Participatory Educational Research (PER)
Vol.9(5), pp. 373-389, September 2022
Available online at http://www.perjournal.com
ISSN: 2148-6123
http://dx.doi.org/10.17275/per.22.119.9.5

Id: 1080276

National Science Curriculum Documents in Türkiye and The United States: Comparison in terms of Scope and Detail

Güngör Yumuşak*
Department of Educational Sciences, Necmettin Erbakan University, Konya, Türkiye
ORCID: 0000-0001-5623-463X

Article history
Received:
28.01.2022

Received in revised form:
10.03.2022

Accepted:
27.06.2022

Key words:
Comparative education; curricula in different systems; science curriculum; the scope of curriculum

The processes of educational planning and program development at the local and national levels differ in centralized and decentralized educational systems. In Türkiye, there is a centralized education system, and curricula are created centrally to include all students. In the United States of America, there is a nationally disseminated curriculum framework for science education and a set of standards developed in accordance with these frameworks, while curriculum development continues at the local level based on these two national documents. Seeing how the curricula are designed in the different systems and what details they provide to teachers would be a source for designing curriculum development policies. The purpose of this study is to provide a comparative description of the scope of curriculum documents and the details of the information they contain in two different systems. The research is a comparative, holistic, multi-case study conducted by analyzing curriculum documents at the national level. As a result of the research, national curriculum documents for science education in the United States contain comprehensive descriptions of expected outcomes and content, even as curriculum development continues to occur at the local level. In contrast, Türkiye's science curriculum describes expected outcomes and content in less detail. The outcomes are discussed in terms of curriculum elements, system diversity, and literature.

Introduction

Educational policies adopted differentiate the structure and functioning of education systems. Differences in education systems bring about comparative education research. In the literature, there are research reports (i.e. OECD reports) on educational policies and practices covering many countries (Opertti, Kang & Magni, 2018). These kinds of comparative studies provide an information infrastructure that will allow countries to compare student performances, review their own education policies, and see good examples. It is difficult to reach a common definition of a curriculum that covers all countries. The elements defined as curriculum can be handled in different scopes in different systems. For this reason, comparing curriculum in countries with quite different systems requires first to start by defining what the curriculum or the documents about the curriculum mean in those systems. For example, science education curriculum is the most important document guiding the science education in Türkiye. The curriculum developed by the commissions in the Ministry of National Education are distributed to all teachers and applied. The situation is quite different in the United States. Many

* Correspondency: gyumusak@erbakan.edu.tr

states can create their own standards teams, and the school or school district can create their own curriculum based on state standards. However, curriculum diversity brings along learning differences among students and this is seen as a problem in terms of competitiveness. In 2013, a science education framework and a set of standards based on this framework were created in the United States in order to reduce the learning differences of students in different states and regions. Of course, although the acceptance or rejection of these documents is left to the discretion of the States, it is stated that has shaped the science education of approximately most of the students (NRC, 2012; NGSS Lead States, 2013) in the country. In addition, science curriculum continues to be developed based on standards accepted on the basis of school or region.

Science curricula implemented at the national level in Türkiye and the documents that direct the education of most of the students in the USA are similar in that they present a general understanding of science education at the national level. Therefore, the purpose of this study is to describe comparatively how the documents on science curriculum in both countries deal with the (subject matters) and detail about science education. In this context according to the National Curriculum Documents for Science Education in Türkiye and the United States of America, the answers for the following questions are sought:

(1) How have science education goals been defined?
(2) How has the content of science education been defined?

The reason for choosing the examples of Türkiye and the United States of America in this study is that the two countries have adopted very different education policies. But there is a similarity in both countries there are documents that aim to shape science education nationwide. It is thought that describing how the programs are shaped within the scope of the different policies determined will form the basis for research on the definition, scope, and implementation of the programs.

National Science Curriculum Documents in the USA: A Framework for K-12 Science Education: Practices, Crosscutting Concepts, and Core Ideas [1] & Next Generation Science Standards[2]

In education systems, concepts such as Curriculum Framework and Education Framework that show the basic vision and framework of education are frequently encountered. In the United States of America, "A Framework for K-12 Science Education: Practices, Crosscutting Concepts, and Core Ideas " is introduced as a document that aims to guide many processes, including the development of standards (National Research Council, 2012, p.8).

Although the concept of Curriculum Framework varies in different systems, it can be generally defined as follows:

> …. It is a core policy document that describes a range of requirements, regulations and advice which should be respected by all stakeholders in the education system, and which should guide the work of schools, teachers, and the developers of other curriculum documents (such as textbooks and teacher guides) (Stabback, 2016: 26).

1 Original name of the document "A Framework for K-12 Science Education: Practices, Crosscutting Concepts, and Core Ideas. In order to facilitate reading, it will be written as "Science Education Framework" hereafter in this study.
2 The original title of the document is "Next Generation Science Standards". And in this article, its abbreviation NGSS will be used.

Although the name changes as in Stabback's definition, documents similar to curriculum frameworks are used in many education systems. For example, the national curriculum document named "National Core Curricula" applied in Finland includes elements such as objectives, content, learning environment and ways to develop these environments, the structure of education and thus guides local curriculum development activities (Vitikka, Krokfors & Hurmerinta, 2012).

