and it included applications such as technology-science relationship, individual learning, active participation, and solving daily problems (Eskicumalı, Demirtaş, Gür Erdoğan and Arslan, 2014). The other curricula were developed by making additions to these basic qualities. One of the significant results obtained from this study is that these curricula are in compliance with the qualities included in the Ohio Competency-Based Science Model in general (Haney et al., 1996).

The “Knowledge” learning domain in the 2017 curriculum included “Science and Engineering Applications” in addition to the topics in the 2013 curriculum. It is a reflection of the STEM education (consists of the initials of Science, Technology, Engineering and Mathematics) used in economically developed countries. The “Skills” learning domain included “Engineering and Design Skills” in addition to the topics in the 2013 curriculum. Similarly, this can be regarded as a reflection of STEM education in this curriculum. Another addition to the skills domain is the “Life Skills” topic that was also present in the 2013 curriculum. The “Innovative Thinking” topic was added to the Life Skills section. The Science-Technology-Society-Environment (FTSE) learning domain included in the 2013 curriculum was designed as the Science-Engineering-Technology-Society-Environment (SETSE) learning domain in the curriculum draft. Two subtitles within this learning domain were updated. The first update was changing the subtitle “Relationship Between Science and Technology” to “Science, Engineering and Technology”. The second update was changing the subtitle “Social Contribution of Science” to “The Relationship of Science and Technology with the Society”. Considering this fact, we once again see that the STEM education was emphasized in this domain. The unit titled “Science and Engineering Applications” was not included in the third grade while it was the last unit of all other grades. When we look at the goals and acquisitions specified in the 2017 curriculum, we think that reflections and products related to the acquisitions of all units will be displayed with activities performed in this unit.

The units in the “Earth and the Universe” domain, which is usually included at all levels of curricula, were the last units in the 2000, 2005, and 2013 curricula, but they became the first units in the 2017 curriculum. The fact that Science lessons start with units related to earth sciences and environment in many countries can be claimed to be the reason for this. That is because students could be enabled to know their immediate surroundings better and become more interested, and they could increase their knowledge about the space which draws their attention. The Light and Sound subjects were distributed across separate units. They used to be included in the fifth and sixth grades, but they were included in the seventh grade in addition to the fifth and sixth grades in the 2017 curriculum. This is a significant example supporting the argument that the curriculum intensity was decreased. Similar results have been obtained in various studies (Bahar, Yener, Yılmaz, Emen and Gürer, 2018).

As for the basic skills in the curricula, another important development is that the “Turkish Qualifications Framework” was emphasized. In this context, the key competencies that constituted the basis for the Science curricula were listed and highlighted as “communication in the mother tongue, communication in a foreign language, mathematical competence and basic competences in science/technology, digital competence, learning how to learn, social and citizenship competences, taking initiatives and entrepreneurship, cultural awareness and expression”. Furthermore, the “Affective” learning domain is the same as the titles in the 2013 curriculum, while the new emphases on the subtitle “Values” draw attention in this domain. Universal values, national and cultural values, and scientific ethic concepts were added to the “Values” title.

The principle about including both the process and the product while developing a curriculum is attached utmost importance (Demirel, 1992). In this regard, we can say that the increased product orientation of the 2017 curriculum is a positive development for compliance with this principle. The statement made by Demirel about implementing curricula at a pilot school for at least one year was not meant for 2017, which means that the changes in the program were to be based on the feedback received in that year. In fact, after the 2017 curriculum was implemented only in the third and fifth grades in the fall semester of the 2017-2018 academic year, it was updated in 2018 with some major changes in acquisitions and contents. We think that the curriculum released in 2018 includes significant changes, and it will be regarded as a new curriculum. For this reason, it could be useful to compare it with the 2017 and other previous curricula, and determine the similarities and differences between them. Although some researchers (Bahar et al., 2018) consider the 2017 and 2018 curricula to be the same, these two curricula are different in terms of both contents and acquisitions. It could be useful to conduct a detailed comparison of these two curricula so that the similarities and differences can be revealed.

