Middle School Teachers' Use of Compulsory Textbooks in Instruction of Mathematics

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This study investigates how a sample of middle school mathematics teachers interpret and use compulsory textbooks in the Turkish classroom context based on their: (i) purposes of using textbooks; (ii) frequency and duration of using textbooks; (iii) approaches to using textbooks; and (iv) preferences concerning an ideal mathematics textbook. The research was carried out using the case study model. Data were collected from 17 middle school teachers in six public schools via semi-structured interviews and classroom observations. A content analysis approach was applied to analyse the data collected from the questionnaire completed by the participants. The results indicated that the teachers used textbooks for both pedagogic purposes and giving student assignments. The teachers revealed varied approaches to using textbooks, including adherence, elaboration, and creation with most of them using an elaboration approach. The teachers commonly used textbooks in whole-class activities rather than individual and group work. The findings also indicated that teachers criticized compulsory textbooks from various aspects when describing an ideal mathematics textbook. This study shows the necessity for further studies that focus on teachers' textbook design capacity to explore the relationships between teachers and textbooks and that examine the role of using different textbooks in the learning process.

Textbooks are prepared based on national goals in the intended curriculum, and they shape the instruction given based on the implemented curriculum in the classroom. Therefore, textbooks function as a mediator between the curriculum and teacher (Viholainen, Partanen, Piiroinen, Asikainen, & Hirvonen, 2015) as the potentially implemented curriculum (Fukkink, 2010; Lepik, 2015; Pepin & Haggarty, 2001). In general, a textbook is "a book used for the study of a subject" (Kilpatrick, 2014, p. 4). Specifically, a textbook can be defined as a resource developed to provide officially sanctioned and authorized human pedagogic knowledge that is dynamically used in the classroom (Gracin & Matić, 2016; Luke, de Castell, Fraser, & Luke, 1989). Fan, Zhu, and Miao (2013) point out that "researchers have generally agreed that textbooks as a major conveyor of the curriculum play a dominant role in modern education scenes across different school subjects" (p. 635). Hence, teachers' adaptation of textbooks in their teaching environment may also provide a substantial indicator of their curricular alignment.

Unlike other school subjects, such as reading and language arts, mathematics has a long history of being driven by textbooks and curriculum materials that teachers use to handle mathematical topics (Remillard, 2005). As was the case in the past with "Euclid's Elements", one of the most famous and successful mathematical textbook of classical antiquity (Boyer & Merzbach, 2011), today the mathematics textbook remains a major classroom resource for learning and teaching of mathematics (Askew, Hodgen, Hossain, & Bretscher, 2010; Haggarty & Pepin, 2002; Nicol & Crespo, 2006; Vincent & Stacey, 2008). Ball and Cohen (1996) state that changes in the teaching of mathematics are highly dependent on the revisions of textbooks since mathematics textbooks are mainly used in two ways: as a source for the selection of tasks, and as a guide for instruction (Pepin &

Haggarty, 2001). Thus, the analysis of teacher-textbook interaction is crucial in terms of understanding and developing the quality of mathematics education.

Studies concerning the enacted curriculum reveal that textbooks have a substantial effect on instruction because teachers generally follow the topics, problems, tasks, and pedagogical approaches presented in textbooks when preparing lessons, engaging in classroom practice, giving homework, and teaching a new subject (Eisenmann & Even, 2011; Gracin, 2011; Haggarty & Pepin, 2002; Pepin & Haggarty, 2001). As the enactor of the curriculum, teachers' use of textbooks is important in understanding how textbooks influence the instructional process and how teachers use textbooks in the classroom (Even, Ayalon, & Olsher, 2016; Stein, Remillard, & Smith, 2007; Thompson & Senk, 2014). Numerous studies reveal that teachers do not always cover all topics as presented in textbooks (Drake & Sherin, 2006; Eisenmann & Even, 2011; Olsher & Even, 2014; Tarr, Chavez, Reys, & Reys, 2006). Instead, they omit those parts that they see as not being critical in their teaching, such as data analysis and probability (Olsher & Even, 2014; Tarr et al., 2006). Furthermore, research indicates that teachers sometimes do not implement some of the tasks in the textbooks, such as tasks that available to the group work (Drake & Sherin, 2006; Eisenmann & Even, 2011).