In the United States, the framework sets out the basic vision, main points and concepts of education and provides an information infrastructure to guide other curriculum documents. Like the Science Education Framework, the NGSS (Next Generation Science Standards) also influences local level programs in many schools. The standards ensure that students clearly state what they can know and can do, and in this way, it is aimed to reduce the learning differences between students. It is thought that determining the performance levels expected from students will enable students to acquire certain knowledge and skills (Marzano, Pickering & McTighe, 1993). At the local level, student qualifications, teacher characteristics, school conditions, etc. appropriate curriculum are prepared based on the specified documents. In the science education framework document, the concept of curriculum is defined as follows:

> Curriculum refers to the knowledge and practices in subject matter areas that teachers teach and that students are supposed to learn. A curriculum generally consists of a scope, or breadth of content, in a given subject area and of a sequence of concepts and activities for learning. … (NRC, 2016: 246).

In the Science Education Framework, the creation of "curriculum" is defined as the next step after the establishment of standards and this process is explained as follows:

> Curriculum is collectively defined by teachers, curriculum coordinators, state agencies, curriculum development organizations, textbook publishers, and curriculum kit publishers. Although standards do not prescribe specific curricula, they do provide some criteria for designing curricula. ….. (NRC, 2012: 246).

As can be seen, the standards are not set out as a specific curriculum. But it does provide a certain basis for the curriculum. Cooper (2013: 680) states that standards are the points that students will reach and that they explain what they can do at the end of the determined class levels, and that this requires a comprehensive support for teachers in the development of new curriculum materials. Similarly, within the framework of Science Education, it has been stated that this document affects all decisions taken at state, district, and school levels, respectively (NRC, 2012).

The United States has a decentralized structure with more power and responsibility given to local education authorities. Therefore, it is difficult to talk about a national curriculum with clear lines of the development process and describe it. Each state can create its own school systems. The management of primary and secondary education has been transferred to local school administrations. Local school districts carry out tasks such as making and implementing standards and curriculum decisions. However, state education practices are not beyond the control and influence of the federal government (Malley, Neidof, Ayora and Kroeger, 2016).

The Science Education Framework actually addresses many issues in general, does not include every detail (e.g. specific objectives), but provides a framework that will guide institutions or individuals who will develop the details. It is mentioned that a wide set of expectations has

been formed within the framework of science education and is stated that this set of expectations will be the source of the establishment of new standards and then the regulation of the curriculum, teaching and evaluation processes (NRC, 2012). In this direction, after the formation of the Science Education Framework, a set of standards (NGSS) was formed by an organization named Achieve (NRC, 2012). The NGSS were developed under the vision of Science Education Framework and published in April 2013. The publication of NGSS is an initiative that requires renewal in education at the national, state and district level. Therefore, it brings about a change that will affect the teaching process, students' learning, and the education process of teachers and teacher candidates (Bybee, 2014). This set of standards includes the features expected from students up to the K12 level and is a resource that guides the creation or organization of science programs to be developed (NGSS Lead States, 2013). NGSS created include the performances expected from students at national level. Thus, it aims to reach a certain common understanding in science education at the national level. At the same time, these reforms and standards affect all decisions taken at the state, district and school level (Bybee, 2014). The main reference point of the programs to be established at local level in the USA is the Science Education Framework and NGSS, and it is stated that 20 states have accepted and adapted to NGSS. In addition, 24 states create their own standards based on the Science Education Framework. As a result, it is stated that 71% of the students in the United States are educated with science programs affected by one of the two documents (NRC, 2012; NGSS Lead States, 2013).

Science Curriculum in Türkiye

Many definitions and classifications come to mind when the curriculum is mentioned. In order to understand the concept of curriculum in Türkiye, it may be useful to look at the Turkish literature. Küçükahmet (2009) defines curricula as a whole consisting of a combination of curriculum. The curriculum is defined as "the program that systematically organizes the teaching activities included in the curriculum and related to the courses" (Küçükahmet, 2009: 9). The curriculum is also used as the curriculum of the course in many sources. Özçelik (1998) defines the curriculum of a course as a guide that first includes the specific objectives of the lesson, then the subjects that reveal the scope of the relevant lesson, then the teacher learning activities to be used in teaching the behaviors to be acquired, and the testing situations that will be used to determine whether the behaviors are realized. These point to the dimensions of goal, content, teaching learning process and evaluation and are listed as the elements of the curriculum in the literature (Küçükahmet, 2009; Demirel, 2010; Gözütok, 2003; Sönmez, 2012; Uşun, 2012; Arrival, 1996). Tyler (1949, trans. 2014)'s program development approach, based on individual, society and subject area needs, and passed through filters such as educational philosophy and educational psychology, becoming the main element of the program. Other processes to be employed from now on are arranged in a way to serve the realization of the goals. Varis (1996) stated that while preparing the program design in line with Tyler's understanding, it was determined how these 4 elements of the program would be organized in line with the data obtained from the analysis of the society, subject area and the individual, and that the program design resulting from this determination was "a book or a guide resource". In this case, it can be said that the curriculum of a lesson is a written document in the form of a source for a teacher that includes the 4 items mentioned.

According to a report of the OECD, the Turkish education system has a strictly centralized structure at the point of making and implementing many decisions (OECD, 2015). In Türkiye, the Ministry of Education takes all political decisions related to education, including the organization of training programs and application controls (Yıldırım, 2003; Akşit, 2007).

The curriculum of the courses in Türkiye prepared by the Ministry of Education and sent to all teachers in the country. However, it is seen that in the programs we call "the curriculum of the course" there is an ambiguity about what information will be given to teachers and what guidance will be given. For example, it is seen that science education programs, which were accepted in 2000 and implemented until 2005, give examples of objectives, content, educational status and examples of evaluation (MoNE, 2003). Considering the 2005 curricula together with the guidebooks, it is seen that there are quite a number of examples regarding the aims, content, educational status and evaluation (MoNE, 2005). Finally, in 2017 and 2018 curricula, it is seen that only objectives and content are included, there are no guidebooks, educational situations and evaluation examples (MoNE, 2018). As a result, it can be said that the processes defined in the programs are defined in more detail at some times and in less detail at other times, or without any detail, when viewed by years. However, apart from the curricula prepared at central level, no curriculum development activity is carried out at the local level. Kaya, Çetin and Yildirim (2014) stated in their study that the conversion of the curriculum prepared by Ministry of National Education (MoNE) in Türkiye into implementation process course process is carried through the annual and daily lesson plans. In the "Directive of the Ministry of National Education on the Planned Implementation of Education and Training Studies" of the Ministry of National Education, it is stated that the activities in the guidebooks can replace the plan for the courses that have a guidebook, and it is stated that a plan should be made for the courses whose guidebooks are removed.

