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RESEARCH ARTICLE

An Investigation of the Science Curriculum in Terms of the European Qualifications and Turkish Qualifications Framework

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Abstract

This study aimed to investigate the science curriculum of 2018 for Turkey according to the Turkish Qualifications and European Qualifications Framework. Document analysis, which is one of the qualitative research approaches, was used in the research process. While collecting the data, the science curriculum of 2018 for Turkey was examined comprehensively and sub-lists were created in various categories (viz. both at the grade level and at the level of acquisitions) to ensure uniformity in the research process. Afterward, coding was carried out by checking each acquisition to specify their suitability to one of the eight key competency levels previously specified. Descriptive and content analysis were used while analyzing the data. As a result of the study, it was seen that the special objectives of the curriculum and the field-specific skills were not distributed in a balanced way in terms of key competencies. In addition, it was determined that the digital competence field was not adequately covered at the level of skills and acquisitions. These competencies are not able to adequately meet the needs of the curriculum of other subjects. At this point, it can be suggested to organize key competencies according to the related subjects.

Keywords: 2018 Science curriculum, key competences, skills and acquisitions, the European Qualifications Framework (EQF), Turkish Qualifications Framework (TQF)

Introduction

Mankind has had to have certain skills and competencies in order to keep up with the altering needs and demands of the society and compete successfully in every century. While these skills at times occur spontaneously as a result of the interactions taking place within the society, they occasionally can be acquired at the end of certain education and training processes (Kalemkuş, 2021). A fair number of countries need qualified and well-educated individuals in order to compete for both at the global and national levels, to live in prosperity and peace and to keep up with the needs of the age; and for this purpose, they are constantly trying to renew and keep their education policies up to date (Cansoy, 2018; Yılmaz, 2021). Changes in education and training services hint at the fact that students are at the forefront and a student-centered education policy is being adopted instead of a teacher-oriented education (Yalçın, 2018).

In this very period we are in, which is called the 21st century or the age of technology and in which a student-centered approach is mostly deployed, there are surely some novel skills to be possessed. The said skills, which can also be expressed as the 21st-century skills, have been addressed in the World Economic Forum (WEF) and have been stated to be among the most preferred skills until 2025 (WEF, 2020). These skills can be enlisted as follows: analytical thinking, active learning, solving complex problems and multi-criteria decision-making, learning to learn, critical thinking and analysis, creativity, being an entrepreneur, leadership and social interaction, resilience, stress tolerance, reasoning, coping with problems, and developing alternative solutions. Although many disciplines in the field of educational sciences contribute to the development of these skills, the field of science education stands out among them. Science education indeed has a responsibility of utmost importance in this sense, in particular, with the coming together of a variety of disciplines, and when the fact that science and technology subjects are predominantly in science and it has content to prepare individuals for life and discover the nature of science (Cangüven et al., 2017) are taken into account. Undoubtedly, a well-prepared curriculum is needed in order to be able to offer an effective science education (Can-Aran & Derman, 2020). In our country, the science curriculum was changed and revised by the Ministry of National Education (MoNE) in 2005, 2013, and 2018 in line with the needs and expectations of the age. As a result of these changes, new skills and competencies were added to the curriculum, and especially the skills expressed as the 21st-century skills were tried to be included in the education process. Field-specific skills in the 2018 science curriculum are presented in Figure 1.

It is necessary to have numerous qualifications so as to gain the skills expressed in Figure 1 and to provide an effective science teaching

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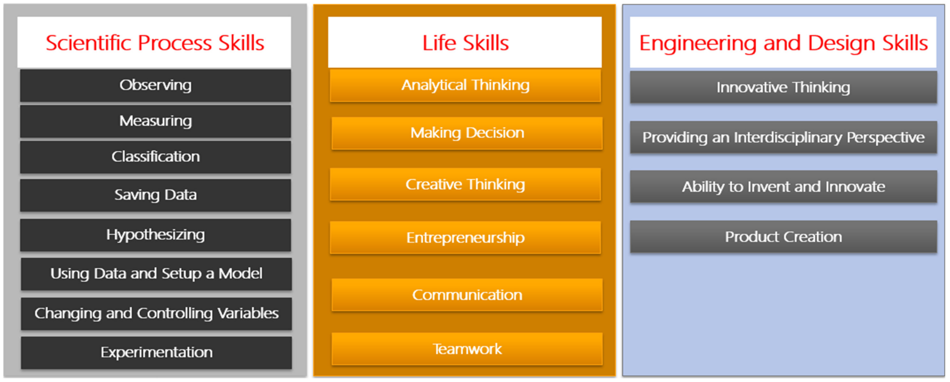

Figure 1.
Field-Specific Skills In The Science Curriculum (MoNE, 2018, pp. 9–10).

program. At this point, in order to create a common mind and a higher quality framework, 36 countries, including Turkey, contributed to the formation of the European Qualifications Framework (EQF). This framework contains questions that mainly serves as a tool to attain an understanding of and compare qualifications. The Turkish Qualifications Framework (TQF) has been established in order to implement these qualifications in our country and to run the existing programs in a more healthy fashion (Vocational Qualifications Institution [VQI], 2021). Although TQF is compatible with the EQF decisions, it aims to consolidate the existing qualifications in our country in detail, increase the quality and assurance level of qualifications, and ensure transparency and recognition at national and international levels (VQI, 2015). There are eight different levels in both TQF and EQF that include knowledge, skills, and competence components. Each level is used to determine the adequacy of the relevant program. In addition, within the scope of TQF, specific categories have been created to address qualifications from different perspectives. These categories are expressed as main competencies, supporting competencies, unit competencies, and special purpose competencies. With the decision of the European Parliament and the European Council, based on the idea that EQF could improve its scope and serve its purpose better, another type of competence, called "key competence," with eight categories, has been added to the existing competence types. These key competencies are shared in the following way: *"1-Communication in mother language, 2-Communication in foreign languages, 3-Mathematical competence and basic competencies in science/technology, 4-Digital competence, 5-Learning to learn, 6-Social and civic competencies, 7-Sense of initiative and entrepreneurship, 8-Cultural awareness and expression"* MoNE, 2018, pp.5-6; VQI, 2021, pp.24-25).

In the national literature, there are a number of studies on key competencies included in TQF and EQF. In their study, Akkaleli-Toprak (2019) examined the computer science course curriculum within the scope of TQF. As a result of the research, it was underpinned that the curricula acquisitions intensely involve the key competencies of *"digital competence, mathematical competence and basic competencies in science/technology and communication in foreign languages."* Atlı (2019) examined the biology course curriculum in terms of the 21st-century skills and punctuated that the achievements and sub-explanations in the program were not sufficient or satisfactory as regards creative skills. Yalkın and Işık (2019) examined the achievements within the scope of the science curriculum and discussed them as key competencies. In this context, they pinpointed that the acquisitions were concentrated on the fields of mathematical competence and basic competencies in science/technology, and there were no acquisitions in communication in foreign languages. Yüksel and Taneri (2020) examined the Life Science Course textbooks vis-à-vis TQF and key competencies. According to what the aforementioned study documented communication in mother language, mathematical competence and basic competencies in science/technology were intensively included. With that being said, it was accentuated that communication in foreign languages and digital competencies were not sufficiently included. Kana and Kiler (2021) examined secondary school Turkish textbooks apropos key competencies in their study. They found out that the key competencies did not exhibit a balanced distribution. In addition to this, it was underscored that almost no emphasis was put on digital competence and on the competence of communication in foreign languages.