Ersoy (2006) points out that a curriculum is not everything no matter how well it is designed considering the learning/teaching activities and the whole education process. He suggests that other factors affecting student success such as teaching methods and techniques as well as teacher qualities must not be overlooked. Therefore, it is a fact that curricula that have been developed and implemented by focusing on student-centered education in the last twenty years cannot solve problems only through some changes. We think that the results of this study analyzing and comparing the contents of the last four curricula may be a guide for those looking for solutions to problems. Examining the analyses included in this study and recognizing the similarities and differences of curricula in addition the philosophies behind them could help the relevant people understand and evaluate the new curriculum. Haney et. al (1996) state that making reforms in education is very difficult and point out that strict precautions must be taken during applications. They also state that cooperating with teachers could be the key element for overcoming such difficulties. Therefore, it must be kept in mind that the actual progress lies in applications no matter how sufficient the contents of curricula are.

References

AAAS (The American Association for the Advancement of Science). (2005). *Science for all Americans: Education for a changing future*. http://www.project2061.org/publications/sfaa/default.htm

Bahar, M., Yener, D., Yılmaz M., Emen, H., Gürer, F. (2018). 2018 Fen bilimleri öğretim programı kazanımlarındaki değişimler ve fen teknoloji matematik mühendislik (STEM) entegrasyonu. [The changes of standards in the 2018 Science curriculum and STEM integration]. *Abant İzzet Baysal Üniversitesi Eğitim Fakültesi Dergisi, 18*(2), 702-735. https://doi.org/10.17240/aibuefd.2018..-412111

Büyüköztürk, Ş., Akgün, Ö. E., Karadeniz, Ş., Demirel, F., & Kılıç, E. (2008*). Bilimsel araştırma yöntemleri [Scientific research methods]*. Ankara: PegemA Yayınları.

Cohen, L. Manion. L., & Morrison, K. (2007*). Research methods in education*. London. Routledge. https://doi.org/10.4324/9780203029053

Çepni, S. (2007). *Araştırma ve proje çalışmalarına giriş [Introduction to research and project studies].* Trabzon: Celepler Yayınevi.

Demirel, Ö. (1992). Türkiye'de program geliştirme uygulamaları [Curriculum development practices in Turkey]. *Hacettepe Üniversitesi Eğitim Fakültesi Dergisi*, *7*(7), 27-43.

Demirel, Ö. (2010). *Kuramdan uygulamaya eğitimde program geliştirme* [Curriculum development in education: From theory to practice (12th Edition)]. Ankara: Pegem Akademi.

Ersoy, Y. (2006). *Fen ve teknoloji öğretim programındaki yenilikler-I: Değişikliğin gerekçesi ve bileşenlerinin çer çevesi [Innovations in the Science and Technology curriculum-I: The reasons for change and the framework of the elements]*. Accessed on 10.09.2018 at http://www.f2e2-ogretmen.com/dagarcigimiz/f2e2-32.pdf.

Eskicumalı, A., Demirtaş, Z., Gür Erdoğan, D., & Arslan, S. (2014). Fen ve teknoloji dersi öğretim programları ile yenilenen fen bilimleri dersi öğretim programlarının karşılaştırılması [The comparison of the Science and Technology curriculum and renewed Science curriculum]. *International Journal of Human Sciences, 11*(1), 1077-1094. https://doi.org/10.14687/ijhs.v11i1.2664

Gökçe, O. (2006). İçerik analizi: *Kuramsal ve pratik bilgiler [Content analysis: Theoretical and practical information]*. Ankara: Siyasal Kitabevi.

Gözütok, F. D. (2003). Türkiye'de program geliştirme çalışmaları [Curriculum development studies in Turkey]. *Milli Eğitim Dergisi*, *160*, 44-64.