Textbooks are viewed as playing a key role in improving mathematics instruction aligned to reformers' ideas of the world (Cohen & Ball, 1990; Pepin & Haggarty, 2001). In Turkey, the Ministry of National Education (MoNE) has made significant curricular reforms concerning the content and presentation of textbooks. These changes include the presentation of mathematics textbooks being simplified mathematically and visually, some topics such as probability, fractals, and histogram being removed from middle school mathematics textbooks, and changing the order of the teaching of some of the topics (e.g., the operations with integers topic has been moved from the sixth grade to the seventh grade). However, the success of the reform efforts largely depends on how, in practice, teachers use the ideas in the curriculum documents to design instruction. In Turkey, mathematics textbooks are published by the MoNE, and the use of textbooks are compulsory. Studies on textbooks in Turkey point to the dissatisfaction with compulsory mathematics textbooks (e.g., Özmantar, Dapgın, Kurt, & İlgün, 2017). For this reason, it is difficult to determine the teachers' preferences for certain mathematics textbooks under these conditions, and how they interpret and employ the compulsory mathematics textbooks in the classroom is relatively unknown. Some research studies have focused on how teachers benefit from textbooks (e.g., Altun, Yazgan, & Arslan, 2004) or what the teachers criticize in textbooks in terms of visual elements, paper and print quality, technical design, and editing issues (e.g., Sefa, 2009). In these studies, the researchers employed survey methods. The reliance of research on text analysis with little attention to the context of the use of the textbook, however, has limitations since researchers argue that textbooks should be examined deeply in terms of how teachers use them in classrooms (Nicol & Crespo, 2006). Furthermore, Leung (2016) noted that it is essential for textbook studies to be situated in cultural settings to understand differences between countries based on instructional practices in different contexts.

Teachers' Use of Textbooks

Fan et al. (2013) proposed the following framework to classify the literature on textbook research in mathematics consisting of the role of textbooks, textbook analysis, and comparison textbook use, and other aspects. According to their analysis, the number

of studies that investigated the use of textbooks is relatively lower than the studies about the role and comparison of textbooks. In an earlier study, Freeman and Porter (1989) examined the lessons of four mathematics teachers who used the same textbooks throughout an entire school year. They concluded that teachers used textbooks for "what topics to teach, how much time to spend on each topic, and the order in which topics are presented" (Freeman & Porter, 1989, p. 418). The authors claimed that there was an overlap between the content taught by teachers and the textbook content in elementary school mathematics.

From the 2000s, researchers proposed several different approaches to investigating how teachers interpret and use textbooks in teaching mathematics (Brown, 2009; Nicol & Crespo, 2006; Trigueros, Lozano, & Sandoval, 2014). Several studies classified the nature of the interaction between teachers and textbooks. Nicol and Crespo (2006) conducted a qualitative study to determine four prospective teachers' use of curricular materials in a Canadian teacher education program. They collected data with content analysis, semi-structured interviews, and classroom observations during the practicum of the prospective teachers. In the study, the authors presented three hierarchical approaches to using textbooks in mathematics classes: *adhering*, *elaborating*, and *creating*. *Adhering* refers to accepting textbooks as the authority for what and how to teach. At this level, teachers make no or few superficial modifications to textbooks in their teaching. *Elaborating* refers to considering textbooks as a guide to what to teach and how to teach it. In this approach, teachers consider textbooks as the main source, but they add to the tasks, exercises, and problems in the textbooks conceptually and contextually. *Creating* refers to utilizing textbooks from a critical perspective accepting the limitations of the book and perceiving the potential to support them in designing what and how to teach. At this level, teachers consider the textbook as only one of the available resources and they make conceptual changes in tasks and problems presented in the textbook adding tasks they designed for teaching. In their study, Nicol and Crespo discovered that prospective teachers' understanding of how to use a textbook changed after classroom instruction in their practicum.