When the national literature is examined, it is seen that there solely exists a single study (Yalkın & Işık, 2019) based on key competencies within the scope of the science course curriculum which directly focused on learning acquisitions. In the international literature, a good number of studies provide advice and guidance on TQF and EQF. These studies are the ones conducted to come up with a general framework and to assure unity and cohesion in implementation. Howbeit, these studies do not vary in the type of curriculum as is the case in our country and include relatively more general application areas. At the same time, within the scope of TQF, no study deals with the science course or establishes a link between the acquisitions and key competencies. Since TQF was implemented in our country in 2015, integrating these key competencies in the science curriculum was made possible with the new program employed in 2018. There are plentiful studies in the relevant literature on the science curriculum (programs prepared in 2005, 2013, and 2018) and competencies, comprising a bulk of research. Existing research and the subject framework are presented below:

- Comparative evaluation of the science program (Bayrak & Erden, 2007; Demirbaş, 2008; Karaer, 2016; Ocak & Kutlu-Kalender, 2017),
- Examining the science program acquisitions and student and teacher opinions in this context (Altınok et al., 2020; Aslan & Çökük, 2018; Çam-Tosun & Çevik, 2011; Erduran-Avcı & Öz, 2012; Özcan & Düzgünoğlu, 2017; Sülün & Dellalbaşı-Kılıç, 2013),
- Views on the science curriculum and practice (Bekmezci & Ateş, 2018; Çıray et al., 2015; Doğan, 2010; Kırındı & Ulu, 2017; Tekbıyık & Akdeniz, 2008; Ünal & Bozdoğan, 2019; Ural-Keleş, 2018),
- Opinions about the activities in the science program (Dindar & Taneri, 2011; Kurtuluş & Çavdar, 2011),
- Comparison of 2005, 2013, and 2018 science curricula concerning various variables (Benli-Özdemir & Arık, 2017; Cansız & Cansız,

2019; Keskinkılıç-Yumuşak, 2017; Kıvanç & Aydın, 2019; Özden & Cavlazoğlu, 2015),
- Shedding light on the science curriculum in terms of 21st-century skills (Kalemkuş, 2021),
- Scrutinizing science program acquisitions in terms of key competencies (Yalkın & Işık, 2019),
- Taking a look at the science curriculum within the scope of Bloom's taxonomy (Cangüven et al., 2017; Yaz & Kurnaz, 2017; Zorluoğlu et al., 2017).

When the national and international literature is examined, it is witnessed that varying types of studies have been carried out on the science curriculum, and the studies mainly consist of teacher opinions, evaluation of acquisitions, and comparison studies. Nevertheless, it is thought that the program is not adequately addressed in terms of EQF and TQF. The fact that TQF was put into use in 2015 can constitute a proof of this situation. Particularly after 2015, since quality, accreditation, and competencies issues have gained more importance in the field of educational sciences, it is thought that conducting a study in this field will contribute to the accumulation of research. To this end, within the scope of the research, it was aimed to examine the science curriculum based on key competencies in relation to EQF and TQF, and the following sub-problems were brought forth:

1. How is the relationship between the specific objectives of the 2018 science curriculum and the key competencies?
2. How is the relationship between the skills and key competencies in the 2018 science curriculum?
3. How is the relationship between the acquisitions of the third-grade science curriculum and the key competencies?
4. How is the relationship between the acquisitions of the fourth-grade science curriculum and the key competencies?
5. How is the relationship between the acquisitions of the fifth-grade science curriculum and the key competencies?
6. How is the relationship between the acquisitions of the sixth-grade science curriculum and the key competencies?
7. How is the relationship between the acquisitions of the seventh-grade science curriculum and the key competencies?
8. How is the relationship between the acquisitions of the eighth-grade science curriculum and the key competencies?

Method

In this part of the research, salient information about the model of the study will be shared, aspects like the data collection processes, data analyses, validity, reliability, and ethics will be mentioned. In this study, in which the science curriculum published in 2018 was investigated within the scope of EQF and TQF key competencies, document analysis, a qualitative research approach, was used. With the document review, in-depth analysis and examination of existing written materials are carried out within the framework of a determined purpose or subject integrity (Yıldırım & Şimşek, 2011). During the research process, written and visual materials in the national and international literature on EQF and TQF were inspected within the scope of the science course.

Data Collection Process

While obtaining the research data, firstly, the 2018 science course curriculum was comprehensively examined and sub-lists were created in diverse categories (grade level, acquisition level) for the purpose of uniformity in the research process. Then, coding was performed via checking each key competence and the eight competence levels mentioned earlier.

Data Analysis, Validity, Reliability, and Ethics

While analyzing the research data, descriptive and content analysis were used. In this context, descriptive statistics applications are also resorted to. The results obtained were first grouped and converted into tables. Afterward, descriptions were made using frequency values and a suitable ground was prepared for comparison. While analyzing the research data, the researchers completed the process pertaining to coding at certain intervals (3 weeks) and a consensus of 73% was achieved between the existing codings. Although it has been underlined that a consensus of 70% or more in the field of educational sciences is sufficient (Yıldırım & Şimşek, 2011), an alternative way has been followed to further increase the quality of the research through sophisticated coding. Thereupon, the research data were coded both by the researchers and by another researcher who is a curriculum developer in the field of science. For the coding process to progress as desired, stages specified by Özkan (2019) were taken into consideration. These stages are the preparation of a guide showing how coding should be done, giving some training regarding coding beforehand (1 week), making a pilot coding application, and checking the operability of the coding process. After the necessary preliminary preparations were made, the actual implementation was initiated and the coding processes were carried out. There is an example of coding in Figure 2.

At the end of coding, the coders' level of consensus and disagreement were calculated (Miles & Huberman, 1994) as 89%. In addition, the Cohen's Kappa coefficient was determined, and the rate of compatibility and interoperability between encoders was found to be 86%. Expert opinion was frequently sought in reliability and validity

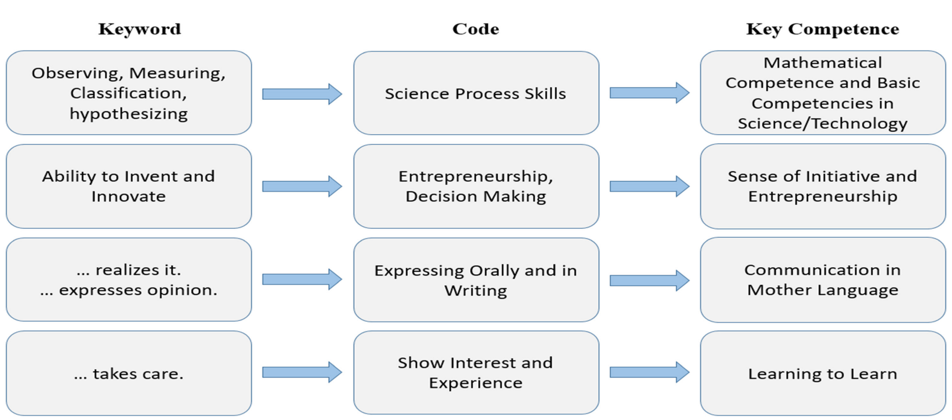

Figure 2.
Coding Process and Key Competency Relationship.

