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Abstract

The purpose of this study is to investigate the extent to which science process skills are represented in the texts and activities in 3rd, 4th, 5th, 6th, 7th, and 8th-grade science textbooks according to the learning areas of the science curriculum. The document analysis method is adopted in the current study. Course contents and activities in science textbooks are analyzed using descriptive analysis. The results show that there are 899 science process skills defined throughout 42 units in the 3rd, 4th, 5th, 6th, 7th, and 8th-grade science textbooks. Moreover, it is found that science process skills are mainly focused on the 6th grade science textbook (n=215) and the least on the 3rd grade science textbook (n=112). Furthermore, when the averages of science process skills used in science textbooks are examined, it has been determined that the use of science process skills in 6th (%23.9) and 7th (%18.8) grade textbooks are above the average. While science process skills in science textbooks increase from the 3rd grade to the 4th grade at the primary education level, a similar increase is not determined in the use of science process skills in secondary school science textbooks. When science textbooks are examined according to grade levels in terms of science process skills, it is discovered that *observing* is the most commonly utilized science process skill, while *using data and modeling* is the least used.

Keywords: Science process skills, Science textbook, Primary school, Secondary school

Introduction

In this age in which we live, the expectations and needs of the individuals and the society we live in change over time with the rapid developments in the field of technology. Science education has great importance in raising individuals and in the features that individuals want to gain, and therefore science education should be organized effectively (Yıldırım & Selvi, 2017). Science education has grown in importance over time, and one of the primary goals of education is to produce productive individuals who can understand and inquire about information, produce solutions to problems they encounter, and use technological applications effectively and efficiently (Hançer et al., 2003).

With the development of technology, traditional educational theories have begun to give way to constructivist education. In the constructivist approach developed by Vygotsky (1978), the learner makes sense of the learning action in their mind through the experiences s/he encounters in real life. To conceptualize a meaning, it must be grounded in experience. For this reason, in the constructivist approach, the student should be at the center of the learning experience, and the role of the teacher should be to guide the student's learning (Matthews, 2002). In other words, in the constructivist approach, scientific knowledge is not directly transferred to the student, but by providing appropriate educational environments, the student is provided to construct the knowledge himself (Büyüktaşkapu, 2010).

According to the constructivist learning approach, everyone attaches a personal meaning to the information, makes sense of it within himself, and constructs it by combining it with his previous knowledge (Cobern, 1993). In constructivist learning environments, students are expected to develop results by following scientific methods by presenting a real-life problem or situation. When students scientifically interact with the world, they find themselves observing, asking questions, making hypotheses, estimating, researching, interpreting, and communicating (Ekici & Erdem, 2020). Thus, instead of memorizing information as the teacher tells or written in the book, students transform it into a meaningful and permanent form by passing it through science process skills

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(Şen & Nakipoğlu, 2012). Science teaching not only focuses on knowledge and thinking, but also on other dimensions such as the learning process, and participation in science-based activities engages scientific process skills (Duda et al., 2019). Appropriate learning models require the availability of teaching media and teachers as facilitators in learning to develop process skills and the suggested model for learning is constructivism, which is consistent with process skills (Arantika et al., 2019; Çetinkaya-Aydin & Cakiroglu, 2017). Science teaching with a constructivist approach can be an effective way for students to learn and correctly interpret the natural environment. In science learning, students should be given direct experience through a learning process based on process skills and scientific attitudes (Juhji & Nuangchalerm 2020). In this way, students learn about universally valid concepts, principles, and theories through a set of processes known as science processes (Siregar et al., 2020). In addition, the nature of science consists of scientific processes and scientific attitudes (Juhji & Nuangchalerm 2020).

SPS is defined as defining a problem, making hypotheses, making predictions, defining variables, testing assumptions by doing experiments, collecting data, analyzing data, and presenting findings (Tobin & Cape, 1982). SPS is also defined as insights to develop the intellectual, social, and physical skills that are the source of the student's self (Atmojo, 2012). SPS is one of the most important skills that every student should have, because these skills are used in daily life and affect personal, social, and individual lives in the global world (Siregar et al., 2020). They are inseparable from the conceptual understanding of learning and applying science in practice (Harlen, 1999a). Students can model, observe, experiment, or research according to the nature of the subject and problem (Choirunnisa et al., 2018).

SPS is one of the competencies that students should acquire in research and inquiry environments and scientific content and concept learning (Windschitl et al., 2008). Science process skills are a very important science learning approach for scientific research (Siregar et al., 2020). These skills are an essential asset for science students who can support mastery of science concepts (Duda et al., 2019). The purpose of science education is not only to contribute to the development of scientific concepts (Tobin et al., 1990); developing science process skills should be a fundamental goal of science education (Harlen, 1999b). The main purpose of science education is to teach students to think effectively, form hypotheses, manipulate the natural world, and reason based on data with the help of science process skills (Özgelen, 2012). Learning science subjects by understanding requires using science process skills (Ergül et al., 2011). In this regard, an important task of science educators is to help students develop the thinking skills of scientists (Roth & Roychoudhury, 1993).

