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How Do Turkish Middle School Science Coursebooks Present the Science Process Skills?

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An important objective in science education is the acquisition of science process skills (SPS) by the students. Therefore, science coursebooks, among the main resources of elementary science curricula, are to convey accurate SPS. This study is a qualitative study based on the content analysis of the science coursebooks used at middle schools. In the present study, 653 science activities presented in 10 Turkish science coursebooks used for teaching science at the 5th to 8th grade were analyzed. The findings show that activities in the coursebooks are in the planning and starting skill level of SPS. The overall investigation of the science coursebooks revealed that the SPS recommended in science curriculums are not reflected in the science coursebooks used in middle schools. Skills like variables determination and controlling-changing variables are either included at the lowest rates or not at all in the science coursebooks employed. In addition, the representation of each skill varies according to the grade, publisher, and unit.

Keywords: science process skills, science coursebooks, science activities, middle school

INTRODUCTION

The Turkish educational system underwent substantial changes resulting with abandonment of the 8+4 educational model and adaptation of a novel 4+4+4 system in 2012. In the recently adopted model, the first 4 years constitute the primary, the followings the middle, and the last 4 years high school education (Ministry of National Education [MoNE], 2012). Science education initiated at the 3rd grade continued in the 5th, 6th, 7th, and 8th grades as a major course within the 4+4+4 education system. The science curriculum is in line with educational reform for elementary education of 2005 basing the curricula on a constructivist approach. The main goal of the 2005 reform in the science and technology curriculum in Turkey was to bring up scientifically and technologically literate students (MoNE, 2006). A revised science curriculum in 2013 reiterated these goals, while emphasizing the importance of inquiry and inclusion of science education in primary schools (MoNE, 2013).

Scientific literacy means being able to use scientific knowledge to identify questions and to draw evidence-based conclusions in order to understand and to make decisions about the natural world and the changes made to it through human

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activity (Organization for Economic Co-operation and Development [OECD], 1998 as cited in Harlen, 1999). Science process skills (SPS) form an important part of scientific inquiry and consequently promote scientific literacy among students (Anderson, 2002). Colvill & Pattie (2002) emphasized that the basic element of scientific literacy and the factors leading to scientific research methodology are a variety of activities containing basic and integrated SPS. Many educators consider the development of SPS in children to be a major objective of education. The intent of many new elementary science programs is to shift away from exclusively teaching science content and the instruction of the process skills that joined the teaching of science content as a complementary thrust of elementary science education (Rowe, 1978 as cited in Zeitler, 1981). The concept of SPS has been always underlined as a critical feature of science education for over a hundred years (DeBoer, 1991; as cited in Yılmaz Senem, 2013). According to Martin (1997), acquisition of SPS will enable students to learn how to do science which is more important than learning the concepts of the science, generalizations, theories, and laws. Rezba, Sprague, McDonnough & Matkins (2007) state that children can learn much better with activities in which they mentally and physically engaged and that require them to use their SPS. SPS are the thinking skills that scientists use to construct knowledge in order to solve problems and formulate results. The scientific method, scientific thinking, and critical thinking are also terms that have been used to describe these skills; however, within the last two decades, SPS has become more prevalent (Padilla, 1990; Bybee & DeBoer, 1993; Özgelen, 2012).

SPS are defined as the understanding of methods and procedures of scientific investigation (American Association for the Advancement of Science [AAAS], 1993). These skills are important - not only in terms of preparing future scientists and technologists, but also for the whole population who need scientific literacy in order to live and function in a world where science impinges on most aspects of personal, social and global life (Harlen, 1999). SPS are a lifelong learning process that forms basis for analytical thinking, creating knowledge by principles of "learning by doing" used for problem solving (Hazır & Türkmen, 2008). In other words, skills to obtain information using scientific methods are expressed as SPS in sciences (Tan & Temiz, 2003). In addition, the function of SPS in global society is highlighted since those skills are not only needed by scientists, but by every citizen in order to become a scientifically literate person (Rillero, 1998; Huppert, Lomask & Lazarowitz, 2002). They are the general descriptions of logical and rational thinking used in many areas of human endeavor. SPS are not only exercised in relation to some science content, but can also relate to the full range of science content and have a central role in learning and understanding this content. Hence, precisely for this reason, it is important to consider them separately (Harlen, 1999). The aim of SPS acquisition is not to train each student to become a scientist, but to help enable them to think like scientists and to facilitate thus their understanding of the scientific topics (Ağgül Yalçın, 2011). Settlage & Southerland (2007) considered SPS as an integral feature of the actions of the scientific culture, but not as all there is to science. SPS will help students become problem solvers, able to apply these skills in real-world contexts (Monhardt & Monhardt, 2006).