Table 1.
The Relationship Between 2018 Science Curriculum Specific Objectives and Key Competencies

Specific Objectives	Competence
1. To provide basic information about astronomy, biology, physics, chemistry, earth and environmental sciences, and science and engineering applications.	3
2. Adopting scientific process skills and scientific research approach in the process of exploring nature and understanding the relationship between human and environment and producing solutions to the problems encountered in these areas.	3-5
3. To realize the mutual interaction between individual, environment, and society. To develop an awareness of sustainable development regarding society, economy, and natural resources.	1-6-7
4. To take responsibility for daily life problems and to use science-related knowledge, scientific process skills, and other life skills to solve these problems.	3-5-6-7
5. To develop an awareness of career and entrepreneurship skills related to science.	7-8
6. To help understand how scientific knowledge is created by scientists, the processes through which this scientia is created, and how it is used in the new research.	3-5
7. To raise interest and curiosity about the events occurring in nature and its immediate surroundings, to develop an attitude.	3
8. To create an awareness of working safely by making people realize the importance of safety in scientific studies.	–
9. To develop reasoning ability, scientific thinking habits, and decision-making skills using socioscientific issues.	3
10. To ensure the adoption of universal moral values, national and cultural values, and scientific ethical principles.	6-8

"1-Communication in mother language, 2-Communication in foreign languages, 3-Mathematical competence and basic competencies in science/technology, 4-Digital competence, 5-Learning to learn, 6-Social and civic competencies, 7-Sense of initiative and entrepreneurship, 8-Cultural awareness and expression" (MoNE, 2018, pp. 5–6).

applications, and care was taken to carry out the process meticulously. Throughout the research process, detailed information was provided at every stage, in a clear manner when/if necessary. Direct quotations (which also enhanced descriptive and interpretive validity) were included within the scope of reliability and transferability, which are among the reliability criteria. Since this research is based on a qualitative paradigm, a well-known research method (document review) is included in the literature and the qualifications and experiences of the researchers (such as having been involved in coding before, possessing analytical skills, owning the ability of processing and analyzing data, and others) are kept in the foreground (Patton, 2014). Within the scope of the research, maximum attention was paid to the rules of science and publication ethics and no conflict of interest occurred. The current research has the permission of the ethics committee dated June 30, 2020, and numbered 29, granted by the Social and Human Sciences Research and Publication Ethics Committee of Kastamonu University.

Results

The findings obtained were discussed from three different perspectives. Eight different key competencies within the scope of TQF and EQF were first associated with the specific objectives of the science curriculum. Then, these were associated with the skills aimed to be gained within the scope of the science curriculum. Finally, its relationship with the acquisitions of the third, fourth, fifth, sixth, seventh, and eighth-grade levels was examined. Table 1 presents the relationship between the specific objectives of the science curriculum and the key competencies (MoNE, 2018, p.9).

When the 10 specific objectives of the science curriculum are compared with the 8 key competencies of TQF and EQF, it is understood that almost all key competencies are included. Nonetheless, it is observed that *"communication in foreign languages"* and *"digital competence"* competencies are not directly included. Besides, it is encountered that *"mathematical competence and basic competencies in science/technology", "social and civic competencies,"* and *"sense of initiative and entrepreneurship"* competencies are stressed more than other fields. Moreover, the *"mathematical competence and basic competencies in science/technology"* competence has been the type of competence that finds the leading place in specific objectives.

In Table 2, the relationship between the skills intended to be acquired within the scope of the science curriculum and key competencies is presented.

When Table 2, which presents the relationship between the skills aimed to be acquired within the scope of the 2018 science course curriculum and key competencies, is perused, it is discerned that skill types are mostly included in the scientific process skills category, and engineering and design skills are also included in this category as addition and innovation. When examined in the context of key competencies, it is verified that all other competencies are included except for *"cultural awareness and expression"* competency. It is detected that especially *"mathematical competence and basic competencies in science/technology" "sense of initiative and entrepreneurship"* competencies come to the fore among the key competencies. Table 3 demonstrates the relationship between the acquisitions of the

Table 2.
The Relationship Between Skills and Key Competencies in the 2018 Science Curriculum (MoNE, 2018, pp. 9–10)

	Skills	Competence
Scientific Process Skills	Observing	3-4
	Measuring	3
	Classification	3
	Saving Data	3-4
	Hypothesizing	3
	Using Data and Setup a Model	3-4
	Changing and Controlling Variables	3
	Experimentation	3
Life Skills	Analytical Thinking	3
	Making Decision	5-7
	Creative Thinking	7
	Entrepreneurship	7
	Communication	1-2-6
	Teamwork	1-2-5
Engineering and Design Skills	Innovative Thinking	5-7
	Providing an Interdisciplinary Perspective	–
	Ability to Invent and Innovate	7
	Product Creation	7

Table 3.
The Relationship Between Third-Grade Science Curriculum Acquisitions and Key Competencies

Unit	Subject Name	Acquisition Code	Key Competence 1	2	3	4	5	6	7	8	Total f	∑ f
Let's Get to Know Our Planet	Shape of the World	F.3.1.1.1	X	–	X	–	–	–	–	–	2	4
		F.3.1.1.2	–	–	X	–	X	–	–	–	2	
	Structure of the World	F.3.1.2.1.	–	–	X	–	–	–	–	–	1	4
		F.3.1.2.2.	X	–	–	–	–	–	–	–	1	
		F.3.1.2.3.	–	–	X	–	X	–	–	–	2	
Our Five Senses	Sense Organs and Their Functions	F.3.2.1.1.	–	–	X	–	–	–	–	–	1	4
		F.3.2.1.2.	X	–	–	–	–	–	–	–	1	
		F.3.2.1.3.	X	–	–	–	X	–	–	–	2	
Let's Get to Know the Force	Movement Properties of Assets	F.3.3.1.1.	X	–	X	–	–	–	–	–	2	2
	Moving and Stopping Objects	F.3.3.2.1.	–	–	X	–	X	–	X	–	3	8
		F.3.3.2.2.	X	–	X	–	–	–	–	–	2	
		F.3.3.2.3.	X	–	X	–	–	X	–	–	3	
Let's Get to Know the Matter	Characteristics of the Matter	F.3.4.1.1.	X	–	X	–	X	–	–	–	3	7
		F.3.4.1.2.	X	–	X	–	–	–	–	–	2	
		F.3.4.1.3.	–	–	–	–	–	X	X	–	2	
	States of Matter	F.3.4.2.1.	–	–	X	–	–	–	–	–	1	1
Light and Sounds Around Us	The Role of Light in Vision	F.3.5.1.1.	–	–	X	–	X	–	–	–	2	2
	Light Sources	F.3.5.2.1.	–	–	X	–	–	–	–	–	1	1
	Sounds Around Us	F.3.5.3.1.	–	–	X	–	–	–	–	–	1	3
		F.3.5.3.2.	–	–	X	–	–	–	–	–	1	
		F.3.5.3.3.	–	–	X	–	–	–	–	–	1	
	The Role of Sound in Hearing	F.3.5.4.1.	–	–	X	–	X	–	–	–	2	5
		F.3.5.4.2.	X	–	X	–	–	–	–	–	2	
		F.3.5.4.3.	X	–	–	–	–	–	–	–	1	
Journey to the World of the Living	Let's Get to Know the Entities Around Us	F.3.6.1.1.	–	–	X	–	–	–	–	–	1	3
		F.3.6.1.2.	X	–	X	–	–	–	–	–	2	
	Me and My Environment	F.3.6.2.1.	–	–	–	–	–	X	–	–	1	12
		F.3.6.2.2.	–	–	–	–	–	X	X	–	2	
		F.3.6.2.3.	X	–	X	–	–	–	–	–	2	
		F.3.6.2.4.	–	–	X	–	–	–	X	–	2	
		F.3.6.2.5.	–	–	X	–	–	–	–	–	1	
		F.3.6.2.6.	X	–	X	–	–	X	X	–	4	
Electric Tools	Electric Appliances	F.3.7.1.1.	X	–	X	–	–	X	–	–	3	3
	Electrical Resources	F.3.7.2.1.	–	–	X	–	–	–	–	–	1	4
		F.3.7.2.2.	X	–	X	–	–	X	–	–	3	
	Safe Use of Electricity	F.3.7.3.1.	–	–	–	–	–	X	–	–	1	1

third-grade science course curriculum and key competencies (MoNE, 2018, pp.15-19).

The third-grade science curriculum includes a total of 7 units, 36 learning acquisitions, with the course duration of 108 hours. In this setting, it was confirmed that the unit with the most key competencies was "Journey to the World of the Living" ($n=15$) and the unit with the least was "Our Five Senses" ($n=4$). What is more, it is realized that key competencies 1, 3, 5, and 6 are frequently included, whereas competencies 2, 4, and 8 are not italicized in an adequate sense. While the key competencies within the scope of TQF and EQF take place alone in some acquisitions, more than one competency can be found together in several acquisitions. Table 4 represents the relationship between the acquisitions of the fourth-grade science curriculum and key competencies (MoNE, 2018, pp.19-24).