Haney, J. J., Czerniak, C. M., & Lumpe, A. T. (1996). Teacher beliefs and intentions regarding the implementation of science education reform strands. *Journal of Research in Science Teaching*, *33*(9), 971-993. https://doi.org/10.1002/(SICI)1098-2736(199611)33:9<971::AID-TEA2>3.0.CO;2-S

Henson, K. T. (2015). *Curriculum planning: integrating multiculturalism, constructivism, and education reform* (5th ed.). Long Grove, IL: Waveland Press.

Hjalmarson, M. A. (2008). Mathematics curriculum systems: Models for analysis of curricular innovation and development. *Peabody Journal of Education, 83*, 592-610. https://doi.org/10.1080/01619560802414965

Karasar, N. (2007). *Bilimsel araştırma yöntemi [Scientific research method]* (17th Edition) Ankara: Nobel Yayınları.

Kelly, A. V. (2009*). The curriculum theory and practice* (6th Ed.). London: SAGE.

Kurt, A., & Erdoğan, M. (2015). Program değerlendirme araştırmalarının içerik analizi ve eğilimleri; 2004-2013 yılları arası [Content analysis and trends of curriculum evaluation research: 2004- 2013], *Eğitim ve Bilim*, 40(178), 199-224.

MEB (Ministry of National Education). (July 8, 2017). *Müfredatta yenileme ve değişiklik çalışmalarımız üzerine [On our curriculum renewal and change activities]*. Talim ve Terbiye Kurulu Başkanlığı, Ankara. Accessed on 06.09.2018 at https://ttkb.meb.gov.tr/meb_iys_dosyalar/2017_07/18160003_basin_aciklamasi-program.pdf.

MEB. (2000). *İlköğretim okulu fen bilgisi dersi öğretim programı [Primary School Science Curriculum].* Ankara: Milli Eğitim Basımevi

MEB. (2005). *İlköğretim fen ve teknoloji dersi (4, 5, 6, 7. ve 8. sınıflar) öğretim programı [Primary education Science and Technology (4th, 5th, 6th, 7th and 8th grades) curriculum]*. Ankara: Talim ve Terbiye Kurulu Başkanlığı.

MEB. (2013). *İlköğretim kurumları (ilkokullar ve ortaokullar) fen bilimleri dersi (3, 4, 5, 6, 7 ve 8. sınıflar) öğretim programı [Primary education institutions (primary schools and middle schools) Science (3rd, 4th, 5th, 6th, 7th and 8th grades) curriculum]*. Ankara: Talim ve Terbiye Kurulu Başkanlığı.

MEB. (2017). *Fen bilimleri dersi öğretim programı (ilkokul ve ortaokul 3, 4, 5, 6, 7 ve 8. sınıflar) [Science curriculum (primary and middle school 3rd, 4th, 5th, 6th, 7th and 8th grades)]*. Ankara: Talim ve Terbiye Kurulu Başkanlığı.

Miles, B., M., & Huberiiian, A., M. (1994). *Qualitative data analysis* (21 Ed.). London: Sage Pub.

OME (Ontario Ministry of Education). (2005). The Ontario curriculum, grades 1-8. The goals of science and technology education, http://www.edu.gov.on.ca/eng/document/curricul/scientec/scientec.html.

Yıldırım, A., & Şimşek, H. (2011). *Sosyal bilimlerde nitel araştırma yöntemleri* [Qualitative research methods in social sciences]. Ankara: Seçkin Yayıncılık.

Yurdatapan, M. (2011). İlköğretim 6, 7 ve 8 sınıf fen öğretim programlarının biyoloji alanı açısından tarihsel değerlendirmesi [The historical evaluation of science teaching programs of 6, 7 and 8th grades of primary education from the perspective of the field of biology]. *Çukurova Üniversitesi Sosyal Bilimler Enstitüsü Dergisi, 20*(1), 41-60.