SPS are defined in different ways by many scientists; similarly they are considered in different categories. For instance; according to MoNE (2005), SPS are provided in three main categories as planning & starting, practicing, analyzing & inferring. Accordingly, observation, comparison-classification, inference, prediction, estimation, variables determination the are in the planning and starting stage; hypothesis formulation, experiment design, knowledge & use of experiment materials and equipment, setting up an experiment apparatus, controlling and changing variables, functional description, measuring, information and data collection, recording the data in practicing stage; data processing and modeling,

interpretation and deduction, presentation skills occur in analyzing and inferring stage of SPS. Padilla (1990) has classified these skills as basic and integrated SPS according to students' developmental stages. Basic SPS include observing, inferring, measuring, communicating, classifying, predicting, using time space relations and using numbers (Padilla, 1990). Martin's (1997) classification includes observation, classification, communication, measurement, prediction, and inference in basic process skills. Integrated process skills include controlling variables, defining operationally, formulating hypothesis, formulating models, interpreting data, and experimenting (Padilla, 1990; Germann, Aram & Burke, 1996; Chabalengula, Mumba & Mbewe, 2012). Martin's (1997) classification involves determining and controlling variables, formulating hypotheses, interpreting data, making operational definitions, experimenting and modeling as integrated SPS. Saat's (2004) classification, similar to Martin's, involves controlling variables, making operational definitions, formulating hypotheses, and experimenting in the category of integrated SPS.

The basic SPS are designed to provide an initial foundation for learning more complex integrated SPS (Padilla, 1990). These skills provide the intellectual groundwork in scientific inquiry, such as the ability to order and describe natural objects and events (Beaumont-Walters & Soyibo, 2001; Ongowo & Indoshi, 2013).These skills form the backbone of the more advanced problem-solving skills and capacities. They represent the foundation of scientific reasoning learners are required to master before acquiring and mastering the advanced integrated SPS (Brotherton & Preece, 1995). Integrated SPS are the terminal skills for solving problems or doing science experiments. The ability to carry out integrated SPS is attributed to hypothetico-deductive reasoning (Beaumont-Walters & Soyibo; Huppert, Lomask & Lazarowitz, 2002).

Developing SPS in science education will affect students' usage of these skills in different learning areas (Yılmaz Senem, 2013). Harlen (1999) emphasized that, SPS are inseparable in practice from the conceptual understanding involved in learning and applying science and play a central role in learning with understanding. According to Scharmann (1989), science courses teaching process skills as well influence the development of science content achievement as well as development of a better understanding of the nature of science.

Studies emphasize that SPS increase students achievement in problem solving (Huppert, Lomask, & Lazarowitz, 2002; Kazeni, 2005), develop science subject matter knowledge (Harlen, 1999; Aktamış & Ergin, 2008), develop positive scientific attitudes (Lawrenz & Cohen, 1985 as cited in Yıldız Feyzioğlu & Tatar, 2012), increase the ability to design experiments in science labs, and perform research (Germann, Aram & Burke, 1996), and improve scientific creativity (Aktamış & Ergin, 2008).

According to Settlage & Southerland (2007), the benefits of SPS are divided into four groups. These groups are expressed as; SPS support students in the development of their efforts during scientific inquiry, development of students' language during discussions and interpretations, and reaching results together in educational environments where students learn together, and make use of students' natural curiosity. If these skills are not well developed and, for example, relevant evidence is not collected, or conclusions are based selectively on those findings which confirm initial preconceptions and ignore contrary evidence, then the emerging concepts will not help children's' understanding of the world around them (Harlen, 1999).

In particular, the underlying reason of the importance attached to SPS is that it enables students to generate meaningful information from their observations and experiences and develop these skills while learning scientific information by doing science (Bağcı Kılıç, 2003). SPS is the most important theoretical concept involved in science education. Outcomes do not differ if the science subjects are philosophical or

practice-based. Therefore, SPS should be strongly emphasized in primary school, secondary school and high school curricula (Temiz, 2001). Research indicates that coursebooks play an important part in the instructional process; therefore, they need to be designed to meet the needs and expectations of both teachers and students (Ogan-Bekiroglu, 2007).

Science coursebooks, the most fundamental material of science lessons, are predominantly used by teachers to develop lessons. Most teachers rely on coursebooks to define both what and how to teach (Chiappetta, & Fillman, 2007; Yılmaz Senem, 2013). Coursebooks also improve thinking and reinforce learning in science classes provided that they meet the student's learning needs. If selected and used properly, coursebookscan facilitate students' learning in complex science inquiry lessons (Ogan-Bekiroglu, 2007). Hence, while designing coursebooks, the aim is not to have coursebooks with fewer topics, or even lengthier treatment of "key" topics, but with a coherent vision of the disciplines presented as an unfolding story, allowing children even in the early grades to connect the bits and pieces with larger concepts. Research on teachers' use of coursebooks has shown that the overwhelming majority use coursebooks as their main curriculum guide, classroom source, and lesson plan, especially at the elementary level responsible for the 5th and 6th grades (Tyson, 1997; Chiappetta & Fillman, 2007). Moreover, activities in the coursebooks play an important role while enabling the students to acquire SPS. Hence, the importance of coursebooks for teachers and students, while emphasizing SPS in the programs and teaching the science subjects, concepts, and conducting experiments, is beyond discussion (Yıldız Feyzioğlu & Tatar, 2012).