Many studies show that science process skills are effective in students' learning of scientific approaches (Ergül et al., 2011). The study of Brotherton and Preece (1995) evaluated the Piagetian development level of secondary school students and determined a significant overlap between the scientific process skills and the Piagetian development level. Chang and Mao (1999) conducted a study with secondary school students, they revealed that inquiry-oriented teaching is superior in promoting students' achievement and attitudes towards earth science. Af'idayani et al. (2018) state that the learning by inquiry model offers students the opportunity to explore and research a concept that is procedural, systematic, and interconnected between one concept and another. Hodosyova et al. (2005) examined the development of science process skills of secondary school students and revealed that these skills are especially useful for hypothesizing, controlling variables, and planning experiments. Students with strong foundations in science process skills can use these skills in more intensive scientific research and are more likely to be successful in this research (Wilke & Straits, 2005). If these skills are not well developed, the concepts learned will not help students understand the world around them (Harlen, 1999a).

To overcome the challenges of the 21st century in the science and technology sector and to increase students' competitiveness in the age of globalization, they need to be equipped with 21st century skills (Turiman et al., 2012). Science process skills, which are among the most important skills to have in the twenty-first century (North Central Regional Educational Laboratory, 2003; National Science Foundation, 2000), play a critical role in the development of high-level thinking skills, which are critical for children's mental development (Tan & Temiz, 2003). Children are like scientists. Many children already have an inquisitive curiosity in their nature, and this curiosity leads them to research. In this way, children start researching at an early age (Ergül et al., 2011). Students with science process skills take an active role in acquiring and structuring information. They can manage a scientific study appropriate to their cognitive level, develop solutions to daily life problems with the help of the information they learn in the classroom, approach events in the form of cause-effect relationships and approach them in different ways. Ergül et al. (2011) stated the benefits of science process skills for students as follows; it facilitates learning in physical sciences, provides active student participation, develops students' sense of responsibility for their learning, increases the permanence of learning, and enables students to acquire research ways and methods. Science process skills are also learning processes designed so that students can find facts, form concepts and theories, and develop intellectual skills and scientific attitudes that can be developed through hands-

on activities (Siregar et al., 2020). They can establish connections between events and predict the probability of certain events that may occur in the future. Thus, students' mental and cognitive skills such as predicting the consequences of a possible situation or problem that they may encounter in the future, making decisions, making judgments, and expressing themselves develop over time (Şen & Nakipoğlu, 2012).

Science process skills are necessary for students to take place in a world dominated by science and technology. Teaching science process skills to students are considered among the main objectives of science education (National Research Council, 2000). To keep up with the needs and requirements of the age, it is aimed to gain these behaviors to the students by adding various skills and behaviors to the education programs. Science teachers should integrate science process skills into their lessons in student-centered constructivist learning environments. Science process skills can be defined as the skills that scientists use when researching and structuring knowledge. They are transferable skills that can be applied to many sciences (Ergül et al., 2011). Science process skills are the thinking skills scientists use to construct knowledge by solving problems and formulating results (Özgelen, 2012). These skills include observing, classifying, estimating/hypothesizing, measuring, changing, and controlling variables, experimenting, recording data, and using data and modeling (Tan & Temiz, 2003). Science process skills are scientific only when applied in the context of science, and applications do not always have to be related to limited scientific content.

On the contrary, the applications of science process skills are related to scientific content and have a central role in learning by understanding this scientific content (Harlen, 1999b). The skills and processes that students use and develop are the same as those used by scientists while working. These studies are necessary to understand the workings of nature and prepare livable environments (Özgelen, 2012). Studies conducted with almost all grade level students indicated that science process skills should teach in constructivist learning environments to develop students' science process skills. These studies also demonstrated that there is an increase in students' problem-solving skills, conceptual understanding, and academic achievement. Since studies show that science process skills developed with the integration of additional treatment, it is necessary to integrate science process skills in a science lesson through curriculum and textbooks (Colvill & Pattie, 2003).

Textbooks, which are one of the materials used in the course process, can also influence the acquisition of these skills in the curriculum. One of the important features of an effective textbook is that a textbook is designed to be compatible with the curriculum adopted in the country (Morgil & Yılmaz, 1999). Kul et al. (2018) stated that textbooks are frequently used teaching material in the teaching and learning processes. The basic principle in the preparation of textbooks to be used in teaching processes is that the textbooks contain activities that can provide students with the behaviors, knowledge, skills, and various features determined in the curriculum and that they are guiding in the realization of these activities (Ünsal & Güneş, 2003). It is important how much the science process skills specified in the 2018 curriculum are represented in the textbooks and play an important role in gaining the determined skills. According to Aybek et al. (2014), the quality of the textbooks taught in schools directly affects the quality of education given to students. In this sense, the published books must be in a way that would provide the necessary skills. For this reason, it is necessary to evaluate the textbooks in terms of the skills that the program is based on for students (Yıldız, Feyzioğlu & Tatar, 2012). In this respect, the main aim of this study was to investigate the extent to which science process skills are represented in the texts and activities in the 3rd, 4th, 5th, 6th, 7th, and 8th-grade school science textbooks according to the learning areas in the science curriculum.