The fourth-grade science curriculum is composed of a total of 7 units, 46 learning acquisitions, with the course duration of 108 hours. In this frame of reference, it was figured out that the unit with the most key competency was "Lighting and Sound Technologies" ($n=20$) and the unit with the least was "Human and Environment" ($n=3$). Addedly, it is discovered that key competencies numbered 1 and 3 are frequently included, yet competencies numbered 2 and 8 are not paid enough attention. Competence number 4, on the other hand, was able to find a place in this section, unlike the third-grade curriculum. While the key competencies within the scope of TQF and EQF take place alone in some acquisitions, more than one competency can be found together in some acquisitions. Notably, *"mathematical competence and basic competencies in science/technology,"* which is the number 3 competency, was able to find a place in almost all achievements. Because the foundation of science education is largely connected to the competencies found in mathematics, science, and technology. Table 5 lays out the relationship between the fifth-grade science curriculum acquisitions and key competencies (MoNE, 2018, pp.25-30).

The fifth-grade science curriculum entails a total of 7 units, 36 learning acquisitions, and is a 144-hour course. Within this framework, when the fifth-grade curriculum was viewed, it was identified that the unit with the most key competence was "Human and Environment" ($n=13$) and the unit with the least was "World of Live Things" ($n=1$). While the unit of human and environment was the unit where key competencies were given the last place in the

Table 4.
The Relationship Between Fourth-Grade Science Curriculum Acquisitions and Key Competencies

Unit	Subject Name	Acquisition Code	Key Competence 1	2	3	4	5	6	7	8	f	Total ∑ f
The Earth's Crust and the Movements of Our Earth	Structure of the Earth's Crust	F.4.1.1.1.	X	–	–	–	–	–	–	–	1	5
		F.4.1.1.2.	X	–	X	–	–	X	–	–	3	
		F.4.1.1.3	X	–	–	–	–	–	–	–	1	
	Movements of Our World	F.4.1.2.1.	X	–	X	–	–	–	–	–	2	4
		F.4.1.2.2.	X	–	X	–	–	–	–	–	2	
Our Nutrients	Nutrients and Properties	F.4.2.1.1.	X	–	X	–	–	–	–	–	2	11
		F.4.2.1.2.	–	–	X	–	–	–	–	–	1	
		F.4.2.1.3.	X	–	X	–	–	X	–	–	3	
		F.4.2.1.4.	–	–	–	–	X	–	–	–	1	
		F.4.2.1.5.	–	–	–	–	X	X	–	–	2	
		F.4.2.1.6.	–	–	–	–	–	X	X	–	2	
Effects of Force	Effects of Force on Objects	F.4.3.1.1.	–	–	X	–	–	–	–	–	1	1
	Force Applied by the Magnet	F.4.3.2.1.	–	–	X	–	X	–	–	–	2	8
		F.4.3.2.2.	–	–	X	–	X	–	–	–	2	
		F.4.3.2.3.	X	–	X	–	X	–	–	–	3	
		F.4.3.2.4.	X	–	–	–	–	–	–	–	1	
Properties of Matter	Characteristics of the Matter	F.4.4.1.1.	X	–	X	–	–	–	–	–	2	2
	Measurable Properties of Matter	F.4.4.2.1.	–	–	X	–	–	–	–	–	1	2
		F.4.4.2.2.	X	–	–	–	–	–	–	–	1	
	States of Matter	F.4.4.3.1.	–	–	X	–	–	–	–	–	1	3
		F.4.4.3.2.	X	–	X	–	–	–	–	–	2	
	Change of Matter with the Effect of Heat	F.4.4.4.1.	–	–	X	–	–	–	–	–	1	2
		F.4.4.4.2.	–	–	X	–	–	–	–	–	1	
	Pure Matter and Mixture	F.4.4.5.1.	X	–	X	–	X	–	–	–	3	8
		F.4.4.5.2.	–	–	X	–	X	–	–	–	2	
		F.4.4.5.3.	X	–	–	–	–	X	X	–	3	
Lighting and Sound Technologies	Lighting Technologies	F.4.5.1.1.	–	–	X	–	–	–	–	–	1	3
		F.4.5.1.2.	–	–	X	–	–	–	7	–	2	
	Appropriate Lighting	F.4.5.2.1.	–	–	X	–	–	–	–	–	1	4
		F.4.5.2.2.	X	–	–	–	–	X	X	–	3	
	Light Pollution	F.4.5.3.1.	–	–	X	–	–	–	–	–	1	4
		F.4.5.3.2.	X	–	–	–	–	–	–	–	1	
		F.4.5.3.3.	–	–	X	–	–	–	X	–	2	
	Audio Technologies from Past to Present	F.4.5.4.1.	–	–	X	–	–	–	–	–	1	3
		F.4.5.4.2.	–	–	X	X	–	–	–	–	2	
	Sound Pollution	F.4.5.5.1.	–	–	X	–	X	–	–	–	2	6
		F.4.5.5.2.	X	–	–	–	–	X	–	–	2	
		F.4.5.5.3.	–	–	–	–	–	X	X	–	2	
Human and Environment	Conscious Consumers	F.4.6.1.1.	–	–	–	–	–	X	X	–	2	3
		F.4.6.1.2.	–	–	–	–	–	X	–	–	1	
Simple Electric Circuits	Simple Electric Circuits	F.4.7.1.1.	–	–	X	–	X	–	–	–	2	5
		F.4.7.1.2.	–	–	X	–	–	–	–	–	1	
		F.4.7.1.3.	–	–	X	–	X	–	–	–	2	

fourth-grade science curriculum, it was the unit that was dealt with the most in the fifth-grade science curriculum. Key competencies numbered 1 and 3 were among the key competencies most often used in the fifth-grade curriculum as well as in the third and fourth-grade programs. It is rationalized that the competencies numbered 2, 4, and 8 are not given enough place as in the third and fourth-grade curriculum. While the key competencies within the scope of TQF and EQF take place alone in some acquisitions, more than one competency can be found together in some acquisitions. Primarily, competence number 3, *"mathematical competence and basic competencies in science/technology,"* was able to find a place in almost all acquisitions. Table 6 extends the relationship between sixth-grade science curriculum acquisitions and key competencies.

The sixth-grade science curriculum contains a total of 7 units, 59 acquisitions, and is with a course duration of 144 hours. On this basis, it was reconciled that the unit with the most key competency was "Matter and Heat" ($n=24$) and the unit with the least was "Solar System and Eclipses" ($n=7$). It is apprehended that the sixth-grade science curriculum is a highly rich program with respect to key competencies compared to the third, fourth, and fifth-grade curriculums. This difference can also be clearly ascertained in the number of acquisitions. Key competencies numbered 1 and 3 were among the most frequently cited key competencies as in the third, fourth, and fifth-grade programs. Table 7 unveils the relationship between the acquisitions, of the seventh-grade science curriculum and key competencies (MoNE, 2018, pp.39-46).