There are many studies focusing on coursebooks analysis according to the SPS. Lumbantobing (2004) analyzed SPS in 3rd to 6th grade science coursebooks in Indonesia and Japan. In both countries, more emphasis is given generally to basic skills rather than integrated skills without almost any emphasis on classification, prediction, time-space relationship, definition of operations, and formulation of models. Aziz & Zain (2010) compared and contrasted SPS included in the 10th -12th grade physics coursebooks content utilized in Yemeni schools. They found that a number of SPS, such as measuring, predicting and hypothesizing, were neglected in the 11th grade physics coursebooks of Yemeni secondary schools. In terms of SPS presence percentages, there were similarities in the 10th and 11th grade physics coursebooks but not with the 12th grade.

Studies conducted in Turkey (Dökme, 2005; Koray, Bahadir, & Köksal, 2007;Yıldız Feyzioğlu & Tatar, 2012; Aslan Efe, Efe, & Yücel, 2012; Yılmaz Senem, 2013) about textbook analysis with respect to SPS show the percentage of each skill in science, physics, chemistry and biology coursebooks. Dökme (2005) analyzed 6th and 7th grade science coursebooks and determined that basic SPS such as classifying, predicting and communicating and constructing hypotheses are less present than others and that the profile of SPS in all activities is not systematic. The Koray, Bahadır, & Köksal (2007) study investigated 10th and 11th grade chemistry coursebooks. They concluded that the chemistry coursebooks do not overlap completely with the chemistry curriculum. Yıldız Feyzioğlu & Tatar (2012) studied the content and structural characteristics of the activities presented in elementary 6th, 7th, and 8th grade science and technology ccoursebooks in terms of SPS. They determined that some SPS recommended for each learning domain in the program are not covered in some coursebooks and the basic skills presented are more open ended than integrated. With the increase in the grade level, basic skills become more close-ended. Yılmaz Senem (2013) investigated the extent in which SPS are included in 9th grade physics curriculum and physics coursebooks. Her results show that the 9th grade physics curriculum emphasizes collecting-interpreting data; yet, disregards predicting, experimenting and inferring. Likewise, the 9th grade physics coursebook includes collecting-interpreting data and measuring; however, ignores

hypothesizing and defining-controlling variables. Aslan Efe, Efe & Yücel (2012) evaluated biology coursebooks from the 9th - 12th grade for SPS. According to their findings, the activities in the10th, 11th, and 12th grade biology coursebooks included inadequate SPS. Despite numerous studies about the presence of SPS in science course-books, new analyses of the activities included using different evaluation criteria can have a positive contribution to the design and publication of more appropriate coursebooks following the tenets of constructivism adopted in the renewed curriculum (Kahveci, 2010; Yıldız Feyzioğlu & Tatar, 2012). Considering the role of coursebooks in the educational process, the systematic presence of activities for the acquisition of SPS can lead to students' effective learning of science. In order to achieve in the aims of science programs, course-coursebooks must urge students to do research and be thought-provoking. Therefore, even at the initial stages of science course-book design and in the activities presented for teaching science, students' acquisition of SPS are to be considered, facilitated, and their presence in coursebooks examined.

METHOD

Document analysis method was used in the present study to analyze middle school science coursebooks in Turkey. The use of documents often entails a specialized analytic approach called content analysis (Marshall & Rossman, 1999). Content analysis is a technique which enables researchers to study human behavior in an indirect way through their communication (Marshall & Rossman, 1999; Yıldırım & Şimşek, 2006).

Selection of science coursebooks

The aim of the present study is to determine SPS presence in the activities of middle school science coursebooks. The study group consists of 10 middle school science coursebooks published by different companies and employed in 5th, 6th, 7th, and 8th grades. In Table 1, details about the coursebooks analyzed in the present study are provided. The selection criterion was the usage of these coursebooks throughout the 2013-2014 academic year. These books are still employed in the science courses of the 5th, 6th, 7th, and 8th grade with the approval of the Ministry of National Education. Further information about these books is given in Table 1.

Table 1. Science coursebooks reviewed in the present study

Grade Level	Publisher	Date of Publication	Author(s)
5th	Evren Publishing	2013	G. Gündüz
	MEB Publishing	2013	Commission
6th	Lider Publishing	2012	A. Altıntaş
	Pasifik Publishing	2012	H. Korkmaz, N. Tatar, A. Kıray, G. Kibar
	MEB Publishing	2013	Commission
7th	Sözcü Publishing	2013	S. Şahin
	Ekoyay Publishing	2012	Ş. Boyraz Topaloğlu
	MEB Publishing	2013	Commission
8th	Altın Publishing	2011	F. Gündoğdu
	MEB Publishing	2012	Commission

Data collection and analysis

MoNE (2005) and MoNE (2006) determined criteria were used to analyze the activities in the science coursebooks of different grade level coursebooks according

to SPS presence. The classification used throughout analysis process is presented in Table 2.