The sub-problems of the study are as follow:

- According to grade levels, what is the distribution of science process skills used in texts and activities in science textbooks?
- According to the units covered, what is the distribution of science process skills used in texts and activities in science textbooks?
- According to the disciplines of science covered, what is the distribution of science process skills used in texts and activities in science textbooks?

Method

Research Design

This research was carried out by document analysis method. Document analysis is a method used to obtain information about the subject and to make sense of the subject by examining the written materials about the research issue without observation or interview (Bowen, 2009; Corbin & Strauss, 2008). This study investigated

the extent to which science process skills are represented in the texts and activities in the 3rd, 4th, 5th, 6th, 7th and 8th-grade science textbooks according to the learning areas in the science curriculum in Turkey.

In the current study, the texts, and activities in the science textbooks within the scope of the study were analyzed by considering the science process skills. 42 units in 7 textbooks were examined using the "Textbook Review Template" given in Appendix 1. The texts and activities in the science textbooks were analyzed using descriptive analysis. Descriptive analysis is used in the analyses made by considering the codes, categories, and themes predetermined by the researcher or already exist within the scope of the theoretical framework (Glesne, 2013).

The analysis of the texts and activities in science textbooks in terms of science process skills was carried out as follows: (1) The texts and activities in the 6th-grade science textbook were analyzed together by the researchers to ensure agreement between the analyzers in the analyses; (2) Science textbooks other than 6th grade were randomly distributed to different researchers, and the analysis of the texts and activities in the textbooks for science process skills was carried out individually by the researchers; (3) The reliability analysis of the study was carried out by examining 15 activities from each science textbook, a total of 120 activities, by an expert not involved in the current study on science process skills. The reliability coefficient of the study was calculated by comparing the analysis results of the researchers with the expert analysis. The reliability coefficient of the analysis was calculated as .94 by using the reliability coefficient formula determined by Miles & Huberman (1994) by evaluating similar results with the field expert in the "consensus" category and different results in the "disagreement" category.

Ethical Procedures

Ethics committee approval is not required for this study as document analysis was conducted.

Results

In the present study, analyses were conducted across units/subjects and grade levels for the use of science process skills in the science textbooks tutored at the 3rd, 4th, 5th, 6th, 7th, and 8th grades of primary and secondary schools under the supervision of the Ministry of National Education. The number and percentages of science process skills determined according to the units at the 3rd, 4th, 5th, 6th, 7th, and 8th-grade science textbooks are presented in the tables below. Table 1 presents the distribution of science process skills according to the 3rd grade level science textbook units.

Table 1. Distribution of science process skills according to units in the 3rd grade level science textbook

		Units (7)								
		Let's Get to Know Our Planet	Our Five Senses	Let's Get to Know the Force	Let's Get to Know the Matter	Light and Sounds Around Us	Journey to the World of the Living	Electric Vehicles	Total	
Grade Level	Science Process Skills	n	n	n	n	n	n	n	%	n (112)
3rd Grade	Observing	6	-	6	6	15	8	2	38.4	43
	Classifying	-	-	1	5	4	3	2	13.4	15
	Estimating/ Hypothesizing	4	-	3	1	6	6	1	18.7	21
	Measuring	2	-	-	-	-	1	-	2.68	3
	Changing and Controlling Variables	1	-	3	1	3	-	-	7.15	8
	Experimenting	1	-	3	1	4	1	-	8.94	10
	Recording Data	-	-	1	2	-	2	-	4.47	5

	Using Data and Modelling		2	-	-	-	-	2	3	6.26	7
	Total	n	16	0	17	16	32	23	8		
		%	14.1	-	15.3	14.1	28.6	20.5	7.14	100	

According to Table 1, 112 science process skills are identified in 7 units of the 3rd-grade science textbook. The most used science process skills at the 3rd-grade level were the *observing* (n=43) and the *estimating/hypothesizing* (n=21), and the least used ones were the *recording data* (n=5) and *measuring* (n=3). It is noted that the unit containing the most science process skills in the 3rd-grade science textbook is the "Light and Sounds Around Us" unit (n=32). On the other hand, it is noteworthy that no activity or content would improve science process skills in the unit related to "Our Five Senses" (n=0). Table 2 presents the distribution of science process skills according to the 4th grade level science textbook units.

Table 2. Distribution of science process skills according to units in the 4th grade level science textbook

		Units (7)							Total	
		Earth and Crust Movements	Our Food	Effects of Force	Properties of Matter	Lighting Technologies	Human and Environment	Simple Electric Circuits		
Grade Level	Science Process Skills	n	n	n	n	n	n	n	%	n (131)
4th Grade	Observing	3	2	4	15	2	1	4	23.66	31
	Classifying	-	3	2	4	2	-	-	8.39	11
	Estimating/ Hypothesizing	5	7	5	7	3	-	3	22.90	30
	Measuring	-	-	-	4	-	-	-	3.05	4
	Changing and Controlling Variables	-	2	4	9	-	-	2	12.97	17
	Experimenting	-	1	4	11	-	-	2	13.74	18
	Recording Data	1	2	3	7	-	-	1	10.68	14
	Using Data and Modelling	1	1	1	1	1	-	1	4.58	6
	Total n	10	18	23	58	8	1	13		
	Total %	14.1	-	15.3	14.1	28.6	20.5	7.14	100	

Table 2 presents that 131 science process skills are identified in the 4th-grade science textbook covering 7 units. The most used science process skills in the 4th-grade science textbook are *observing* (n=31) and *estimating/hypothesizing* (n=30), while the least used skills are *using data and modeling* (n=6) and *measuring* (n=4). It is found that while science process skills mainly were included in the unit "Properties of Matter" (n=58), these skills were used the least in the "Human and Environment" unit (n=1). Table 3 presents the distribution of science process skills used in science textbooks according to science disciplines at the primary school level.