Similar to the work of Nicol and Crespo (2006), Brown (2009) categorized teachers' interaction with textbooks into three levels: *offloading*, *adapting*, and *improvising*. At the *offloading* level, teachers use textbooks in a literal manner, but in the *adapting* level, teachers flexibly use textbooks and see it as necessary to adjust the content. The third category of *improvising* refers to teachers adopting more flexibility toward the textbook and making innovation to modify and change the content. Although these two models of teacher use of textbooks have similarities, we consider Nicol and Crespo's classification as a more suitable model for the current study because the term creating seems more appropriate than the term improvising when explaining the related level of teachers' use of textbooks in the Turkish classroom context.

Mathematics Textbooks in Turkish Context

In primary and secondary education in Turkey, textbooks are compulsory, and students are required to have the textbook in lessons. The draft mathematical textbooks being prepared in the relevant service unit or publishing house are next evaluated by an official team appointed by MoNE including experts and teachers. Each expert group is composed of teachers trained in measurement and assessment, field trainers/experts, visual design professionals with language experts, testing and evaluation experts, a

program developer, a counsellor, and a specialist in child development and/or educational technology. The textbooks are evaluated based on four basic dimensions: (1) conformity to the instructions; (2) scientific competence; (3) the level of achievement of instructional objectives; and (4) quality of visual and content design. In order to determine whether a mathematics textbook can be used in instruction, it first has to be approved by MoNE. The MoNE decides which textbook can be used in public schools. The official gazette Regulations about Textbooks and Educational Materials (Milli Eğitim Bakanlığı…, 2012) stated that the textbooks or other educational tools not approved by the MoNE cannot be used for teaching schools. In all primary and secondary schools in Turkey, only the textbooks approved by MoNE are used and distributed free of charge to students and teachers.

Textbooks are also compulsory in some other countries including Estonia (Lepik, 2015), Croatia (Gracin, & Matić, 2016), Japan (Clarke, Emanuelsson, Jablonka, & Mok, 2006), and the Netherlands (Mullins et al., 2000; Palha, Dekker, & Gravemeijer, 2015). Mullins et al. (2000) think that compulsory textbooks play an important role in Dutch schools because the conventional nature of compulsory textbooks, and the curricula can lead to insufficiencies in the learning environment (Lithner, 2004; Mayer, 2002) due to their step-by-step presentation of the tasks requiring calculations and straightforward answers. Palha et al. (2015) state that "it remains difficult to foster problem-solving and mathematical-reasoning capabilities in classrooms where students and teachers are accustomed to the more traditional forms of education" (p. 1589). The results of this study contribute to the literature in terms of making a comparison between compulsory textbook use and teachers' approaches to using textbooks. This study is also valuable in that it considers both teachers' instructional actions in their use of compulsory textbooks and their preferences and perceptions concerning the necessary features of an ideal mathematics textbook. Exploring teacher images of an ideal textbook can help design and increase quality of mathematics textbooks in terms of national and international aspects. Thus, in the current study, we investigated how middle school mathematics teachers interpret and use compulsory mathematics textbooks in their lessons. More specifically, we aimed to answer the following research questions:

(1) For what purposes do teachers use textbooks in mathematics instruction?
(2) How often do teachers use textbooks in the instruction of mathematics and how many minutes of class time do they allocate to the use of textbooks?
(3) What kinds of approaches (adhering, elaborating, and creating) do teachers adopt in their use of textbooks in mathematics instruction?
(4) If the teachers were able to choose any mathematics textbook, what would be the teachers' preferences?