Haubrich (1991) mentioned that centralization can affect curriculum at different levels. While some curriculums provide teachers and students with considerable scope for making many decisions, in another case the curriculum may have a limitation to a few items. In another case, there is a strict definition that includes the goals, content, educational situations, evaluation, and textbooks to be taught that teachers should follow closely. Curriculum and curriculum resources developed in 2005 displays an image that fits this strict definition. However, student workbooks and teacher's guidebooks of some courses have been removed with the new curriculum developed since 2013, with the differentiation of textbooks in primary and secondary school stages (Güneş, Varol, & Güneş, 2016). Removal of guidebooks can be evaluated positively or negatively by teachers. The direction of the comments may vary depending on the teacher's preference for autonomy or guidance in planning. In some studies, teachers stated that there should be guidebooks describing what the program expected from the teacher (Demircioğlu, Aslan, & Yadigaroğlu, 2015; Aykaç & Uzgur, 2016). However, the removal of guidebooks is a great change in terms of the implementation process of the programs. In the current situation, although the goals and content are included in the curriculum, the decisions regarding the educational situation and evaluation processes now seem to be largely belonged to the teachers.

Methodology

Research Design

In this study, a multiple case-holistic design was conducted to compare the scope and objectives of science education in two different systems. In the multiple case-holistic design, there is more than one case that is whole by themselves. First, these situations are defined within themselves and then compared with each other (Yıldırım & Şimşek, 2005). This research was carried out based on the examination and analysis of important documents guiding science education in two different countries. In the study, firstly both situations were described within themselves, and then comparative analysis was included.

Analysis units and selection

In this study, the "Science Curriculum" is used as the analysis unit for Türkiye. The purpose of choosing science curriculum created by the Ministry of National Education as the analysis unit is that they are officially accepted and implemented in all schools.

For the United States of America, a document named "A Framework for K-12 Science Education: Practices, Crosscutting Concepts, and Core Ideas", which was created under the leadership of the organizations named "Carnegie Corporation of New York" and "Institute of Advanced Study", was determined. The reason why this document is determined as the analysis unit is that it has been prepared by many organizations regarding science education to develop a common understanding across the country, forms a general framework and is the source of the national standards team called NGSS. The reason for choosing this document is that it guides the curriculum development processes. When the two documents are considered together in the United States, it is stated that these documents affect 71% of American students (NRC, 2012; NGSS Lead States, 2013).

Validity and reliability

In order to ensure the validity of the research, it has been made to prove the inferences regarding the research results. For this purpose, the information obtained from the documents was conveyed in a clear and understandable manner without being changed. In addition, the opinions of expert academicians from both countries were taken into account in the selection of analysis units for science education. Reliability was tried to be ensured by "defining the processes followed in conducting the research and supporting with relevant documents" (Yıldırım and Şimşek, 2005: 289). Each study and research finding is supported by direct quotations from the relevant document. In this way, reliable evidence was tried to be presented regarding the dimensions subject to examination. In addition, the considerations in the selection of the documents are explained in detail with their limitations in terms of enabling similar research.

Data Analysis, scope and limitations

In this study, the data were analyzed descriptively. The main theme and sub-titles were determined according to the common features of the analyzed documents and their differing features. Descriptions of each main theme and headings were made by giving examples from the documents, and then the findings regarding the comparison were shown in tables. Comparisons were made especially regarding how the documents deal with the specified dimensions and what kind of information they provided to the practitioners. For this reason, this study focused more on how they are defined and how much information they provide, not what the goals and the content of science education are.

Findings

In order to find answers to the research questions, the documents mentioned were first examined separately for the two countries, and then the information was presented in a way to allow comparison in tables.

Goals and Expected Outcomes for Science Education in Türkiye and the United States

The first question of the study was formed this way, "How have science education goals been defined?" To answer this question first, the education documents of both countries were examined in terms of separate objectives and tabulated with examples.

Goals and Expected Outcomes in Science Curriculum Documents in Türkiye

Goals and expected outcomes in Turkish Science Curricula can be seen as below. In the table one goals refers to the general features that are desired to be achieved. And the outcomes are more specific features.

Table 1. Goals and Outcomes in Science Curricula in Türkiye

Goals	1. To provide basic information about astronomy, biology, physics, chemistry, earth and environmental sciences, science and engineering applications, 2…. …. 10. To ensure the adoption of universal moral values, national and cultural values, and scientific ethical principles (MONE, 2018: 9).
Outcomes	F.3.1. Getting to Know Our Planet / Earth and the Universe …… F.3.1.1. Shape of the Earth Recommended Duration: 3 lesson hours Subject / Concepts: Globe F.3.1.1.1. Realizes that the shape of the Earth is like a sphere. F.3.1.1.2. Prepares a model for the shape of the Earth. (It is mentioned that the Earth is made up of layers.) MONE (2018, p.15)

As can be seen in the table above, it is seen that Science Curriculum has a wide range of goals, from subject matter knowledge to scientific ethics and responsibility, in 10 items. Outcome statements to make the students achieve are seen to contain in the Turkish science curriculum to be used in achieving the goals under the scope of each topic and an example for it takes place at the bottom line. The outcomes in the whole curriculum are explained as in the structure given in the table above. The outcomes are given under the topics and express the expected behaviors of the students at the end of the lesson. It is seen that just below the outcomes, there are brief explanations about the scope of the topics and what will be highlighted. For example, under the F.3.1.2 gain "It is mentioned that the earth consists of layers" statement is an explanation for the outcome.