Table 5.
The Relationship Between Fifth-Grade Science Curriculum Acquisitions and Key Competencies

Unit	Subject Name	Acquisition Code	Key Competence								Total	
			1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**f**	**∑ f**
Sun, Earth and Moon	The Structure and Properties of the Sun	F.5.1.1.1.	X	–	X	–	–	–	–	–	2	3
		F.5.1.1.2	–	–	X	–	–	–	–	–	1	
	Structure and Properties of the Moon	F.5.1.2.1.	X	–	X	–	–	–	–	–	2	4
		F.5.1.2.2.	X	–	X	–	–	–	–	–	2	
	Moon's Movements and Phases	F.5.1.3.1.	X	–	X	–	–	–	–	–	2	4
		F.5.1.3.2.	X	–	X	–	–	–	–	–	2	
	Sun, Earth and Moon	F.5.1.4.1.	–	–	X	–	–	–	–	–	1	1
World of Live Things	Let's Get to Know the Living Things	F.5.2.1.1.	–	–	X	–	–	–	–	–	1	1
Measuring Force and Friction	Measuring Force	F.5.3.1.1.	–	–	X	–	–	–	–	–	1	2
		F.5.3.1.2.	–	–	X	–	–	–	–	–	1	
	Frictional force	F.5.3.2.1.	X	–	–	–	X	–	–	–	2	5
		F.5.3.2.2.	–	–	X	–	–	–	–	–	1	
		F.5.3.2.3.	–	–	–	–	X	–	X	–	2	
Matter and Change	Change of State of Matter	F.5.4.1.1.	X	–	X	–	–	–	–	–	2	2
	Distinctive Features of Matter	F.5.4.2.1.	–	–	X	–	–	–	–	–	1	1
	Heat and Temperature	F.5.4.3.1.	X	–	X	–	–	–	–	–	2	4
		F.5.4.3.2.	X	–	X	–	–	–	–	–	2	
	Heat Affects Matters	F.5.4.4.1.	X	–	X	–	–	–	–	–	2	4
		F.5.4.4.2.	–	–	X	–	X	–	–	–	2	
Spread of Light	Spread of Light	F.5.5.1.1.	–	–	X	–	–	–	–	–	1	1
	Reflection of Light	F.5.5.2.1.	–	–	X	–	–	–	–	–	1	3
		F.5.5.2.2.	X	–	X	–	–	–	–	–	2	
	Encountering Light with Matter	F.5.5.3.1.	–	–	X	–	–	–	–	–	1	1
	Umbra	F.5.5.4.1.	–	–	X	–	–	–	–	–	1	3
		F.5.5.4.2.	–	–	X	–	X	–	–	–	2	
Human and Environment	Biodiversity	F.5.6.1.1.	–	–	–	–	–	X	X	–	2	4
		F.5.6.1.2.	X	–	X	–	–	–	–	–	2	
	Human and Environment Relationship	F.5.6.2.1.	X	–	–	–	–	–	–	–	1	7
		F.5.6.2.2.	–	–	–	–	–	X	X	–	2	
		F.5.6.2.3.	–	–	–	–	–	X	X	–	2	
		F.5.6.2.4.	X	–	–	–	–	X	–	–	2	
	Destructive Natural Events	F.5.6.3.1.	X	–	–	–	–	–	–	–	1	2
		F.5.6.3.2.	X	–	–	–	–	–	–	–	1	
Electrical Circuit Elements	Representation of Circuit Elements with Symbols and Circuit Diagrams	F.5.7.1.1.	–	–	X	–	–	–	–	–	1	2
		F.5.7.1.2.	–	–	X	–	–	–	–	–	1	
	Variables Affecting Lamp Brightness in a Simple Electrical Circuit	F.5.7.2.1.	–	–	X	–	–	–	–	–	1	1

The seventh-grade science curriculum incorporates a total of 7 units, 67 acquisitions, and 144 hours of course time. Within this framework, it was arbitrated that the unit with the most key competency was "Pure Matters and Mixtures" ($n=30$) and the unit with the least was "Reproduction, Growth and Development in Living Things" ($n=13$). It would be fair to state that the seventh-grade science curriculum is also a very rich program in terms of key competencies, just like the sixth-grade curriculum. This difference can be clearly seen in the number of acquisitions. Key competencies numbered 1 and 3 were among the most frequently cited key competencies, as is the case with the third, fourth, fifth, and sixth-grade programs. Table 8 discloses the relationship between the acquisitions of the eighth-grade science curriculum and key competencies (MoNe, 2018, pp.47-54).

The eighth-grade science curriculum embraces a total of 7 units, 61 acquisitions, and has a course duration of 144 hours. Based on this, it was determined that the unit with the most key competency was "Matter and Industry" ($n=28$) and the unit with the least emphasis was "Seasons and Climate/Simple Machines" ($n=4$). It is remarked that the eighth-grade science curriculum is in fact an endowed program respecting key competencies, as in the sixth and seventh-grade curriculum. This situation reflects itself in the number of acquisitions. Key competencies numbered 1 and 3 were among the most frequently cited key competencies, as in the third, fourth, fifth, sixth, and seventh-grade programs. While it was seen that the key competencies numbered 2 and 8 were not included at all, it was determined that competency number 4 was included in 2 acquisitions.

Table 6.
The Relationship Between Sixth-Grade Science Curriculum Acquisitions and Key Competencies (MoNE, 2018, pp. 31–38).

Unit	Subject Name	Acquisition Code	Key Competence								Total	
			1	2	3	4	5	6	7	8	f	∑ f
Solar System and Eclipses	Solar System	F.6.1.1.1.	X	–	X	–	–	–	–	–	2	4
		F.6.1.1.2	–	–	X	–	X	–	–	–	2	
	Solar and Lunar Eclipses	F.6.1.2.1.	–	–	X	–	–	–	–	–	1	3
		F.6.1.2.2.	–	–	X	–	–	–	–	–	1	
		F.6.1.2.3.	–	–	X	–	–	–	–	–	1	
Systems in Our Body	Support and Movement System	F.6.2.1.1.	X	–	X	–	–	–	–	–	2	2
	Digestive System	F.6.2.2.1.	X	–	X	–	–	–	–	–	2	6
		F.6.2.2.2.	–	–	X	–	X	–	–	–	2	
		F.6.2.2.3.	X	–	X	–	–	–	–	–	2	
	The Circulatory System	F.6.2.3.1.	X	–	X	–	–	–	–	–	2	8
		F.6.2.3.2.	X	–	X	–	–	–	–	–	2	
		F.6.2.3.3.	X	–	–	–	–	–	–	–	1	
		F.6.2.3.4.	X	–	–	–	–	–	–	–	1	
		F.6.2.3.5.	X	–	–	–	–	X	–	–	2	
	Respiratory System	F.6.2.4.1.	X	–	X	–	–	–	–	–	2	2
	Excretory System	F.6.2.5.1.	X	–	X	–	–	–	–	–	2	2
Force and Movement	Resultant Force	F.6.3.1.1.	–	–	X	–	–	–	–	–	1	5
		F.6.3.1.2.	X	–	X	–	–	–	–	–	2	
		F.6.3.1.3.	X	–	X	–	–	–	–	–	2	
	Constant Speed Movement	F.6.3.2.1.	X	–	–	–	X	–	–	–	2	3
		F.6.3.2.2.	–	–	X	–	–	–	–	–	1	
Matter and Heat	Particulate Structure of Matter	F.6.4.1.1.	X	–	–	–	–	–	–	–	1	3
		F.6.4.1.2.	–	–	X	–	X	–	–	–	2	
	Intensity	F.6.4.2.1.	X	–	–	–	–	–	–	–	1	8
		F.6.4.2.2.	–	–	X	–	X	–	–	–	2	
		F.6.4.2.3.	–	–	X	–	X	–	–	–	2	
		F.6.4.2.4.	X	–	X	–	–	X	–	–	3	
	Matter and Heat	F.6.4.3.1.	–	–	X	–	–	–	–	–	1	7
		F.6.4.3.2.	–	–	X	–	–	–	–	–	1	
		F.6.4.3.3.	–	–	X	–	X	–	X	–	3	
		F.6.4.3.4.	X	–	–	–	–	X	–	–	2	
	Fuels	F.6.4.4.1.	X	–	X	–	–	–	–	–	2	6
		F.6.4.4.2.	X	–	–	–	–	X	–	–	2	
		F.6.4.4.3.	X	–	X	–	–	–	–	–	2	
Sound and Features	Spread of Sound	F.6.5.1.1.	–	–	X	–	–	–	–	–	1	1
	Sound Hearing Differently in Different Environments	F.6.5.2.1.	–	–	X	–	X	–	–	–	2	4
		F.6.5.2.2.	–	–	X	–	X	–	–	–	2	
	Speed of Sound	F.6.5.3.1.	–	–	X	–	–	–	–	–	1	1
	Interaction of Sound with Matter	F.6.5.4.1.	X	–	X	–	–	–	–	–	2	8
		F.6.5.4.2.	X	–	X	–	–	–	–	–	2	
		F.6.5.4.3.	X	–	–	–	–	–	–	–	1	
		F.6.5.4.4.	X	–	–	–	–	–	–	–	1	
		F.6.5.4.5.	–	–	X	–	–	–	X	–	2	
Systems and Health in Our Body	Supervisory and Regulatory Systems	F.6.6.1.1.	X	–	X	–	–	–	–	–	2	9
		F.6.6.1.2.	–	–	X	–	–	–	–	–	1	
		F.6.6.1.3.	X	–	–	–	–	X	–	–	2	
		F.6.6.1.4.	X	–	X	–	–	X	–	–	3	
		F.6.6.1.5.	X	–	–	–	–	–	–	–	1	
	Sense Organs	F.6.6.2.1.	X	–	X	–	–	–	–	–	2	6
		F.6.6.2.2.	–	–	X	–	–	–	X	–	2	
		F.6.6.2.3.	X	–	–	–	–	–	–	–	1	
		F.6.6.2.4.	X	–	–	–	–	–	–	–	1	
	Health of Systems	F.6.6.3.1.	X	–	X	–	–	–	–	–	2	3
		F.6.6.3.2.	–	–	–	–	–	X	–	–	1	
Conduction of Electricity	Conductive and Insulating Matters	F.6.7.1.1.	–	–	X	–	–	–	X	–	2	5
		F.6.7.1.2.	X	–	X	–	–	–	X	–	3	
	Electrical Resistance and Dependent Factors	F.6.7.2.1.	X	–	X	–	–	–	–	–	2	5
		F.6.7.2.2.	X	–	–	–	–	–	–	–	1	
		F.6.7.2.3.	–	–	X	–	X	–	–	–	2	