Methodology

A case study methodology was adopted in the current study. In case studies, researchers can examine a situation and collect detailed information in a limited time and from limited activities within its context (Yin, 2003). The current study involved teachers' preferences and their use of mathematics textbooks in their teaching. To examine how teachers use mathematics textbooks in their teaching, we interviewed, observed, and analysed the written responses of 17 middle school mathematics teachers. Our analysis focused on the teachers' preferences and actions related to integrating mathematics textbooks into their teaching environments. We intended to describe how middle school

mathematics teachers and their students interacted with textbooks in the process of teaching mathematics.

Participants

Data from classroom settings were collected from 17 middle school teachers in six public schools in the Kastamonu province of Turkey. All teachers (10 females and 7 males) voluntarily participated in the study and possessed a teaching diploma which qualified them to teach middle school mathematics. Their teaching experience ranged from three to 21 years with a mean of 12.3 years.

Data Collection and Analysis

Three data collection tools were used. At the beginning of the study, a semi-structured questionnaire involving three open-ended questions was employed to collect information about teachers' integration of mathematics textbooks in teaching: (1) What are your preferences for mathematics textbooks? (2) How do you use mathematics texts in your teaching? and (3) How do you encourage/instruct your students to use textbooks? A content analysis approach was applied to analyze the data collected through the questionnaire. Content analysis is defined as "systematic assignments of communication content to categories according to rules and the analysis of relationships involving those categories using statistical methods" (Riffe, Lacy, & Fico 2005, p. 3). Data were organized into common themes, and the compatible themes were merged (Patton, 1990). The frequencies of the themes were provided and supported by quotes from the teachers' interviews. The nature of all themes was presented in the Findings section. Two authors worked independently during the analysis. The inter-coder reliability was found to be .94 according to Miles and Huberman's (1994) formula. The items which caused disagreement were discussed by the coders until an agreement was reached.

To triangulate the questionnaire results, a total of 51-hour lessons (three lessons per teacher) spanning grades 5, 6, 7, and 8 were observed. Six master students in the Mathematics Education Department observed the lessons and noted how often the teachers referred to the textbooks and recorded the duration of the textbook usage for per lesson. Based on their responses to the questionnaire and the classroom observations, the teachers were classified according to approaches to using textbooks in instruction (see Table 1).

After the two authors categorized the teachers based on their usage of textbooks in the teaching of mathematics with almost full agreement, interviews with eight teachers were conducted individually to elucidate and deepen data obtained from observations and questionnaire. Heterogeneity sampling (Patton, 2002) was chosen for the selection of interviewees, in which the teachers were chosen to represent diversity in terms of the three approaches to using textbooks in the teaching of mathematics (two adhering, four elaborating, and two creative teachers). Some characteristics of these teachers are presented in Table 2.

Table 1
Approaches to Using Textbooks in Teaching (Nicol & Crespo, 2006, p. 343)

Approaches	Indicators
Adhering	Accepts text as the authority for what and how to teach Adheres to one main curriculum resource Expects the text to provide routines/structures for students and teacher Makes few or no adaptations to lessons, tasks, problems, and exercises in the text. If adaptations are made, they are superficial (contextual rather than conceptual) Does not see self as a resource
Elaborating	Considers text as a guide for what and how to teach Considers the text as the main resource but elaborates it with other resources Elaborates and extends textbook lessons, tasks, problems, and exercises Makes conceptual and contextual elaborations Sees self as a resource
Creating	Examines text with a critical eye for its potential and limitations in deciding what and how to teach Considers the text as one of many resources for teaching Creates problems and questions using the text to stimulate ideas for the structure, sequence, and context of lessons Adaptations are conceptual Sees self as a knowledgeable resource for designing problems