The outcomes will be given are determined in the titles within the scope of the learning field. However, it is stated in the curriculum that the skills and the values desired to be gained are integrated into the curricula. If we handle one of the outcomes above, F.3.1.1.2., the gain of "prepares a model for the shape of the world", can be considered as a scientific process skill objective. It is known that in the programs prepared in 2005, scientific process skills were defined and attainment statements regarding these skills were also given (MONE, 2005, p. 48). However, in 2013, 2017 and 2018 programs, it is seen that Science Process Skill achievements are not listed in the curriculum, and Scientific Process Skills are given implicitly in the outcomes (MONE, 2013; MONE, 2017; MONE, 2018). Similarly, values education, competencies, and other skill outcomes specific to the field are expressed implicitly in the curricula. In summary, while subject area outcomes are given with their explanations in the curriculum within the scope of the specific target, skills and value gains are implicitly included in the expected outcomes.

Goals and Expected Outcomes of Science Curriculum Documents in the United States

The general view of the goals expressed in documents guiding science education in the USA is explained in the scope of the table below.

Table 2. Goals and Outcomes in US science education documents

Goals*	Vision: "…(1) educating all students in science and engineering and (2) providing the foundational knowledge for those who will become the scientists, engineers, technologists, and technicians of the future…." (NRC, 2012: 10)
	1. Asking questions (for science) and defining problems (for engineering) By grade 12 students should be able to • Ask questions about the natural and human-built worlds—for example: Why are there seasons? What do bees do? …. • …..(NRC, 2012: 55) 2. Developing and using models By grade 12, students should be able to • Construct drawings or diagrams as representations of events or systems…... • ….. 3……(NRC, 2012: 57)
(Outcomes)** Performance Expectations	3. PS2.3. . It asks questions to determine the cause-and-effect relationships of electrical or magnetic interactions between two objects that are not in contact with each other (NGSS Lead States, 2013, p.18).

* Included in the "Science education framework" (NRC, 2012)
** It is included in the "Next Generation Science Standards" document as "Performance expectations" (NGSS Lead States, 2013).

Note: Performance expectations are defined as "what students should know and do with an evaluable quality" and also "expressions of what students should do after education" (NGSS Lead States, p.1), so it was accepted as an expected outcome statement in this study to facilitate comparison.

As can be seen in the table above the students are expected to graduate with sufficient knowledge and skills until the end of the class 12 under the Science Education Framework (NRC, 2012, p.7). While the general goals are included in the "Science Education Framework", it is seen that the more practical "performance expectation" statements are included in the NGSS document. For example, goals related to "science and engineering skills" are listed within the framework of Science education. Afterwards, more specific definitions were made in the NGSS, which was prepared by considering the framework, as seen in the example below:

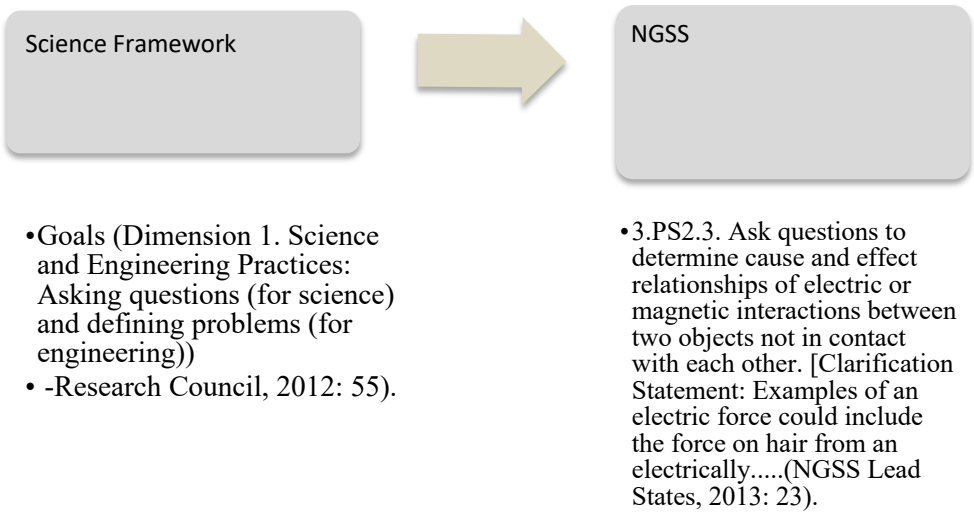

Figure 1. An example of transition from goals to performance expectations in Science and Engineering Practices

Detailed explanations on performance expectations are included in the Next Generation Science Standards (NGSS Lead State, 2013). The standard can be defined as a structure that includes performance expectations, interdisciplinary associations, explanations, limitations (See: Annex 2 standard example). It is seen that each performance expectation includes 3 dimensions specified as much as possible. In other words, both intersecting concepts, basic ideas, and scientific and engineering skills are represented in each statement.

Comparison

The findings obtained from the examination of curriculum documentation related to Türkiye and the United States are presented in summary that allows comparisons in the following table.