Table 2. Classification used for scientific process skills analyses

Planning and Starting	• Observation • Comparison-Classification • Inference • Prediction • Estimation • Variables Determination • Hypothesis Formulation *
Practicing	• Experiment Design • Knowledge and Use of Experiment Materials and Equipment • Setting Up an Experiment Apparatus* • Controlling and Changing Variables* • Functional Description* • Measuring • Information and Data collection • Recording the Data
Analyzing and Inferring	• Data Processing and Modeling • Interpretation and Deduce • Presentation

** These skills are disregarded in the analysis of 5th grade course-coursebooks as they are not present in the 5th grade curriculum.*

In order to determine if SPS were present or to what extent in middle school science coursebook activities, all activities in the coursebook units were examined and SPS in each activity was determined by comparing them with rubric included in science curricula. After recording SPS in all activities, the frequency value of each SPS was calculated and thus the representation of SPS determined throughout the activities in middle school science coursebooks.

In order to establish coding reliability in the study, SPS rubric within the science curriculum was employed during content analysis procedure. Moreover, besides the researcher, the coursebooks were also coded by another researcher experienced in qualitative analysis. Subsequently, the consistence between coders was examined. A match of at least 90% for each course-book was taken into consideration (Miles & Huberman, 1994). Disagreements were resolved through discussion.

FINDINGS

Fifth-grade science coursebooks

Numerical data related to SPS presence in the activities throughout the units and of grade five science coursebooks is given in Table 3.

Table 3 presents the frequencies of the SPS categories found in fifth-grade science coursebooks. According to Table 3, there are 34 activities in the 5th grade science coursebook published by Evren Publishing and 58 activities in the science coursebookof MEB Publications. The most frequently observed skills in the science coursebook activities of the Evren Publishing are; observation, comparison-classification, and measuring recording and in the science coursebook of MEB Publications; observation, information and data collection, interpretation and deduction skills. The three skills with the lowest rate in in the activities of Evren Publishing are; the variables determination, data processing and modeling, interpretation and deduction, and in MEB Publications; variables determination, experiment design, and knowledge and use of experiment materials and equipment. According to these results, the variables determination takes place among the lowest rated skills in both coursebooks. Estimation skill is not involved in the

activities of both coursebooks. In addition, inference in the universe, prediction, designing experiment, knowledge and use of experiment materials and equipment and presentation skills are not represented throughout activities in both coursebooks.

Table 3. Frequency of science process skills categories found in fifth-grade science coursebooks

Publisher	Units	Number of activities	Science Process Skills													
			Planning and Starting					Practicing						Analyzing and Inferring		
			Observation	Comparison-Classification	Inference	Prediction	Estimation	Variables Determination	Experiment Design	Knowledge and Use of Experiment Materials and Equipment	Measuring	Information and data collection	Recording the data	Data processing and modeling	Interpretation and Deduce	Presentation
Evren Publishing	1. Solving Our Body Puzzle	6	2	3	-	-	-	-	-	-	1	1	2	1	1	-
	2. Measurement the Size of the Force	4	4	4	-	-	-	-	-	-	1	1	1	-	-	-
	3. Change of Matter	8	8	1	-	-	-	-	-	-	6	6	6	1	-	-
	4. Propagation of the Light and Sound	11	11	6	-	-	-	-	-	-	2	1	1	-	-	-
	5. Visits and Identify the World of the Living Beings	3	3	-	-	-	-	-	-	-	1	-	-	-	-	-
	6.Indispensable Part of our lives: Electric	2	2	2	-	-	-	2	-	-	-	-	-	-	-	-
	7. Mystery of Earth Crust	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	Total	**34**	**30**	**16**	**-**	**-**	**-**	**2**	**-**	**-**	**11**	**9**	**10**	**2**	**1**	**-**
MEB Publishing	1. Solving Our Body Puzzle	16	13	8	3	6	-	-	1	-	1	14	14	4	14	7
	2. Measurement the Size of the Force	5	5	3	2	3	-	-	1	-	3	5	5	-	5	1
	3. Change of Matter	11	10	2	-	10	-	-	-	4	7	10	10	2	11	5
	4. Propagation of the Light and Sound	10	10	3	2	9	-	-	-	-	1	10	10	-	9	4
	5. Visits and Identify the World of the Living Beings	6	6	4	2	2	-	-	-	-	1	6	6	-	5	6
	6.Indispensable Part of our lives: Electric	2	2	2	1	2	-	1	-	2	-	2	2	-	2	1
	7. Mystery of Earth Crust	8	8	4	2	2					2	8		3	8	7
	Total	**58**	**54**	**26**	**12**	**34**	**-**	**1**	**2**	**6**	**15**	**55**	**47**	**9**	**54**	**31**

Sixth-grade science coursebooks

Numerical data related to the representation status of SPS in activities throughout the units and coursebooks designed to be used in the 6th grade are presented in Table 4.