Table 2
Some Characteristics of the Teachers Interviewed

Teachers	Experience	Gender	Textbook Use	Educational Level
T1	7 years	Male	Adhering	Master's degree
T2	13 years	Female	Adhering	Bachelor's degree
T3	10 years	Female	Elaborating	Bachelor's degree
T4	11 years	Female	Elaborating	Bachelor's degree
T5	13 years	Female	Elaborating	Master's degree
T6	14 years	Female	Elaborating	Master's degree
T7	10 years	Female	Creating	Bachelor's degree
T8	5 years	Male	Creating	Master's degree

Teachers selected for semi-structured interviews among the 17 participants were coded as T1, T2, …, T8. The other teachers were coded as T9, T10, …, T17. Semi-structured interview questions are presented in Table 3. Each interview took 40-50 minutes and was conducted after classroom observations were completed. All the interviews were audio-taped and transcribed digitally. The transcripts were examined via open coding (Strauss, 1987) for themes that refer to the four research questions. Data triangulation was also used to check the validity of the themes and obtained results concerning the teachers' ideas about textbooks in terms of the quality as a resource for teaching and their preferences for textbooks when teaching mathematics.

Table 3
Semi-Structured Interview Questions

Types of Questions	Example Questions
The use of compulsory textbooks in planning and teaching of mathematics lessons	• How do you use mathematics textbooks when you plan and organize your lessons? • How do you use mathematics textbooks when you teach mathematical topics? • How do you use activities and problems in the textbooks? Do you use all the activities and problems during your instruction? • When planning and teaching your mathematics lesson, do you use other sources that are different from the textbooks approved by MoNE? Why do you prefer to use these resources? How often and how do you use these additional resources? Can you give specific examples?
The use of compulsory textbooks in supporting students' learning	• How do you encourage your students to use mathematics textbooks more effectively? • Which parts of the textbook do you use more in teaching to support the children's' learning?
The perceptions about the ideal mathematics textbook	• How do you evaluate the quality of the compulsory textbooks? What are the strengths and weaknesses of these textbooks? • How would you describe an ideal mathematics textbook? • What is the role of a teacher in using mathematics textbooks?

Findings

We presented findings based on the four research questions, which concerned the teachers': purposes of using textbooks; frequency and duration of using textbooks; approaches to using textbooks; and preferences concerning an ideal mathematics textbook.

Teachers' Purposes of Using Textbooks

Table 4 presents frequencies of teachers' statements regarding the purposes of using textbooks. Their written answers to the open-ended questionnaire were used to identify the different aspects listed in the first column of the table. It should be noted that some statements served more than one purpose; thus, the total frequency of purposes exceeds the total number of mathematics teachers who participated in the study.

Table 4
Purposes of Teachers' Use of Textbooks

Purposes of Using Textbooks		Frequency (n = 17)
Pedagogical purposes	Providing questions for students to respond to	16
	Identifying the teaching agenda	15
	Continuing the course work following the curriculum	13
	Providing a resource for students to follow text or diagrams	12
	Bringing the different opinions of the students to a common point	7
	Providing illustrations to enrich explanations or questions	4
	Guiding practical activities	3
	Consolidating or investigating theoretical knowledge	2
	Total frequency	72
Assignments for students	Source of homework exercises for students	11
	Source of revision material to assign to students	8
	Source of exercises for use during the lesson	6
	Source of explanations for students to read during the lesson	4
	Total frequency	29

In general, the mathematics teachers' statements regarding the use of textbooks were gathered under two themes: pedagogical purposes and assignments for students. Table 4 shows that for pedagogical purpose, the majority of teachers used textbooks for identifying teaching agenda, providing a source from which the learners can copy text or diagrams, providing questions for learners to answer, and following the curriculum defined in the teaching program. A teacher, during the interview, provided detailed explanations of his/her use of textbooks in planning:

> T6: I examine textbooks that contain how topics and activities are presented and how learning materials are used in the presentation of the subject. I also determine whether there are different solutions to a problem. I use a PDF form of a textbook in my lessons. We discuss introductory activities when starting a new mathematical topic. However, in problem-solution parts, I use different sources since the textbooks are inadequate. They include mostly procedural questions instead of reasoning questions.