Table 7.
The Relationship Between Seventh-Grade Science Curriculum Acquisitions and Key Competencies

Unit	Subject Name	Acquisition Code	Key Competence								Total	
			1	2	3	4	5	6	7	8	f	∑ f
Solar System and Beyond	Space Research	F.7.1.1.1.	X	–	–	–	–	–	–	–	1	13
		F.7.1.1.2.	X	–	X	–	–	–	–	–	2	
		F.7.1.1.3.	X	–	X	X	–	–	–	–	3	
		F.7.1.1.4.	X	–	X	–	–	–	–	–	2	
		F.7.1.1.5.	–	–	X	–	X	–	–	–	2	
		F.7.1.1.6.	X	–	X	–	–	–	X	–	3	
	Beyond the Solar System: Celestial Bodies	F.7.1.2.1.	–	–	X	–	X	–	–	–	2	7
		F.7.1.2.2.	X	–	–	–	–	–	–	–	1	
		F.7.1.2.3.	X	–	X	–	–	–	–	–	2	
		F.7.1.2.4.	X	–	X	–	–	–	–	–	2	
Cell and Divisions	Cell	F.7.2.1.1.	–	–	X	–	X	–	–	–	2	7
		F.7.2.1.2.	X	–	X	X	–	–	–	–	3	
		F.7.2.1.3.	X	–	X	–	–	–	–	–	2	
	Mitosis	F.7.2.2.1.	X	–	–	–	–	X	–	–	2	4
		F.7.2.2.2.	X	–	X	–	–	–	–	–	2	
	Meiosis	F.7.2.3.1.	X	–	–	–	–	X	–	–	2	5
		F.7.2.3.2.	–	–	X	–	–	–	–	–	1	
		F.7.2.3.3.	–	–	X	–	X	–	–	–	2	
Force and Energy	Mass and Weight Relationship	F.7.3.1.1.	–	–	X	–	X	–	–	–	2	6
		F.7.3.1.2.	–	–	X	–	–	–	–	–	1	
		F.7.3.1.3.	X	–	X	–	X	–	–	–	3	
	Force, Work, and Energy Relationship	F.7.3.2.1.	X	–	X	–	–	–	–	–	2	4
		F.7.3.2.2.	–	–	X	–	X	–	–	–	2	
	Energy Conversions	F.7.3.3.1.	–	–	X	–	X	–	–	–	2	6
		F.7.3.3.2.	X	–	X	–	–	–	–	–	2	
		F.7.3.3.3.	–	–	X	–	–	–	X	–	2	
Pure Matters and Mixtures	Particulate Structure of Matter	F.7.4.1.1.	X	–	–	–	–	–	–	–	1	7
		F.7.4.1.2.	–	–	X	–	X	–	–	–	2	
		F.7.4.1.3.	X	–	X	–	–	–	–	–	2	
		F.7.4.1.4.	X	–	X	–	–	–	–	–	2	
	Pure Mattes	F.7.4.2.1.	–	–	X	–	–	–	–	–	1	7
		F.7.4.2.2.	X	–	X	–	X	–	–	–	3	
		F.7.4.2.3.	X	–	X	–	X	–	–	–	3	
	Mixtures	F.7.4.3.1.	–	–	X	–	–	–	–	–	1	6
		F.7.4.3.2.	–	–	X	–	X	X	–	–	3	
		F.7.4.3.3.	–	–	X	–	X	–	–	–	2	
	Separation of Mixtures	F.7.4.4.1.	–	–	X	–	–	–	–	–	1	1
	Household Waste and Recycling	F.7.4.5.1.	–	–	X	–	–	–	–	–	1	9
		F.7.4.5.2.	–	–	X	–	–	–	X	–	2	
		F.7.4.5.3.	–	–	X	–	–	X	–	–	2	
		F.7.4.5.4.	–	–	–	–	–	X	X	–	2	
		F.7.4.5.5.	–	–	–	–	–	X	X	–	2	
Interaction of Light with Matter	Absorption of Light	F.7.5.1.1.	–	–	X	–	X	–	–	–	2	8
		F.7.5.1.2.	–	–	X	–	–	–	–	–	1	
		F.7.5.1.3.	–	–	X	–	X	–	–	–	2	
		F.7.5.1.4.	X	–	–	–	–	–	–	–	1	
		F.7.5.1.5.	X	–	–	–	–	–	X	–	2	
	Mirrors	F.7.5.2.1.	X	–	X	–	–	–	–	–	2	4
		F.7.5.2.2.	–	–	X	–	–	–	–	–	2	
	Refraction of Light and Lenses	F.7.5.3.1.	–	–	X	–	X	–	–	–	2	8
		F.7.5.3.2.	–	–	X	–	–	–	–	–	1	
		F.7.5.3.3.	–	–	X	–	–	–	–	–	1	
		F.7.5.3.4.	–	–	–	X	–	X	–	–	2	
		F.7.5.3.5.	–	–	X	–	–	–	X	–	2	

(*Continued*)

Table 7.
The Relationship Between Seventh-Grade Science Curriculum Acquisitions and Key Competencies (Continued)

Unit	Subject Name	Acquisition Code	Key Competence								Total	
			1	2	3	4	5	6	7	8	f	∑ f
Reproduction, Growth and Development in Living Things	Human Reproduction, Growth, and Development	F.7.6.1.1.	X	–	X	–	–	–	–	–	2	6
		F.7.6.1.2.	X	–	X	–	–	–	–	–	2	
		F.7.6.1.3.	X	–	X	–	–	–	–	–	2	
	Reproduction, Growth, and Development in Plants and Animals	F.7.6.2.1.	–	–	X	–	–	–	–	–	1	7
		F.7.6.2.2.	X	–	X	–	–	–	–	–	2	
		F.7.6.2.3.	X	–	X	–	–	–	–	–	2	
		F.7.6.2.4.	X	–	X	–	–	–	–	–	2	
Electric Circuits	How to Connect Bulbs	F.7.7.1.1.	–	–	X	–	–	–	–	–	1	10
		F.7.7.1.2.	–	–	X	–	X	–	–	–	2	
		F.7.7.1.3.	X	–	–	–	–	–	–	–	1	
		F.7.7.1.4.	X	–	X	–	–	–	–	–	2	
		F.7.7.1.5.	–	–	X	–	X	–	–	–	2	
		F.7.7.1.6.	–	–	X	–	–	–	X	–	2	