Table 3. Distribution of science process skills used in science textbooks according to the disciplines of science at primary school level

		Science Process Skills									
		Observing	Classifying	Estimating/ Hypothesizing	Measuring	Changing and Controlling Variables	Experimenting	Recording Data	Using Data and Modelling	Total	
Grade Level	Disciplines of Science	n	n	n	n	n	n	n	n	n	%
3rd Grade	Human and environment	23	7	12	1	3	5	2	2	55	49.1
	Physics	8	3	4	-	3	3	1	3	25	22.3
	Astronomy and earth science	6	-	4	2	1	1	-	2	16	14.3
	Chemistry	6	5	1	-	1	1	2	-	16	14.3
	Biology	-	-	-	-	-	-	-	-	-	-
	Total	43	15	21	3	8	10	5	7	112	100
4th Grade	Chemistry	15	4	7	4	9	11	7	1	58	44.3
	Physics	8	2	8	-	6	6	4	2	36	27.5
	Biology	2	3	7	-	2	1	2	1	18	13.7
	Astronomy and earth science	3	-	5	-	-	-	1	1	10	7.6
	Human and environment	3	2	3	-	-	-	-	1	9	6.9
	Total	31	11	30	4	17	18	14	6	131	100
	The Overall Total	74	26	51	7	25	28	19	13	243	100

When Table 3 is examined, it was determined that science process skills took place mostly in the disciplines related to human and the environment (n=55) in science textbooks, followed by physics (n=25), astronomy and earth science (n=16), and chemistry (n=16) at the 3rd-grade level. On the other hand, at the 4th-grade level, science process skills mainly were included in science textbooks in the discipline related to chemistry (n=58), followed by physics (n=36), biology (n=18), astronomy and earth science (n=10), and human and environment (n=9), respectively. Table 4 presents the distribution of science process skills according to the 5th grade level units.

Table 4. Distribution of science process skills according to units in the 5th grade level science textbook

		Units (7)								
		Sun, Earth and Moon	World of Creatures	Measuring Force and Friction	Matter and Change	Propagation of Light	Human and Environment	Electrical Circuit Elements	Total	
Grade Level	Science Process Skills	n	n	n	n	n	n	n	%	n (125)
5th Grade	Observing	2	1	3	10	8	3	2	23.2	29
	Classifying	-	1	1	-	3	-	-	4	5
	Estimating/ Hypothesizing	4	1	6	4	8	5	2	24	30
	Measuring	-	-	2	4	3	-	-	7.2	9
	Changing and Controlling Variables	-	-	3	6	4	-	2	12	15
	Experimenting	-	1	3	9	7	1	2	18.4	23

	Recording Data	-	1	1	3	5	-	-	8	10
	Using Data and Modelling	2	-	1	-	-	-	1	3.2	4
	Total n	8	5	20	36	38	9	9		
	Total %	6.40	4.00	16.0	28.8	30.4	7.20	7.20	100	

Table 4 presents that 125 science process skills are identified in the 5th-grade science textbook covering 7 units. Findings similar to the analysis results of the 4th-grade textbook are also found in the 5th-grade textbook. According to Table 4, the most used science process skills in the 5th-grade science textbook are *estimating/hypothesizing* (n=30) and *observing* (n=29), while the least used skills are *measuring* (n=9) and *using data and modeling* (n=4). It was also found that the science process skills were mostly used in the unit of "Propagation of Light" (n=38), at least in "World of Creatures" (n=5). Table 5 presents the distribution of science process skills according to units in the 6th grade level science textbook.

Table 5. Distribution of science process skills according to units in the 6th grade level science textbook

		Units (7)							Total	
		Solar System and Eclipses	Systems in Our Body	Force and Motion	Matter and Heat	Sound and Features	Systems and Health in Our Body	Conduction of Electricity		
Grade Level	Science Process Skills	n	n	n	n	n	n	n	%	n (215)
6th Grade	Observing	5	7	4	8	14	5	5	22.32	48
	Classifying	1	2	1	2	-	3	2	5.11	11
	Estimating/ Hypothesizing	3	6	3	9	7	-	5	15.34	33
	Measuring	-	1	6	8	-	1	1	7.90	17
	Changing and Controlling Variables	3	1	3	7	9	4	5	14.88	32
	Experimenting	1	2	5	10	13	5	5	19.06	41
	Recording Data	1	2	6	9	1	5	5	13.48	29
	Using Data and Modelling	2	1	-	-	1	-	-	1.86	4
	Total n	16	22	28	53	45	23	28		
	Total %	7.44	10.23	13.02	24.65	20.95	10.69	13.02	100	