The teacher also stressed the weaknesses of mathematics textbooks in providing problem-solving activities requiring higher-order thinking skills, such as reasoning. Another teacher commented on the use of textbooks for making a good start to the lesson:

> Researcher: Which parts do you use in the [compulsory] textbooks?
>
> T8: I always peruse the introductory part of the textbooks. I examine not only compulsory math books but also other textbooks. Also, I compare the introductory parts in textbooks previously published by MoNE. Then, I prepare a lesson plan by synthesizing the books because the [compulsory] textbooks are not sufficient in terms of quality and quantity of problems and exercises. So, I do not generally use [compulsory] textbooks in the instructional process.

This teacher also found the quality and quantity of problems presented in compulsory textbooks to be inadequate and commented that as a result, teachers tended to use other sources not approved by MoNE in the instruction of mathematics. Regarding the question "for which purposes do you use textbooks?", a teacher gave the following response:

T7: A syllabus is defined in the teaching program. For this reason, I use mathematics textbooks to follow the objectives presented in the teaching program. Sometimes, in a lesson, I present some interesting questions from the textbook to the students.

About one-third of the teachers cited the textbook as a source of authority that mediates the different views of learners and supports the teachers' expositions with illustrations and questions. Occasionally, a teacher would refer to the textbook only to provide diagrams to support exposition or questions, guide practical activities, and read parts to consolidate or explore theoretical knowledge.

Table 4 reveals that teachers' statements also include using textbooks as a source of assignments for the students. For most teachers, textbook assignments were in the form of homework exercises while more than half of them also used textbooks as a source of revision material to assign to students. Those cases included textbook use outside the classroom, and the students were expected to repeat the work/subjects from the textbooks that were covered in the class. Some teachers also mentioned that the textbooks could be used as a source of exercises and explanations for students to read during the lesson. Observations and the interview data showed how the teachers used textbooks in giving assignments to the students and the reasons behind their preferences:

T5: I generally use textbooks when I give homework to the students because all the students have the same mathematics textbooks. I assign exercises at the end of the unit. In the next lesson, I present the solutions to some problems that are not solved by the students.

T8: Normally, I don't like [compulsory] textbooks. However, the questions asked in the central examination sometimes bear similarity to the questions in compulsory textbooks.

Frequency and Duration of Using Textbooks

Table 5 shows how the teachers integrated the textbooks in their teaching focusing on textbook usage frequency and duration. The mean frequency of mathematics textbook usage was 2.1 ranging from 0 to 12 times per lesson. Teachers also used textbooks for 0-30 minutes per lesson with an average of 5.2 minutes. Table 5 also presents the frequencies of the occurrence of different social interactions related to textbook use.

Table 5
Textbook Adaptation

Textbook Usage Frequency (per Lesson)		Textbook Usage Duration (min per lesson)		Textbook Usage Interaction	Frequency	Total Frequency (%)
Range	Mean	Range	Mean			
0-12	2.1	0-30	5.2	In class		174 (67)
				Individual learners	22	
				Groups of learners	15	
				The whole class	137	
				At home		86 (33)
				Individual learners	84	
				Groups of learners	2	
				Total frequency (%)		260 (100)

Teachers' preferences for textbook interaction describes the nature of social interactions among students. Namely, the textbook was referred to by the whole class (at

school), a group in the class, or an individual (at school or home). Findings revealed that the mathematics teachers used mathematics textbooks in all categories presented in Table 5. Among the cases of class usage of textbooks, most of the time, the teacher invoked the whole-class usage of the textbook, while the teacher usually referred to the textbook to set homework tasks that required the learners to study individually at home. In only 22 of the instances, teacher directed individuals to the textbook (usually after they asked a question or provided an unacceptable response). The few occasions where the teachers mentioned group usage of the textbook occurred in the class (f = 15) and at home (f = 2).