Table 8.
The Relationship Between Eighth-Grade Science Curriculum Acquisitions and Key Competencies

Unit	Subject Name	Acquisition Code	Key Competence								Total	
			1	2	3	4	5	6	7	8	f	∑ f
Seasons and Climate	Formation of the Seasons	F.8.1.1.1.	–	–	X	–	–	–	–	–	1	1
	Climate and Weather Movements	F.8.1.2.1.	X	–	X	–	–	–	–	–	2	3
		F.8.1.2.2.	X	–	–	–	–	–	–	–	1	
DNA and Genetic Code	DNA and Genetic Code	F.8.2.1.1.	X	–	–	–	X	–	–	–	2	4
		F.8.2.1.2.	–	–	X	–	–	–	–	–	1	
		F.8.2.1.3.	X	–	–	–	–	–	–	–	1	
	Extends	F.8.2.2.1.	X	–	–	–	–	–	–	–	1	3
		F.8.2.2.2.	X	–	X	–	–	–	–	–	2	
	Mutation and Modification	F.8.2.3.1.	X	–	X	–	–	–	–	–	2	6
		F.8.2.3.2.	X	–	X	–	–	–	–	–	2	
		F.8.2.3.3.	–	–	X	–	X	–	–	–	2	
	Environmental Adaptation	F.8.2.4.1.	X	–	X	–	–	–	–	–	2	2
	Biotechnology	F.8.2.5.1.	–	–	X	–	–	–	–	–	1	5
		F.8.2.5.2.	X	–	–	–	–	X	–	–	2	
		F.8.2.5.3.	–	–	X	–	X	–	–	–	2	
Pressure	Pressure	F.8.3.1.1.	–	–	X	–	X	–	–	–	2	8
		F.8.3.1.2.	–	–	X	–	X	–	–	–	2	
		F.8.3.1.3.	X	–	X	X	–	X	–	–	4	
Matter and Industry	Periodic System	F.8.4.1.1.	X	–	X	–	–	–	–	–	2	3
		F.8.4.1.2.	–	–	X	–	–	–	–	–	1	
	Physical and Chemical Changes	F.8.4.2.1.	X	–	X	–	–	–	–	–	2	2
	Chemical Reactions	F.8.4.3.1.	–	–	X	–	X	–	–	–	2	2
	Acids and Bases	F.8.4.4.1.	X	–	–	–	–	–	–	–	1	9
		F.8.4.4.2.	–	–	X	–	–	–	–	–	1	
		F.8.4.4.3.	–	–	X	–	–	–	–	–	1	
		F.8.4.4.4.	–	–	X	–	X	–	–	–	2	
		F.8.4.4.5.	–	–	X	–	–	–	–	–	1	
		F.8.4.4.6.	–	–	–	–	–	–	–	–	–	
		F.8.4.4.7.	–	–	X	–	–	–	X	–	3	
	Interaction of Matter with Heat	F.8.4.5.1.	–	–	X	–	X	–	–	–	2	8
		F.8.4.5.2.	–	–	X	–	X	–	–	–	2	
		F.8.4.5.3.	X	–	X	–	–	–	–	–	2	
		F.8.4.5.4.	–	–	X	–	–	X	–	–	2	
	Chemical Industry in Turkey	F.8.4.6.1.	–	–	X	–	X	–	–	–	2	4
		F.8.4.6.2.	–	–	X	–	–	–	X	–	2	
Simple Machines	Simple Machines	F.8.5.1.1.	X	–	X	–	–	–	–	–	2	4
		F.8.5.1.2.	–	–	X	–	–	–	X	–	2	

(*Continued*)

Table 8.
The Relationship Between Eighth-Grade Science Curriculum Acquisitions and Key Competencies (Continued)

Unit	Subject Name	Acquisition Code	Key Competence								Total	
			1	2	3	4	5	6	7	8	f	∑ f
Energy Conversions and Environmental Science	Food Chain and Energy Flow	F.8.6.1.1.	–	–	X	–	–	–	–	–	1	1
	Energy Conversions	F.8.6.2.1.	–	–	X	–	X	–	–	–	2	5
		F.8.6.2.2.	–	–	X	–	X	–	–	–	2	
		F.8.6.2.3.	X	–	–	–	–	–	–	–	1	
	Matter Cycles and Environmental Issues	F.8.6.3.1.	X	–	X	–	–	–	–	–	2	6
		F.8.6.3.2.	–	–	X	–	–	X	–	–	2	
		F.8.6.3.3.	X	–	–	–	–	X	–	–	2	
	Sustainable Development	F.8.6.4.1.	–	–	–	–	–	X	X	–	2	9
		F.8.6.4.2.	–	–	X	–	–	–	X	–	2	
		F.8.6.4.3.	X	–	–	–	–	–	–	–	1	
		F.8.6.4.4.	–	–	X	–	–	X	–	–	2	
		F.8.6.4.5.	–	–	X	–	–	X	–	–	2	
Electrical Loads and Electrical Energy	Electric Loads and Electrification	F.8.7.1.1.	X	–	X	X	–	–	–	–	3	8
		F.8.7.1.2.	X	–	X	–	X	–	–	–	3	
		F.8.7.1.3.	–	–	X	–	X	–	–	–	2	
	Electrically Loaded Objects	F.8.7.2.1.	–	–	X	–	–	–	–	–	1	2
		F.8.7.2.2.	X	–	–	–	–	–	–	–	1	
	Conversion of Electrical Energy	F.8.7.3.1.	–	–	X	–	X	–	–	–	2	11
		F.8.7.3.2.	–	–	X	–	–	–	–	–	1	
		F.8.7.3.3.	X	–	X	–	–	–	–	–	2	
		F.8.7.3.4.	–	–	X	–	–	X	–	–	2	
		F.8.7.3.5.	X	–	–	–	–	X	–	–	2	
		F.8.7.3.6.	–	–	–	–	–	X	X	–	2	

Conclusion, Discussion, and Recommendations

In light of the findings and results of the present study, arguably the TQF appears to form a subset of the EQF and they complement each other in terms of key competencies. For this reason, all competencies classified within the scope of TQF can also be evaluated within the scope of EQF. In this study, in which the 2018 science course curriculum was delved into within the scope of TQF and EQF, the program's specific objectives and key competencies were first compared. In this direction, the specific objectives of the science course curriculum have been determined to be associated with *"communication in mother language, mathematical competence and basic competencies in science/technology, learning to learn, social and civic competencies, sense of initiative and entrepreneurship, cultural awareness and expression"* competencies but not adequately with *"communication in foreign languages, digital competence"* competencies. In his study, Pala (2020) highlighted that there is no acquisition of competence of *"communication in foreign languages"* in the fifth-grade curriculum of the social studies course. These results support the results of the research. European Commission (2007) oftentimes asserts the importance of key competencies for life-long learning. It is accented that serious programs have been created, for the most part on globalization and internationalization. From this point of view, *"communication in foreign languages"* comes to the fore. Jarvis (2007) approached life-long learning skills from a sociological perspective and reiterated that communicating and getting to know new individuals is the first step in learning. These views imply that the key competence of *"communication in foreign languages"* should be included more in the curriculum acquisitions.