In Table 5, a total of 215 science process skills are identified in 7 units of the 6th-grade science textbook. It is noteworthy that the distribution science process skills used in the 6th-grade textbook (n=215) are higher than that of other grade levels. The distribution of the use of science process skills at this grade level is as follows: *observing* (48), *experimenting* (n=41), *estimating/hypothesizing* (n=33), *changing and controlling variables* (n=32), *recording data* (n=29), *measuring* (n=17), *classifying* (n=11), and *using data and modeling* (n=4). Science process skills were used the most in the "Matter and Heat" unit (n=53), and the least in the unit of "Solar System and Eclipses" (n=16) at the 6th-grade level. Table 6 presents the distribution of science process skills according to the 7th grade level science textbook units.

Table 6. Distribution of science process skills according to units in the 7th grade level science textbook

		Units (7)								
		Solar System and Beyond	Cell and Divisions	Force and Energy	Pure Substances and Mixtures	Interaction of Light with Matter	Reproduction, Growth and	Electric Circuits	Total	
Grade Level	Science Process Skills	n	n	n	n	n	n	n	%	n (169)
7th Grade	Observing	4	5	10	8	9	1	5	24.85	42
	Classifying	1	4	2	4	1	-	2	8.28	14
	Estimating/ Hypothesizing	3	4	10	10	10	3	3	25.44	43
	Measuring	-	-	4	2	2	1	4	7.70	13
	Changing and Controlling Variables	-	1	4	2	4	2	3	9.46	16
	Experimenting	-	1	5	3	5	2	5	12.42	21
	Recording Data	-	1	4	2	2	1	4	8.29	14
	Using Data and Modelling	1	-	1	2	1	-	1	3.56	6
	Total	n	9	16	40	33	34	10	27	
		%	5.44	9.46	23.7	19.5	20.1	5.9	15.9	100

Table 6 presents that a total of 169 science process skills are identified in 7 units of the 7th-grade science textbook. As in the 3rd, 4th, and 5th-grade science textbooks, the 7th-grade science textbook focuses on the science process skills of *estimating/hypothesizing* (n=43) and *observing* (n=42). *Recording data* (n=14) and *using data and modeling* (n=6) are also the least used science process skills in this grade-level science textbook. It is determined that at the 7th grade level, science process skills are mostly used in the "Force and Energy" unit (n=40) and the least in the "Solar System and Beyond" unit (n=9). Table 7 presents the distribution of science process skills according to the 8th grade level science textbook units.

Table 7. Distribution of science process skills according to units in the 8th grade level science textbook

		Units (7)							
		Seasons and Climate	DNA and Genetic Code	Pressure	Matter and Industry	Elementary Machines	Transformation of Energy and Environmental	Electrical Charge and Electrical Energy	Total
Grade Level	Science Process Skills	n	n	n	n	n	n	n	% n (147)
8th		4	2	4	10	3	7	5	23.80 35

Observing									
Classifying	-	1	-	1	-	2	-	2.77	4
Estimating/ Hypothesizing	3	1	3	6	-	3	-	10.89	16
Measuring	2	-	2	8	2	4	-	12.25	18
Changing and Controlling Variables	-	-	3	7	2	5	3	13.60	20
Experimenting	2	1	3	10	2	5	5	19.04	28
Recording Data	2	1	2	6	1	3	1	10.89	16
Using Data and Modelling	2	2	1	1	1	2	1	6.80	10
Total n	15	8	18	49	11	31	15		
%	10.2	5.46	12.25	33.3	7.50	21.09	10.2	100	

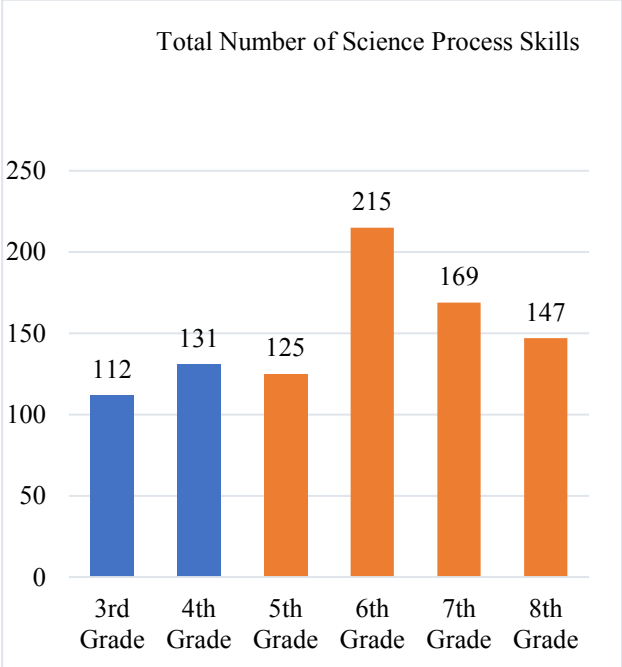
Table 7 presents that a total of 147 science process skills are identified in 7 units of the 8th-grade science textbook. While it is determined that the science process skills of *observing* (n=35) and *experimenting* (n=28) are mostly included in the 8th-grade science textbook, *using data and modeling* (n=10) and *classifying* (n=4) are the least included ones. It is seen that science process skills are mostly included in the "Matter and Industry" unit (n=49), and the least in the "DNA and Genetic Code" unit (n=8). Table 8 presents the distribution of science process skills used in science textbooks according to science disciplines at the secondary school level.