According to Table 4, there are 76, 58 and 76 activities throughout science coursebooks of Lider publishing, Pasifik Publishing and MEB publishing, respectively. The most frequently observed skills in the activities of Lider Publishing are; observation, data recording, interpretation and deduction skills, and in Pasifik and MEB Publications; observation, information and data collection, interpretation and deduction skills. The three skills with the lowest rate in the activities of Lider

Publishing are; variables determination, controlling and changing variables, presentation; however, in Pasifik Publishing; estimation, variables determination and experiment design skills, and in MEB Publications; estimation, controlling and changing variables, and functional description skills. Although involved in 6th grade science curriculum, estimation, hypothesis formulation, designing experiments, knowledge and use of experiment materials and equipment, and functional description skills in Lider Publishing, controlling and changing variables, hypothesis formulation, and functional description skills in Pasifik publishing are not present in the coursebooks. However, representation of each skill is included in MEB Publishing.

Table 4. Frequency of science process skills categories found in sixth-grade science coursebooks

Publisher	Units	Number of activities	Science Process Skills																	
			Planning and Starting						Practicing										Analyzing and Inferring	
			Observation	Comparison-Classification	Inference	Prediction	Estimation	Variables Determination	Hypothesis Formulation	Experiment Design	Knowledge and Use of Experiment Materials and Equipment	Setting up an experiment apparatus	Controlling and Changing Variables	Functional description	Measuring	Information and data collection	Recording the data	Data processing and modeling	Interpretation and deduce	Presentation
Lider Publishing	1. Reproduction, Growth and Development in Human Beings	10	10	5	2	1	-	-	-	-	-	-	2	-	-	-	10	1	10	2
	2. Force and Motion	7	4	4	3	-	-	-	-	-	-	-	-	-	7	7	6	1	7	-
	3. Granular Structure of Matter	14	14	7	8	1	-	-	-	-	-	-	-	-	1	11	10	4	10	-
	4. Electricity in Our Life	6	6	2	1	3	-	1	-	-	-	6	1	-	1	6	6	-	6	-
	5. Systems in Our Body	9	9	5	3	1	-	-	-	-	-	-	-	-	4	9	9	1	8	-
	6. Matter and Heat	10	10	4	6	-	-	-	-	-	-	-	-	-	4	10	9	-	10	-
	7. Light and Sound	15	15	4	5	-	-	-	-	-	-	-	-	-	3	15	13	-	11	-
	8. What Constitutes Earth Crust?	5	5	3	2	-	-	-	-	-	-	-	-	-	2	5	3	2	2	1
	Total	**76**	**73**	**34**	**30**	**6**	**-**	**1**	**-**	**-**	**-**	**6**	**3**	**-**	**22**	**63**	**66**	**9**	**64**	**3**
Pasifik Publishing	1. Reproduction, Growth and Development in Human Beings	6	6	5	6	-	1	2	-	-	-	-	-	-	-	6	4	2	6	3
	2. Force and Motion	9	9	5	5	2	-	-	-	1	1	1	-	-	7	9	9	2	9	-
	3. Granular Structure of Matter	9	9	8	4	-	-	-	-	-	1	1	-	-	4	9	7	2	8	7
	4. Electricity in Our Life	5	5	4	-	2	-	1	-	4	4	4	-	-	2	5	5	-	5	2
	5. Systems in Our Body	8	8	6	6	3	1	-	-	-	-	-	-	-	3	8	6	2	6	1
	6. Matter and Heat	5	5	3	3	2	-	-	-	-	-	-	-	-	3	5	5	-	4	4
	7. Light and Sound	11	11	6	3	5	-	-	-	-	-	-	-	-	4	10	3	-	10	1
	8. What Constitutes Earth Crust?	5	5	4	2	4	-	-	-	-	-	-	-	-	3	5	2	1	5	1
	Total	**58**	**58**	**41**	**29**	**18**	**2**	**3**	**-**	**5**	**6**	**6**	**-**	**-**	**26**	**57**	**41**	**9**	**53**	**19**
	1. Reproduction, Growth and Development in Human Beings	11	11	8	2	3	-	1	1	-	-	1	1	-	2	11	11	6	11	6

MEB Publishing	2. Force and Motion	9	9	5	5	2	1	-	-	1	-								
	3. Granular Structure of Matter	14	14	11	9	3	-	-	-	-	-								
	4. Electricity in Our Life	4	4	2	-	3	-	1	-	1	3								
	5. Systems in Our Body	13	13	8	2	5	-	-	-	-	-								
	6. Matter and Heat	8	8	4	6	5	-	1	1	2	2								
	7. Light and Sound	10	10	5	6	-	-	-	-	-	-								
	8. What Constitutes Earth Crust?	7	7	6	1	2	-	-	-	-	-								
	Total	**76**	**76**	**49**	**31**	**23**	**1**	**3**	**2**	**4**	**5**								

Seventh-grade science coursebooks

Table 5. Frequency of science process skills categories found in seventh-grade science coursebooks