Table 3. Comparison of Turkish and the USA Science Curriculum taking the goals and Expected outcomes into consideration

	Türkiye	U.S.
Goals	Goals are listed in the curriculum. Special Targets are included with the words "Outcomes". Outcomes are included under each topic.	Overall objectives are included in the Science Education Framework. In addition, expected outcomes are included in the Standards set with the expressions "performance expectation".
Expected Outcomes	Dimensions are implicitly included in outcome statements. Example: F.5.1.4.1. Prepares a *model* that represents the movements of the Sun, Earth, and Moon to each other.	All dimensions are represented in each performance expectation statement, and it is explained which dimensions are represented.
Interdisciplinary Associations	None	Yes (see: NGSS lead States, 2013)

As it is seen in Table 3, the overall objective of the course is formed in the science curriculum in Türkiye, after which the program that is used to achieve these overall goals later in special goals (outcomes) appears to take place. In programs implemented in Türkiye with scientific skills in special outcome statement, the values are stated or referred to basic skills. There are

no explanations regarding interdisciplinary associations. It is seen that the American Science Education Framework includes explanations regarding goals and dimensions, and in the NGSS, performance expectations are created in line with these general goals. It is stated that all 3 dimensions are represented in performance expectations, and their scope and limitations are explained. In addition, the standards include explanations on interdisciplinary associations.

The Contents of Science Education in Türkiye and the United States of America and Comparison

The content of science education in Türkiye and the US differ in some aspects of scientific documents have similar titles and content in some respects. Therefore, this title has been examined under 3 subtitles. The first is science and engineering skills, the second is discipline-specific subjects, and the third is differentiating dimensions.

Science Education Content in Science Curricula in Türkiye

Table 4. Science Education Content in Science Curricula in Türkiye

Values: Justice, friendship, honesty, self-control, patience, respect, love, responsibility, patriotism, benevolence (MONE, 2018, p.5)
Competencies: Communication in mother tongue, Communication in Foreign Language, Mathematical competence and Basic competencies in Science / Technology, Digital Competence, Learning to Learn, Social and Citizenship Competencies, Taking Initiative and Entrepreneurship, Cultural Awareness and Expression (MONE, 2018, p.5-6)
Field-specific skills: Scientific Process Skills, Life Skills (Analytical thinking, Decision making, Creative thinking, Entrepreneurship, Communication, Teamwork), Engineering and Design Skills (Innovative (innovative) thinking)
Subject area and units: Earth and Universe, Living and Life, Physical Events, Matter and Change, Science and Engineering Applications (Science and engineering applications begins in the Grade 4)

The dimensions of science curriculum of Türkiye were examined under the titles of individual values, competencies, area-specific skills, and subject areas. Values are defined and briefly explained as "the sum of principles that make up the perspective of the curriculum" (MONE, 2018: 5), as in the curriculum of all other courses in the science curriculum. Another dimension is the 9 competencies which were created within the scope of Turkish Qualifications Framework (VQA, 2015) and taken place in the curriculum. These competencies are also represented in the curricula of many other courses. Each competency area is briefly defined in the science curricula. Field-specific skills which are another curriculum dimension are studied under 3 headings. Field-specific skills are also seen to be explained in short paragraphs in the curriculum. Finally, 5 learning areas are mentioned in the curriculum. Learning areas are addressed again and again at each grade level. However, it is seen that different subjects, which are generally within the scope of learning areas, are mentioned at different grade levels. For example, in the "World and the Universe" learning area, subjects are listed as parts of a whole at different grade levels. In other words, the things that should be known about the world and the universe are distributed to the classes section by section. In each classroom, there is information about the world and the universe, and when this information is collected, it is desired to give students the body of knowledge about the world and the universe.

Science Education Content in Science Education Documents in the U.S.

Table 5. Science Education Content in Science Education Documents in the U.S.

Science and Engineering Practices 1. Asking questions (for science) and defining problems (for engineering) 2. Developing and using models 3. …
Crosscutting Concepts: 1. Patterns, 2. Cause and effect, 3. Scale, proportion, and quantity, 4. Systems and system models, 5. Energy and matter, 6. Structure and function, 7. Stability and change.
Disciplinary Core Ideas: Life Sciences, Earth and Space Sciences, Physical Sciences, Engineering, technology, and applications of science

In the United States of America, the dimensions addressed in the Science Education Framework, which are among the documents that guide science education, are specified as Science and Engineering Practices, Crosscutting Concepts and Disciplinary core ideas. These dimensions are also divided into sub-dimensions (NRC, 2012).

Within the framework of the curriculum related to the Scientific and Engineering Practices dimension, there are overall objectives for each sub-dimension of this dimension. Table 4 provides a few examples of asking questions only. Targets for each sub-dimension of this dimension were listed, detailed definitions and explanations were made, and how to proceed according to the grade levels was explained.

If we take the "asking questions and posing problems" sub-category, the scope and importance of this sub-category has been explained and the progress recommendations regarding the category are given as follows.

> "Students at any grade level should be able to ask questions of each other about the texts they read, the features of the phenomena they observe, and the conclusions they draw from their models or scientific investigations. ……." (NRC, 2012, S. 56)

Overall objective statements regarding other dimensions are not included in the Science Education Framework.

Crosscutting concepts: Similarly, intersecting concepts are explained in the Science Education Framework. Intersecting concepts refer to concepts commonly used in many fields of science and engineering. The intersecting concepts are divided into sub-concepts, and these concepts are explained in detail one by one and suggestions for progress towards the gaining of each concept are included.

Disciplinary Core Ideas: In the framework of science education, the need for teaching of not every subject related to science can be studied in detail, instead the information which is called "Basic Ideas" specific to a particular field or of great interdisciplinary importance related to science and engineering, which is very necessary to understand complex issues or solve problems, address the interests, experiences and needs of the individual or society, can be taught at an early age, and can also be improved as the grade level grows is emphasized (NRC, 2012).