Table 8. Distribution of science process skills used in science textbooks according to the disciplines of science at secondary school level

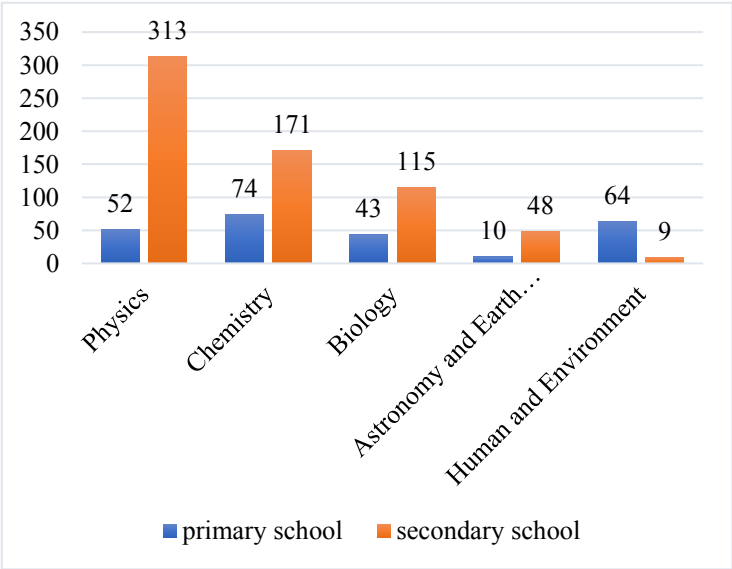
		Science Process Skills									
		Observing	Classifying	Estimating/ Hypothesizing	Measuring	Changing and Controlling Variables	Experimenting	Recording Data	Using Data and Modelling	Total	
Grade Level	Disciplines of Science	n	n	n	n	n	n	n	n	n	%
5th Grade	Physic	13	4	16	5	9	12	6	2	67	53.6
	Chemistry	10	-	4	4	6	9	3	-	36	28.8
	Human and environment	3	-	5	-	-	1	-	-	9	7.2
	Astronomy and earth science	2	-	4	-	-	-	-	2	8	6.4
	Biology	1	1	1	-	-	1	1	-	5	4.0
	Total	29	5	30	9	15	23	10	4	125	100
6th Grade	Physics	23	3	15	7	17	23	12	1	101	47.0
	Chemistry	8	2	9	8	7	10	9	0	53	24.6
	Biology	12	5	6	2	5	7	7	1	45	21.0
	Astronomy and earth sciences	5	1	3	0	3	1	1	2	16	7.40
	Total	48	11	33	17	32	41	29	4	215	100

7th Grade	Physics	24	5	23	10	11	15	10	3	101	59.8
	Chemistry	8	4	10	2	2	3	2	2	33	19.5
	Biology	6	4	7	1	3	3	2	-	26	15.4
	Astronomy and earth sciences	4	1	3	-	-	-	-	1	9	5.30
	Total	42	14	43	13	16	21	14	6	169	100
8th Grade	Chemistry	10	1	6	8	7	10	6	1	49	33.3
	Physics	12	-	3	4	8	10	4	3	44	30.0
	Biology	9	3	4	4	5	6	4	4	39	26.5
	Astronomy and earth sciences	4	-	3	2	-	2	2	2	15	10.2
	Total	35	4	16	18	20	28	16	10	147	100
	The Overall Total	154	34	122	57	83	113	69	24	656	100

When the content of science textbooks is examined according to the use of science process skills at the secondary school level, the frequency of activities and contents connected to the physics discipline of science (n=313) at the 5th, 6th, 7th, and 8th grade levels is notable, as shown in Table 8. The activities and contents involving science process skills related to physics subjects were followed by chemistry (n=171), biology (n=115), and astronomy and earth sciences (n=48), respectively. The graphs below show the distribution of science process skills in science textbooks by grade level and science disciplines.



Graph 1. Distribution of science process skills in science textbooks according to different grade levels



Graph 2. Distribution of science process skills in science textbooks according to the disciplines of science

Graph 1 shows the distribution of the total number of science process skills (n=899) according to different grade levels. When science process skills in science textbooks are evaluated according to grade level, it is seen that science process skills are mostly (n=215) included in the 6th-grade science textbook, while it is the least in the 3rd-grade science textbook (n=112). In Graph 2, when the total scores related to science process skills were evaluated (3rd, 4th, 5th, 6th, 7th, and 8th grades), it is determined that science process skills are mostly included in subjects

related to physics (n=365). Subjects related to physics are followed by subjects related to chemistry (n=245), biology (n=158), human and environment (n=73), and astronomy and earth science (n=58). The graphs below can examine how each science process skill is distributed by grade level.