Publisher	Units	Number of activities	Science Process Skills																	
			Planning and Starting								Practicing							Analyzing and Inferring		
			Observation	Comparison-Classification	Inference	Prediction	Estimation	Variables Determination	Hypothesis Formulation	Experiment Design	Knowledge and Use of Experiment	Setting up an experiment	Controlling and Changing	Functional description	Measuring	Information and data collection	Recording the data	Data processing and modeling	Interpretation and Deduce	Presentation
Ekoyay Publishing	1. Systems in Our Body	12	12	5	1	3	-	-	-	-	-	-	-	-	5	11	9	2	12	7
	2. Force and Motion	10	10	5	3	2	-	-	3	-	-	-	-	-	8	9	6	3	10	3
	3. Electricity in Our Life	10	10	5	-	5	-	-	-	-	4	4	-	-	5	10	9	1	10	2
	4. Matter Structure and Properties	22	22	13	4	2	-	-	1	1	1	1	-	-	6	21	18	7	19	17
	5. Light	11	11	5	3	1	-	-	-	1	1	1	-	-	4	11	6	2	11	4
	6. Human and Environment	5	5	3	1	1	-	-	-	-	-	-	-	-	2	5	4	4	5	5
	7. Solar System and Beyond	10	10	7	-	1	-	-	-	-	-	-	-	-	2	9	8	7	10	9
	Total	**80**	**80**	**43**	**12**	**15**	**-**	**-**	**4**	**2**	**6**	**6**	**-**	**-**	**32**	**76**	**60**	**26**	**77**	**47**
Sözcü Publishing	1. Systems in Our Body	11	11	9	8	2	-	-	-	-	-	-	-	-	2	11	6	2	8	-
	2. Force and Motion	13	13	9	7	3	-	1	3	3	1	-	-	-	7	12	9	2	8	3
	3. Electricity in Our Life	12	12	3	1	2	-	-	-	-	7	7	-	-	6	10	8	2	7	-
	4. Matter Structure and Properties	9	9	4	4	-	-	-	-	-	-	-	-	-	2	7	3	2	8	3
	5. Light	13	13	2	5	-	-	-	-	-	-	-	-	-	2	12	4	1	11	-
	6. Human and Environment	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	7. Solar System and Beyond	4	4	2	-										3	3	4	3	3	2
	Total	**62**	**62**	**29**	**25**	**7**	**-**	**1**	**3**	**3**	**8**	**7**	**-**	**-**	**22**	**55**	**34**	**12**	**45**	**8**
MEB Publishing	1. Systems in Our Body	13	13	3	5	2	-	1	1	1	1	1	-	-	3	11	10	3	12	7
	2. Force and Motion	9	9	6	6	4	1	-	-	-	-	-	-	-	7	9	5	2	8	1
	3. Electricity in Our Life	8	8	6	6	4	-	1	-	-	6	6	-	-	6	8	7	3	6	1
	4. Matter Structure and Properties	20	20	11	8	-	-	-	-	-	-	-	-	-	7	15	9	6	18	3
	5. Light	11	11	8	3	1	-	-	-	-	-	-	-	-	4	11	6	1	8	-
	6. Human and Environment	7	7	5	2	-	-	-	-	-	-	-	-	-	1	6	5	4	6	6
	7. Solar System and Beyond	8	8	6	1	-	-	-	-	-	1	1	-	-	3	8	6	6	8	3
	Total	**76**	**76**	**45**	**31**	**11**	**1**	**2**	**1**	**1**	**8**	**8**	**-**	**-**	**31**	**68**	**48**	**25**	**66**	**21**

Numerical data related to the representation status of scientific process skills in activities throughout units and coursebooks for grade seven science coursebooks is presented in Table 5.

According to Table 5, there are 80 activities in the 7th grade coursebook of Ekoyay Publishing, 62 activities in the coursebook of Sözcü Publishing and 76 activities in coursebook of MEB Publications. The most frequently observed three skills in these activities in all of the coursebooks are observation, information and data collection, interpretation and deduction. The skills with the lowest rate in the activities of Ekoyay Publishing are; hypothesis formulation, experiment design, knowledge and use of experiment materials and equipment, setting up an

experiment apparatus. In Sözcü Publishing the skills with the lowest rate of presence are; variables determination, hypothesis formulation, experiment design and in the activities of MEB Publication; estimation, hypothesis formulation, experiment design. According to these results, it can be seen that hypothesis formulation and experiment design skills take place among the lowest rated skills in all of the coursebooks. Although involved in 7th grade science curriculum, controlling and changing variables and functional description skills in all the coursebooks, estimation skill in Ekoyay and Sözcü Publishings, and also variables determination skill in Ekoyay Publishing are not present in the 7th grade coursebooks.