Comparison

Table 6. Comparison of Turkish and the USA Science Curriculum by Taking the Science and Engineering Competencies and Other Skills

	Türkiye	U.S.
Science Specific Competencies and Engineering Skills	1. Scientific Process Skills 2. Life Skills a. Analytical thinking . . e. Teamwork 3. Engineering and Design Skills	Science and Engineering Studies 1.Asking questions (for science) and defining problems (for engineering) 2…… . . 8. Obtaining, evaluating, and communicating information
Skills Explanations	Short definitions	Definition, explanations, objectives and progress

When American Science Education Framework and science curriculum implemented in Türkiye are examined together, they are seen to define the various science and engineering skills in both programs. Life skills are seen to include in the documents of Türkiye. In the USA documents, it is seen that more detailed explanations are made about the skills described. It has already been premised that separate target phrases were not created for science and engineering skills and other skills for the curriculum applied in Türkiye, but statement relating to skills were given in special objectives; that is, the skills were handled implicitely in the special objectives. It is seen that science and engineering skills are handled in more detailed manner Science Education Framework and Next Generation Science Standards in this aspect according to the program implemented in Türkiye, more comprehensive description is made, explanation on how to proceed according to their grade level and the overall and specific objectives are discussed in detail.

Table 7. Comparison of Turkish and the USA Science Curriculum taking the Discipline-Specific Issues into consideration

	U.S.	Türkiye
Disciplinary issues	Discipline Basic Ideas a. Life Sciences, b. Earth and Space Sciences, c. Physical Sciences, d. Engineering, technology, and applications of science	Learning Areas a. Earth and Universe b. Creatures and Life c. Physical Events d. Matter and Change e.. Science and Engineering Applications
Remarks	In the Science Education Framework, explanations about what each dimension mean and what it covers, and how to progress in the levels (progressions) are included.	No explanation and progress are included.

When Table 7 is examined, it is seen that almost the same learning areas specific to disciplines are dealt with. In the framework of Science Education, it was stated that physics and chemistry subjects were combined under the title of Physical Sciences. In the NGSS and Science

Education Framework, the improvements to be made each year within the framework of the basic ideas are defined and as can be seen from the table, it is aimed to make progress on the subject with the same topics every year. In the curriculum implemented in Türkiye are given in the areas of learning and subjects instead of the basic ideas.

Discussion

In this study, documents guiding science education were compared, taking the objectives and the content of the course into account.

Documents in terms of objectives:

When the curriculum is compared in terms of dimensions of the objectives, it is seen that the overall objectives and special goals (gaining) of the course are defined in Türkiye. It is observed that scientific skills, values, or basic skills are implicitly referred to in the special purpose statements and that interdisciplinary relationships are not included. When looking at the USA Science Education Framework and the standards set (NGSS) together, it is seen that there are overall objectives, overall objectives regarding dimensions, and explanations about the level of progress according to class levels in the Science Education Framework; and performance expectations are created in line with these overall objectives in the NGSS. It is stated that all 3 dimensions are represented in performance expectations. How these three dimensions are represented, their scope and limitations are explained in the standards. In addition, the standards include explanations on interdisciplinary associations.

In fact, although the gaining related to scientific process skills were expressed in detail and clearly in the curriculums of 2005 in Türkiye and gaining statements were given, it was abandoned as of 2013. It is possible to come across some studies in the literature regarding teachers' views on this subject. Eskicumalı and Demirtaş, Erdoğan and Arslan (2014) stated that teachers may have difficulties in implementation when the gains are not clearly stated. Similarly, Çıray, Küçükyılmaz, and Güven (2015) found in their study that teachers stated that they did not find outcome statements written in this type explicit and clear. Saban, Aydoğdu, and Elmas (2014) suggested that the implicit attachment of gains to other gains in the curriculum might weaken the realization process of these gains, therefore, determination of gains in curricula, creating examples regarding educational situations and making suggestions for evaluation.

Documents in terms of content

When examined in terms of skills, it is seen that scientific skills are included in the documents produced in both countries. Science-specific skills are outlined shortly in greater numbers in the curriculums implemented in Türkiye. When Framework for Science Education and NGSS are discussed together, it is found out that according to the applied science program in Türkiye, the description of the purpose and objectives relating to science and engineering skills are described more concrete and in detail. According to Reiser (2013), a central role is assigned to science and engineering practices in the framework and next generation science standards.

When the curriculums are examined in terms of disciplinary dimension, it is seen that almost the same learning areas specific to the disciplines are handled in the programs in both countries. In the Framework of Science Education, explanations about what each subject area covers are given. In addition, in the Science Education Framework and NGSS, a subject area structure

represents the most important basic ideas that can be considered as the most important evidence of understanding the subject area, and it is recommended to be processed in deeper dimensions every year.

Overview

Although the curriculums are formed at the central level in Türkiye, it is seen that very few details were given. In the United States of America, not every state is obliged to adopt and implement the documents. At the same time, schools can adapt to their own needs, even if implementation is accepted in a state. However, it is seen that science education documents contain quite a lot of detail. The following can be said based on the comparison findings in this study.