Graph 3. Distribution of science process skills by grade levels

Graph 3 shows that the science process skill of observing is frequently used at the 6th-grade level (n=48) and least in the 5th-grade level (n=29) science textbooks. In addition, the science process skill of classifying is mainly used in the 3rd grade (n=15) and at least in the 8th-grade level (n=4) science textbooks. Moreover, there is a linear increase in estimating/hypothesizing science process skills from the 3rd to the 7th-grade level, while it decreases to the minimum at the 8th-grade level. It is determined that the estimating/hypothesizing skill is mostly used at the 7th-grade level (n=43), at least at the 3rd grade level (n=21) in science textbooks. Furthermore, there is an increase in the measuring of science process skills from the 3rd grade (n=3) to the 8th grade (n=18), excluding the 7th grade science textbook. In addition, the science process skill of changing and controlling variables is mainly used at the 6th-grade level (n=32) and at least at the 3rd grade level (n=8) in science textbooks. The science process skill of experimenting is increased from the 3rd grade (n=10) to the 6th-grade level (n=41), but the use of this skill in science textbooks decreased from the 6th grade onwards. Besides, although the science process skill of recording data in science textbooks does not increase in direct proportion with the grade level, there is an increase from the 3rd-grade level (n=5) to the 6th-grade level (n=29), but the decrease in the use of this skill after the 6th grade is also noteworthy. In addition to these, the skill of using data and modeling decreased from the 3rd to the 5th grade, but the use of this skill in science textbooks increased after the 6th grade level. It is clearly shown from the above graph that using data and modeling skills is mainly used in the 8th grade (n=10) science textbook.

Discussion and Conclusion

SPS plays an important role in science education (Saban et al., 2019). They are important in developing students' cognitive development and ensuring students' active participation in the teaching and learning process (Darus & Saat, 2014). SPS is associated with cognitive development. Developing SPS supports students' thinking, reasoning, questioning, evaluation, problem-solving skills, and creativity (Özgelen, 2012). Considering that each student has a different cognitive structure, evaluating students' SPS acquisition is an important dimension of science education in the context of measurement and evaluation and provides students with a scientific perspective (Aydin-Ceran & Ates, 2020). In addition, it is obvious that textbooks are an accessible source of science information for teachers and students. Textbooks are crucial to understanding the fundamentals of the science curriculum because many science teachers consider the content of the textbooks when designing their lessons (Dogan, 2021). When SPS is consciously included in a science and technology course emphasizing SPS, students' SPS can be developed gradually over time (Durmaz & Mutlu, 2017). In this respect, this current study focused on determining the SPS in science textbooks tutored at the 3rd, 4th, 5th, 6th, 7th, and 8th grades of primary and secondary school levels. The related analyzes of SPS in science textbooks were conducted according to units, grade levels, and science disciplines.

When the averages of SPS use in science textbooks are examined, it has been determined that SPS use in 6th and 7th-grade textbooks is above the average. While the use of SPS in science textbooks increases from the 3rd grade to the 4th grade at the primary education level, a similar increase is not determined in the use of SPS in secondary education textbooks. The study of Aydoğdu (2017) indicates that the basic process skills of primary school students are not sufficient. He concluded that the test of basic process skill scores of primary school students was higher among the upper grades than in the lower grade levels.

In the current study, it has been determined that the SPS determined in primary and secondary education levels are mostly related to physics disciplines of science, which is followed by chemistry, biology, astronomy, earth sciences, and human and environment disciplines, respectively. When the studies in the related literature are examined according to science disciplines, physics subjects in science are most studied compared to other disciplines (Duran & Ünal, 2016; Kustijono et al., 2018; Limatahu & Prahani, 2018; Jalil et al., 2018). Physics science discipline is followed by biology (Chatila & Husseiny, 2017; Erten & Taşçi, 2016; Sahin et al., 2016; Şen & Vekli, 2016) and chemistry (Daşdemir & Doymuş, 2016; Kurnaz & Kutlu, 2016).

In this study, it was found that the most common science process skill in all grade levels is *observing*, followed by *estimating/hypothesising*, *experimenting*, *changing and controlling variables*, *recording data*, *measuring*, *classifying*, and *using data or modelling*, respectively. In other words, the analysis results showed that the most frequently used science process skill in primary and secondary school science textbooks is *observing*, and the least used one is *using data and modelling*. According to the findings of a survey of primary school teachers' science practices in Spain, *observation* is the only scientific ability developed in science teaching (Montero-Pau & Tuzón, 2017).The acquisition of SPS skills such as *observing*, *predicting*, *measuring*, *comparing*, and *classifying* was at or above average in a study conducted by Saban et al. (2019) with 5th-grade students, while *inferring*, *organizing data*, *identifying, and using experimental materials*, *processing data*, and *formulating models*, *controlling variables*, *experimenting*, *interpreting*, and *inferring* were below average. They stated that while preparing activities to develop SPS, it is essential to focus on the basic reasons that support the correct development of SPS,