Due to the nature of science education, it has been distinguished that *"mathematical competence and basic competencies in science/technology"* competence is frequently touched upon. This competence area, which includes analytical thinking and basic skills for science, is an area that is mostly emphasized in a great many meetings and statements (Bergen Communiqué, 2005; ETF, 2016; Eurydice, 2005). In this respect, it is expected that it will be included in the programs intensively. Other competencies that found themselves the most in special purposes were *"social and civic competencies"* and *"sense of initiative and entrepreneurship"*. For these competencies, it can be uttered that science education is consistent with helping the individual adapt to the environment and to society in which they live and with supporting innovation and entrepreneurship attitudes (Pala & Başıbüyük, 2019; SAQA, 2014). When the skills expected to be acquired by students within the scope of the science curriculum are compared with the key competencies, it is seen possible to descry that *"mathematical competence and basic competencies in science/technology, digital competence, sense of initiative and entrepreneurship"* competencies are predominantly included, while *"cultural awareness and expression"* competence is not included. Along with it, no key competence was associated with the skill of *"providing an interdisciplinary perspective."* In the literature, in the first part of the Global Inventory of Regional and National Qualifications Frameworks (2017), this subject has been dwelled on in-depth, and it has been announced that gaining an interdisciplinary perspective supports a considerable number of different skills in students. In this respect, it can be concluded that some skills are not sufficiently correlated in terms of key competence.

Engineering and design skills came to the fore in the 2018 science curriculum, and these skills were largely associated with *"learning to learn"* and *"sense of initiative and entrepreneurship"* competencies. Digital competence, which is one of the key competencies with a fundamental place in the 21st century, has found more place in the skills section compared to the special purposes. Digital competence has started to take place in the national competence framework of many countries in a similar way (Allais, 2011; Bolton & Reddy, 2015; Cedefop, 2016; Strathdee, 2011). The science curriculum embodies third, fourth, fifth, sixth, seventh, and eighth-grade levels, and each of them consists of seven units. When examined with regard to the number of acquisitions, it is recognized that there are 36 acquisitions in the third grade, 46 in the fourth grade, 36 in the fifth grade, 59 in the sixth grade, 67 in the seventh grade, and 61 in the eighth grade, and the content of acquisitions and subjects have been increased since the sixth grade. This situation indirectly affects the amount of key competence included. As per the relevant curriculum, many topics have been prepared gradually and complemented according to grade levels. That said, this situation is not valid for the key competencies. To cite an example, while "Journey to the World of Living Things" was the most frequently used unit in the third-grade program in terms of key competence, the "Human and Environment" unit in the fourth-grade program, which constitutes a continuation and complement of this unit, was the least included key competence unit. In actuality, this is true for many units.

Regardless of grade level, unit, and subject content, it is inferred that *"communication in mother language"* and *"mathematical competence and basic competencies in science/technology"* competencies are intensely included in all science curriculum and these competencies come to light in almost all acquisitions. After the aforementioned competencies, there come the competencies: *"learning to learn," "social and civic competencies,"* and *"sense of initiative and Entrepreneurship."* These competencies are remarkably emphasized in plenty of reports published at the international level. As a matter of fact, it is seen that they are in NESET (2017), ETF (2020), and the European Commission Key Competencies for Lifelong Learning (European Commission, 2019a). *"Communication in foreign languages," "digital competence,"* and *"cultural awareness and expression"* competencies, on the other hand, found a place in the program at very few levels. Regarding this issue, some suggestions were made on key competencies at the conference held in Brussels in 2019. Among these suggestions, the competence to be bilingual enters the picture the most. With this key competence, it is aimed that individuals can communicate at a high level and explore different cultures (European Commission, 2019b). It is seen that the acquisitions in the science curriculum are generally designed to carry two different competencies. Notwithstanding, it is found out that while there is only one competency in some acquisitions, in some of them, up to two, three, or four key competencies are included. Considering that the science course has an interdisciplinary structure, it can be stated that the program is well prepared when viewed in this way.

When the literature on the research results is enquired into, it is seen that there are similarities and differences. Tedmem (2017) stated in the *Transformation of PISA report* that there should be a new field of competence, especially in the evaluation of PISA 2018 exams, and named this competence *"Global Competence."* Along similar lines, global competence was included in the European Commission's 2018 recommendation (European Commission, 2018). This area of competence has hitherto not taken its place among the key competencies, but when the science curriculum is examined, it can be enunciated that global competence is inevitable. In the study conducted by Epçaçan (2013), the primary school fourth-grade Turkish textbook was examined, and it was declared that life-long learning competencies were largely included. Yıldırım (2015) verbalized in his study that some of the competencies of classroom teachers differ according to their seniority and these differences are in *"digital competence" and "learning to learn"* fields. Gencel (2013) stated in their study that pre-service teachers consider themselves to be at a good level in *"communication in mother language"* competence but insufficient in *"communication in foreign languages"* and "social and civic" competencies. Verily, this result shows similarity in the distribution of gains in terms of key competencies. Because, while competence of *"communication in the mother language"* is included in almost all acquisitions, competencies related to *"communication in foreign languages"* and *"social and civic competencies"* found less place in the acquisitions. Abbak (2018) examined branch teachers in his study. Accordingly, it was determined that female branch teachers had higher competencies in the fields of *"communication in mother language," "communication in foreign languages,"* and *"social and civic competencies"* than male teachers. Yalkın and Işık (2019) expounded on the science curriculum in view of lifelong learning competencies in their study. In parallel with the studies found in the research, they stated that more importance should be given to *"communication in foreign languages"* and "digital competence". Additionally, they called attention to that the acquisitions should be presented to the students in a more quality way by designing activities accordingly.

When the science curricula of the countries within the scope of the European Union are scrutinized, it is concluded that there is a common curriculum and key competence system. In these, skills, acquisitions and key competencies are specified as in our country. But still, there are some differences. First of all, skills and acquisitions were matched, and it was clearly stated which acquisition supported which skill. On top of that, key competencies are matched with learning acquisitions depending on skills. In other words, teachers know which acquisition they will use and which skills they can support as a result. These skills are compatible with concretely expressed learning acquisitions and key competencies. Each key competence was discussed in detail under the categories of knowledge, skill, and competence and was expressed to observe student behaviors rather than being stated through general expressions directly. Consequently, a sequential control system has been created so that teachers can observe student behaviors more easily and manage them. In light of the findings obtained in the research, some suggestions are made. These can be found below:

1. It has been observed that the key competencies in both the science curriculum and the field-specific skills are not evenly distributed, some competencies—*"communication in mother language, mathematical competence and basic competencies in science/ technology"*—are frequently included, while some *competencies—"communication in foreign languages, digital competence, cultural awareness and expression"*—are not given much space. It can be suggested that more attention is paid to this point in the renewal studies of the science curriculum.
2. In the 21st century, the matter of gaining and facilitating digital competence is prominent. Even so, when the science curriculum is checked, it is seen that this area of competence is not given much space both at the skill level and at the level of acquisitions. Thence it can be suggested that the achievements be revised to include digital competency practices, and the number of sample practices and sequential activities should be boosted.
3. Key competencies that form a framework within the scope of TQF and EQF can be made clearer by creating knowledge, skills, and competency sub-criteria as scope, content, and application area. These competencies cannot adequately meet the needs of every program. At this point, it can be suggested to organize key competencies according to branches.
4. Today, professions that depend on automation (in which digital systems are predominant) are increasing day by day. This situation makes the existence as well as the use of technology inevitable in all areas of our lives. It can be put forward that digital competence applications need to be given more space in the context of acquisitions.
5. When global research results such as PISA exams are examined, it is stated that most of the students have insufficient basic skills. In 2015, one in five students faced serious difficulties developing adequate reading and math and science skills. While there are individuals with low levels of digital skills up to 44% in some countries, this rate can drop to 19% from time to time (European Commission, 2018). For this reason, key competencies need to be distributed in harmony with basic skills.

6. As a result, key competencies need to be incorporated into the science curriculum in a more detailed and applicable way and revised in line with the needs of the age.

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