Eighth-grade science coursebooks

Table 6. Frequency of science process skills categories found in eighth-grade science coursebooks

Publisher	Units	Number of activities	Science Process Skills																	
			Planning and Starting								Practicing						Analyzing and Inferring			
			Observation	Comparison-Classification	Inference	Prediction	Estimation	Variables Determination	Hypothesis Formulation	Experiment Design	Knowledge and Use of Experiment	Setting up an experiment	Controlling and Changing	Functional description	Measuring	Information and data collection	Recording the data	Data processing and modeling	Interpretation and Deduce	Presentation
Altın Publishing	1. Cell Division and Heredity	11	11	10	4	4	-	-	-	-	-	-	-	-	5	11	7	5	10	7
	2. Force and Movement	8	8	4	4	-	1	-	1	-	-	-	-	-	5	8	7	1	8	3
	3. Matter Structure and Properties	12	12	10	10	2	-	-	-	-	-	-	-	-	5	11	11	1	12	2
	4. Sound	4	4	3	2	2	-	2	2	2	1	-	1	-	-	4	2	1	4	2
	5. State of Matter and Heat	9	9	7	1	1	-	-	1	1	-	-	-	-	9	9	6	2	9	5
	6. Living Beings and Energy Relations	5	5	3	3	1	-	-	-	-	-	-	-	-	1	5	4	1	5	2
	7. Electricity in Our Life	7	7	1	2	3	-	-	-	-	1	1	1	-	4	7	5	2	6	6
	8. Natural Processes	6	6	4	2	1	-	1	3	2	-	-	-	-	3	6	5	4	3	3
	Total	**62**	**62**	**42**	**28**	**14**	**1**	**3**	**7**	**5**	**2**	**1**	**2**	**-**	**32**	**61**	**47**	**17**	**57**	**30**
MEB Publishing	1. Cell Division and Heredity	10	10	8	6	3	-	-	-	-	1	-	-	1	4	9	7	6	10	5
	2. Force and Movement	8	8	7	5	4	-	-	-	-	-	-	-	-	6	8	5	1	8	2
	3. Matter Structure and Properties	18	18	15	7	2	-	-	-	-	-	-	-	-	6	15	9	3	14	4
	4. Sound	3	3	3	3	2	-	1	1	-	-	-	-	-	2	3	-	1	3	1
	5. State of Matter and Heat	12	12	10	7	4	1	-	-	2	2	2	1	1	11	12	9	5	11	-
	6. Living Beings and Energy Relations	6	6	4	4	1	1	1	1	-	-	-	-	-	1	6	4	2	5	3
	7. Electricity in Our Life	6	6	5	4	1	2	2	-	2	2	2	-	-	5	6	3	-	6	2
	8. Natural Processes	8	8	6	3	4	1	1	-	1	1	1	1	-	6	8	7	5	7	2
	Total	**71**	**71**	**58**	**39**	**21**	**5**	**5**	**2**	**5**	**6**	**5**	**2**	**2**	**41**	**67**	**44**	**23**	**64**	**19**

Numerical data related to the representation status of SPS in the activities throughout units and coursebooks of the 8th grade is presented in Table 6.

According to Table 6, there are 62 activities in the 8th grade science coursebook of Altin Publishing and 71 activities in coursebook of MEB Publications. The most frequently observed skills in these activities in both coursebooks are observation, information and data collection, interpretation and deduction. The skills with the lowest rate in the activities of Altın Publishing are; estimation, knowledge and use of experiment materials and equipment, setting up an experiment apparatus, controlling and changing variables and in the science coursebook of MEB Publications; hypothesis formulation, controlling and changing variables and functional description skills. According to these results, it can be seen that controlling and changing variables are among the lowest rated skills in both coursebooks. Although involved in 8th grade science curriculum, functional

description skill is not presented in the coursebooks of Altın Publishing. However, in the science coursebook of MEB publication each skill is presented.

DISCUSSION AND CONCLUSION

In this study, 653 science activities in a total of 10 Turkish science coursebooks offered at four different class grades were analyzed in order to determine the representation status of SPS located in 5th, 6th, 7th and 8th middle school science coursebooks. In this respect, the total number of SPS was determined as 81 in the 5th grade science coursebook of Evren Publishing, as 346 in the 5th grade science coursebook of MEB Publications; as 380 in the 6th grade science coursebook of Lider Publishing, as 373 in the 6th grade science coursebook of Pasifik Publishing, as 460 in the 6th grade science coursebook of for MEB Publications; as 486 in the 7th grade science coursebook of Ekoyay Publishing, as 321 in the 7th grade science coursebook of Sözcü Publishing, as 443 in the 7th grade science coursebook of MEB Publications; as 411 in the 8th grade science coursebook of Altın Publishing, and as 479 in the 8th grade science coursebook of MEB Publications. In conclusion, particularly in the 5th grade science coursebook less SPS are included compared to other grades. This situation can be attributed to SPS inclusion stated implicitly in 2013 science program reflected in science coursebooks. This change is considered as leading to a weakening SPS acquisition (Saban, Aydoğdu & Elmas, 2014).