that there is a relationship between academic success and SPS. Therefore, frequent activities focusing on SPS can also help students' academic success. They underlined that to create a higher impact, students should be active and make informed decisions in activities focused on SPS. The findings of Darus and Saat's (2014) research showed that primary school students have a low ability to formulate hypothesis skills. These students could not identify the variables of any given experiment. Although this skill is fundamental to the ability to form hypotheses, they could not establish relationships between the variables either. The findings also revealed that some students memorized statements about forming hypotheses, and it was determined that students could only give the correct answer for some situations. In other words, the inconsistency in their hypothesis-forming skills may be due to their memorization syndrome. In the study by Aziz and Zain (2010), they compared the science process skills in the content of the 10th, 11th, and 12th-grade physics textbooks used in Yemeni schools, it was revealed that "*observing*" was the most common SPS among the three textbooks. *Experimenting* for the 10th grade, *interpreting the data* for the 11th grade, and *operational definitions* for the 12th grade had the highest percentages for integrated science process skills. Ozkan and Umdu Topsakal (2021) analyzed the learning outcomes of the 2018 science curriculum in Turkey, starting from the 4th grade to the 8th grade in terms of SPS. The study results indicated that the least common science process skills were *measuring* and *hypothesizing* dimensions, while the most common ones were *data interpreting* and *inferring* dimensions. Dogan (2021) revealed that *observing* and *inferring* were the most frequently used skills for grades 9-12 biology textbooks. Duruk, Akgün, Dogan, and Gülsuyu (2017), in their study in which they examined the Turkish Secondary School Science Curriculum revised in 2013, concluded that as the grade level increases, there was a regular increase in learning outcomes and the ratio of SPS represented. When the secondary school science curriculum was evaluated according to the basic SPS, it was worth noting that the *observin*g skill followed by *classifying* and *communicating* skills had a significant representation rate at the 5th, 6th, 7th, and 8th-grade levels. When the science curriculum was analyzed according to integrated science process skill skills, it was seen that the representation rate of *experimenting* and *interpreting data* skills, followed by the *modeling* skill, was high at secondary school grade levels.

The examination of middle school science textbooks used in the 2013-2014 academic year in Turkey shows that the activities in these textbooks were at the planning and starting skill level of SPS. In addition, it has been revealed that the SPS suggested in science curricula was not reflected in the science textbooks used in middle schools. Skills such as *determination and changing controlling variables* were either at the lowest rate or not at all in the science textbooks used. Also, the representation of each skill varied by grade level, publisher, and unit (Aslan, 2015). SPS is also included in the school science textbooks of different countries. For example, SPS have become one of the needed components in the 2013 curriculum in Indonesia, especially in elementary schools. They can be used not only in school but also in daily life. Scientific learning provides the application of learning on scientific principles to develop students' thinking skills and skills in the science process necessary to train students to conduct scientific activities. These skills are *observing, interpreting observations, predicting, using tools* and *materials, applying the concept, planning research,* and *communicating* (Amarta, Sarwanto & Rintayati, 2018). Sideri and Skoumios (2021) examined the involvement of SPS in the content of science school textbooks of the last two primary school grades in Greece. It was concluded that the activities in the primary school textbooks in Greece mainly included the skills of *communicating, observing*, and *inferring*. In contrast, the participation of the remaining science process skills was limited. As a result, they stated that school textbooks do not provide students with satisfactory opportunities for the development of SPS and a better understanding of scientific ideas and concepts. Bangladesh's revised basic primary science textbooks support a student-centered inquiry-based approach teaching. A content analysis of these textbooks showed that they put the most emphasis on inquiry process skills like *observing* results, *recording data*, and *communicating* results (Chakraborty & Kidman, 2021). Morris, Masnick, Baker, and Junglen (2015) conducted a descriptive study examining middle school science textbooks through many activities. Their results showed that although half of the activities in the textbooks contain data, few of these activities provide opportunities to learn how to *record*, *analyze* and *interpret data*. Examination of in Lebanese national science textbooks according to science process skills showed that more attention should be paid to the inclusion and diversification of SPS to enable students to be prone to *creativity, problem-solving,* and *reflective thinking*. Furthermore, more emphasis should be placed on skills such as *designing experiments*, *formulating hypotheses*, *interpreting data,* and *formulating models* (Zeitoun & Hajo, 2015).

In summary, the descriptive analysis of SPS in the texts and activities in the 3rd, 4th, 5th, 6th, 7th, and 8th grade science textbooks shows that 899 scientific process skills have been identified in school science textbooks covering a total of 42 units. SPS is included in the 6th-grade science textbook at most and in the 3rd grade science textbook at least. Moreover, when the average use of SPS in science textbooks is examined, it is determined that SPS use in 6th and 7th-grade textbooks is above the average. Furthermore, while the use of SPS in science textbooks increases from the 3rd grade to the 4th grade at the primary education level, a similar increase is not determined in the use of SPS in secondary school science textbooks. In addition, when science textbooks are evaluated according

to grade levels in terms of SPS, it is determined that the most common SPS identified is *observing*, and the least used one is the *using the data and modeling*.

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Conflicts of Interest
No potential conflict of interest was reported by the author(s)**.**

Ethical Approval
Ethics committee approval is not required for this study as document analysis was conducted.

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