The lack of detail of the curriculums can provide flexibility to teachers in terms of implementing the curricula. However, the opposite situation may arise. Considering the 2005 curriculums in Türkiye, the abolition of the centrally prepared teachers' guidebooks since 2013 and the absence of teacher guides for science teachers may create uncertainty about how teachers will implement the curricula. Because detailed explanations about educational situations and measurement and evaluation in the curriculums, which were previously made through guidebooks, are no longer included in the curricula. In some studies, teachers stated that there should be guidebooks explaining what the curriculum expects from the teacher and they found it useful (Demircioğlu et al., 2015; Aykaç & Uzgur, 2016; Karamustafaoğlu et al., 2016). However, at the same time, the preparation of guidebooks can put teachers in a certain pattern and prevent creative and more effective planning processes. In a study by Göçer and Aktürk (2015), most of the teachers consider guidebooks as useful, while others have stated that it stereotypes the teacher. The variability of the curriculum in Türkiye shows that meaning attributed to concept of the Curricula is also variable. At this point, teachers' opinions are of importance. Detailed research into what teachers expect from a curriculum can lead to a more decisive pathway to the content and scope of the curricula.

There are clear and detailed descriptions in the framework and standards accepted in many states in the United States. These documents, which are widely popular especially at the national level, aim to increase the competitiveness of the country as well as a more equal and fair education. The science framework is expected to provide a common understanding in setting standards, and it is seen that the new science standards express more clearly and comprehensively what students will do compared to the previous ones. It is thought by policy makers that this will contribute to overcoming the diversity and uncertainty in standards (Hardy & Campbell, 2020). However, DeBoer (2012) states that the American education system tends towards more centralization compared to the past. Especially the establishment of standards such as common core and NGSS that have great impact at the national level can be considered as an orientation towards increasing the influence of the federal authority. However, although a curriculum framework contains important and explanatory information, it will not be enough to guide the teacher on how to plan a lesson and how to make the assessment; at this point, the quality of the program should be increased with "textbooks", "teacher guides" and "other materials" that support teaching (Stabback, 2016, p. 19). This is maintained by curriculum development activities carried out at local and school level. Bybee (2017) stated that the main function of science education standards is to define scientific content and skills in science education in a consistent, comprehensive, and understandable manner. It is also known that this definition will affect curricula, teacher training practices and local and regional education practices.

Conclusion

Generally, the overall and specific goals of science education and the subjects to be taught at national level in both countries are tried to be explained in these documents. However, documents of Science in Türkiye are referred to as a curriculum, but no education situations oriented on how the teachers will teach the lesson and evaluation recommendations are included; the explanations are kept fairly short and simple. In addition to this, additional curriculum development work is not carried out in schools or provinces. On the other hand, it is seen that even if the curriculum development works at the local level in a decentralized system in the United States will continue, quite detailed explanations are made in the standards team and the Science Education Framework, and the content is explained in detail. It is seen that what is expected from the students at the end of the course is described in a separate document such as NGSS and created in a way to guide the curriculum development studies to be developed at local level.

Acknowledgements

This study was carried out within the scope of postdoctoral research support of The Council of Higher Education (YÖK). The author would like to thank Professor Jennifer Wilhelm of the University of Kentucky for helpful comments on an earlier draft of this article.

References

Akşit, N. (2007). Educational reform in Turkey. *International Journal of Educational Development*, 27 (2), 129-137.

Aykaç, N. & Uzgur, B.Ç. (2016). Bilişim teknolojileri ve yazılım dersi öğretim programının öğretmen görüşlerine göre değerlendirilmesi (Ege Bölgesi örneği) [The evaluation of information technologies and software course's curriculum according to the teacher's ideas.] *Mustafa Kemal University Journal of Social Sciences Institute*, 13 (34), 273-297.

Bruner, J. S (1961). *Toward a theory of instruction*. Cambridge, MA: Harvard University Press.

Bybee, R. (2014). NGSS and the next generation of science teachers. *Journal of Science Teacher Education*, 25 (2), 211-221.

Çıray, F., Küçükyılmaz, EA, & Güven, M. (2015). Ortaokullar için güncellenen fen bilimleri dersi öğretim programina yönelik öğretmen görüşleri [The views of teachers about the curriculum of science revised for secondary schools], *Dicle University Journal of Ziya Gökalp Education Faculty*, (25), 31-56

DeBoer, J. (2012). Centralization and decentralization in American education policy, *Peabody Journal of Education, (*87) 4, 510-513, DOI: 10.1080 / 0161956X.2012.705153

Demircioğlu, G., Aslan, A. & Yadigaroğlu, M. (2015). Yenilenen kimya dersi öğretim programının öğretmen görüşleri ile destekli analizi [Analysis of renewed chemistry curriculum aided by teachers' perceptions]. *Journal of Research in Education and Teaching*, 4 (1), 135-146.

Demirel, Ö. (2010). Eğitimde program geliştirme: kuramdan uygulamaya [*Program Development in education: from theory to practice]*. Ankara: Pegem Akademi.

Doğanay, A. (2008). Çağdaş sosyal bilgiler anlayışı ışığında yeni sosyal bilgiler programının değerlendirilmesi [Evaluation of new social studies curriculum in the light of contemporary social studies]. *Çukurova University Journal of Social Sciences Institute*, 17 (2), 77-96.

Durukan, E. (2008). İlköğretim ikinci kademe (2005) Türkçe dersi öğretim programinda genel amaçlar - hedef/kazanimlar ilişkisi [The association between general targets and

goals/acquisitions in Turkish language program]. *The Journal of International Social Research*, 1 (4), 149-158.

Eskicumalı, A., Demirtaş, Z., Erdoğan, D. G. & 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.

Göçer, A. & Aktürk, Y. (2015). İlk ve ortaokul öğretmenlerinin öğretmen kılavuz kitabına yönelik algıları: metafor analizi [Perceptions of primary and secondary school teachers on teacher's guidebooks: a metaphor analysis]. *International Journal of Turkish Education Sciences*, (4), 186-199.

Gözütok, D. (2003). Türkiye'de program geliştirme çalışmaları [Program development studies in Turkey]. *Journal of National Education, 160*.