All the activities situated in all the coursebooks, prepared according to 2005 and 2013 academic year science curriculum and reviewed in the present study, are mostly at the planning and starting level. The skills in this level correspond to basic SPS such as observation, classification, prediction and inference as reported in the other studies related to this subject (Dökme, 2005; Koray, Bahadir & Köksal, 2007; Yıldız Feyzioğlu & Tatar, 2012; Şen & Nakiboğlu, 2014). Bağcı, Kılıç, Haymana & Bozyılmaz (2008) have investigated primary school science and technology lesson curricula, prepared in 2005, for scientific literacy and presence of SPS. They had indicated that SPS are cared for in the curriculum, however mostly basic skills are presented in coursebooks, while combined skills are neglected. The concluded that focusing on SPS generally at lower level in coursebooks is associated with the style of preparation of the activities presented in the coursebooks. Soyibo (1998) stated that this situation can be explained by determining whether SPS are situated in activities already presented to student in coursebooks or created by the student themselves.. While creating and displaying these skills, students show that these skills have an open-ended aspect; however, an explanation of these skills in the coursebooks and demanding the students to repeat indicated that it is closed-ended skill aspect. The prepared deduction oriented verification o fhte activities are application steps following a specific order and if the reasons of the obtained findings are questioned at the end of these steps, students initially know what they would get at the end of the activities (Soyibo, 1998). The activities in coursebooks should be designed in an open-ended and induction oriented manner. Thus, both the diversity and open ended nature of SPS will increase.

The overall investigation of all the science coursebooks, revealed that SPS proposed in science curriculum are not presented in some coursebooks. For each grade, estimation, variables determination skills in starting and planning stage; hypothesis formulation, experiment design, knowledge and use of experiment materials and equipment , setting up an experiment apparatus, controlling and changing variables, and functional description skills in the application stage; presentation skill in inferring stage are less represented than the other skills. These findings are similar to the study carried out by Koray, Bahadır, & Köksal (2007) who stated that basic process skills are more involved, causal skills are less involved, experimental skills are barely or not involved in the 10th and 11th grade chemistry

coursebooks. Dökme (2004) stated that most of the activities in the 7th grade science coursebooks are sufficient to cover basic process skills. This situation can be attributed to the fact that the outcomes of the science curriculum mostly focus on basic process skills (Bağcı Kılıç, Haymana & Bozyılmaz, 2008).

Skills like variables determination and controlling and changing variables are either not present in science coursebooks or presented at the lowest rate. In addition, each skills presence varies according to the publisher and the unit. As indicated by Ağgül Yalçın (2011), this situation has been attributed to designing experiments without determination of independent variables or trying to test hypotheses. This result is consistent with the results of Yıldız Feyzioğlu & Tatar (2012) and Dökme (2005) who determined that activities in the coursebooks do not have a systematic distribution in terms of SPS. Teachers views , indicating that science coursebooks are insufficient to enable students to design and conduct experiments, to interpret experiment results, to think independently and judgmentally, to generate solution to problems, support these results (Güneş, Çelikler & Gökalp, 2009). This situation prevents the students to improve both their cognitive skills and handicrafts as they do follow the activities of coursebooks and thus restrict their ability to do research by their own, to use mental skills, and learning to become permanents (Yıldız Feyzioğlu & Tatar, 2012).

While preparing the activities in science coursebooks, all skills should be represented in a balanced manner and arranged manner so as to allow students to complete their missing skills. Thus, more effective teaching and better acquisition of these skills will be made possible.

Inadequate activities in science coursebooks in terms of SPS impose more duties to the teacher as they do have a crucial role in students' acquisition of SPS. The first step in making the student acquire these skills is to make them aware that they have these skills (Ango, 2002). Studies carried out with teachers indicate that teachers are insufficient in these subjects. Bowen & Roth (1999) determined that pre-service science teachers and teachers have difficulties in conducting scientific research and commenting on them, in teaching how to teach data analysis, in managing open-ended research problems, in summarizing, and in interpreting graphics. Another study by Bowen & Roth (2005) investigating how pre-service teachers indicate research results mathematically, how they present their measurements, how they interpret obtained data, the researchers determined that the pre-service teachers were insufficient in interpretation of data and graphics and thus are not ready to teach these skills. Insufficient coursebooks, teachers, and pre-service teachers emerge as an important obstacle to achieve the aims targeted in science curriculum in terms of SPS. Achieving the targeted level of scientific literacy of students depends on overcoming these obstacles and having coursebooks and teachers sufficient in these subjects.

In conclusion, the present study has analyzed SPS presence in the science coursebooks despite the fact that they are highlighted in the science curriculum. Differences in SPS presence in the coursebooks might stem from the discrepancy of science coursebook writers and publication companies regarding SPS acquisition. The findings of the present study should be taken into consideration by science coursebook writers, science coursebook publication companies, members of science coursebook evaluation committees, and science teachers. Further studies might evaluate the knowledge and views of science coursebook writers and science coursebook evaluation committees. Moreover, consideration of SPS by science coursebook writers during the writing process could also be analyzed. A further topic of study could be the comparison of SPS in the coursebooks and their practice within the classes.

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