Güneş, T., Varol, C. & Güneş, O. (2016). Fen Bilimleri derslerinde kitap kullanımı ve öğrenci çalışma kitaplarının öğrenci görüşlerine göre değerlendirilmesi [Evaluation of using book and student's workbooks used in science lessons according to students' opinions]. *International Journal of Social Sciences and Education Research*, 2 (2), 374-386. DOI: 10.24289 / ijsser.279051

Haubrich, H. (1991). Centralization or decentralization of geography curricula: an international perspective. *Geography*, 76 (3), 209-217.

Hardy, I. & Campbell, T. (2020). Developing and supporting the Next Generation Science Standarts: The role of policy entrepreneurs. *Science Education. 104 (3), 479-499*

Kaya, E., Çetin, P.S. & Yıldırım, A. (2014). Transformation of Centralized Curriculum into Classroom Practice: An Analysis of Teachers' Experiences. *Uluslararası Eğitim Programları ve Öğretim Çalışmaları Dergisi*, 2 (3), 103-114.

Küçükahmet, L. (2009*). Program geliştirme ve öğretim [Curriculum Development and Teaching*). Ankara: Nobel

Marzano, RJ, Pickering, D., & McTighe, J. (1993). *Assessing Student Outcomes: Performance Assessment Using the Dimensions of Learning Model*. Virginia: ASCD

Malley, L., Neidorf, T., Arora, A. & Kroeger, T. (2015). *United States-Overview of Education System*. http://timssandpirls.bc.edu. Access Date: 18. 10.2017

Ministry of National Education (MoNE) (2005). *İlköğretim fen ve teknoloji dersi öğretim programı (4 ve 5. sınıflar) [Primary science and technology curriculum (4th and 5th grades]*. Retrieved from www.meb.gov.tr/TTKB. Access Date: 17. 08. 2010.

Ministry of National Education (MoNE) (2013). *Fen bilimleri dersi öğretim programı [Science Curriculum]*. Retrieved from www.meb.gov.tr/TTKB. Access Date: 25.04.2016.

Ministry of National Education (MoNE) (2018). *Fen bilimleri dersi öğretim programı [Science Curriculum]*. Retrieved from mufredat.meb.gov.tr. Access Date: Access Date: January 11, 2020.

National Governors Association Center for Best Practices & Council of Chief State School Officers (NGA & CCSSO) (2010). *Common Core State Standards*. Retrieved from http://www.corestandards.org/. Access date: 10/2014

National Research Council (NRC) (2012). *A Framework for K-12 Science Education: Practices, Crosscutting Concepts, and Core Ideas*. Washington, DC: The National Academies Press. https://doi.org/10.17226/13165.

NGSS Lead States. (2013). *Next Generation Science Standards: For States, By State*s. Washington, DC: The National Academies Press.

Nunalall S. (2012). *The effect of continuous curriculum policy changes on the Professional lives of foundation phase in post-apartheid South Africa*. MEd dissertation. Durban: University of KwaZulu-Natal.

OECD (2015). *"Turkey" in Education Policy Outlook 2015: Making Reforms Happen*, Paris: OECD Publishing.

Opertti, R., Kang, H., & Magni, G. (2018). *Comparative Analysis of the National Curriculum Frameworks of Five Countries: Brazil, Cambodia, Finland, Kenya and Peru*. UNESCO International Bureau of Education

Özçelik, DA (1998). Eğitim programları ve öğretim [*Curriculum and instruction]*. Ankara: ÖSYM Publications

Reiser, BJ (2013). *What Professional Development Strategies Are Needed for Successful Implementation of the Next Generation Science Standards?*. Invitational Research Symposium on Science Assessment, September.

Sönmez, V. (2012). Program geliştirmede öğretmen el kitabı [*Teacher's Handbook in Curriculum Development]*. Ankara: Anı Publications

Stabback, P. (2016). What Makes a Quality Curriculum? In-Progress Reflection No.2. Accessed from the UNESCO digital library. https://unesdoc.unesco.org/ark:/48223/pf0000243975. Access date: 01-02.2020

Tyler, WR (1949). Eğitim programları ve öğretim. [*Basic Principles of Education Curriculum and Instruction].* (Translated by: M. Emin Rüzgar, Berna Aslan, 2014). Ankara: Pegem A

Uşun, S. (2012*). Eğitimde program değerlendirme: süreçler, yaklaşımlar ve modeller [Curriculum evaluation: processes, Approaches, Models)*. Ankara: Anı Publication

Varış, F. (1996). Eğitimde program geliştirme [*Curriculum Development in Education: Theories, Techniques]*. Ankara: Alkim Publishing

Vitikka E., Krokfors L.& Hurmerinta E. (2012) The Finnish National Core Curriculum. Niemi H., Toom A., Kallioniemi A. (eds) *Miracle of Education* in. Sense Publishers

Vocational Qualifications Authority (VQA) (2015). Turkish Qualifications Framework *(2015).* Retrieved from https://www.myk.gov.tr/TRR/File6.pdf. Access Date: January 10, 2020.

Vural, M. (2003). İlköğretim programı [*Primary School Curricula]*. Erzurum: Yakutiye Publications.

Wiggins, G. & McTighe, J. (2005). *Understanding by design*. Alexandria, VA: ASCD.

Yıldırım, A. & Şimşek, H. (2016). Sosyal bilimlerde nitel araştırma yöntemleri [*Qualitative research methods in social sciences*]. Ankara: Seçkin Publication.

Yıldırım, A. (2003). Instructional planning in a centralized school system: Lessons of a study among primary school teachers in Turkey. *International Review of Education* 49, 525–543. https://doi.org/10.1023/A:1026361208399