Interviews conducted at the end of observations revealed some of the reasons why teachers did not choose to use textbooks in group learning. The interview responses of three teachers are given below.

> T1: I do not choose to undertake group activities based on textbooks. In group activities, students do not know what they have done mathematically. They think that they can play instead of learning mathematics. For this reason, I prefer to use textbooks mostly in individual or whole-class activities.
>
> T5: My classes include about 40 students. Because the class is crowded, I could not engage in group activities in the mathematics lessons. When I conduct group activities, I would not be able to complete the objectives and mathematics topics in the time suggested by MoNE.
>
> T4: I'm teaching eighth-graders. These students will take LGS [the high school entrance examination] at the end of the second semester. Students need to solve many problems and answer questions in a mathematics lesson to prepare for the central exam. For this reason, we do not engage in any group activities in the classroom. Instead, we solve different problems in the textbooks with the whole class.

Teachers' example explanations showed that they did not prefer to assign group work based on textbooks since they did not consider it beneficial for learning mathematics, as well as due to the difficulties in implementing group work in crowded classrooms and the anxiety they felt in preparing the students for the centralized examination.

Teachers' Approaches to Using Textbooks

Most teachers (n = 10) were classified as elaborating teachers in terms of their adaptation of textbooks to mathematics teaching. These teachers consider textbooks as a guide to what and how to teach. For them, textbooks were the main resource, but they needed to be elaborated with other resources, and they were observed to add tasks, problems, and exercises. The teacher interviews also indicated that when they made conceptual and contextual elaborations, they saw themselves as a resource. On the other hand, only two teachers were creative in terms of their approaches to using textbooks. Their characteristics included examining textbooks with a critical eye for its potential and limitations in deciding what and how to teach, considering the textbook as one of many resources for teaching, and creating problems and questions using the text to stimulate ideas for the structure, sequence, and context of lessons. Their adaptation of the content of textbooks was conceptual and they saw themselves as a knowledgeable resource for designing problems. Some examples are presented that illustrate teachers' approaches to their use of textbooks based on observations and interview data.

Examples for adhering teachers

T1 was observed only using smart books page by page in teaching mathematics to his sixth graders. Smart books are the school resources that combine textbooks and notebooks containing definitions, explanations, rules, examples, and exercises with blank spaces

under the questions or exercises in which the students write their explanations or solutions. This resource comes with software to use with an interactive whiteboard; thus, the teacher only needs to write the solutions. The excerpt below from the interview with this teacher shows his explanation regarding the research question: "Why do you use smart books over textbooks?

> T1: I am happy since I do not have to worry about writing definitions or other explanations [notes or rules] and questions. Students are also happy since they also do not have to take notes from the board, and they can pay attention only to my teaching. Moreover, using smart books saves time that I can use to provide more questions. Furthermore, students who started the school in early years due to the 4+4+4 (year) system do not write fast. I find useful smart books for these students.

Another teacher provided a detailed explanation about her use of smart books when the researcher asked the same question:

> T2: I use time more efficiently. I have more time.
>
> Researcher: For what?
>
> T2: To solve more questions.
>
> Researcher: Why is it important?
>
> T2: Learn the topics and prepare them [the students].
>
> Researcher: For what?
>
> T2: To prepare them for the central exams. They have to solve more questions in a short time. They need to provide a quick response.

This excerpt revealed that the teacher focused on students' achievement in mathematics and success in solving questions, giving centralized examinations as the main reason. Therefore, it appears that teachers tend to use smart books because they believe the practice is more important in learning than conceptual understanding.

Examples of elaborating teachers

T7 was coded as an elaborating teacher based on her written responses and classroom observations. She provided one statement: "I often use other sources or concrete materials to provide a better conceptual understanding of mathematical subjects". She was observed while using counting chips while teaching of multiplication of fractions, although this strategy did not appear in the textbook. Another example was observed when a teacher (T11) was defining prime numbers; he wrote the following definition from the book on the board: "A prime number is a number that can only be divided by one and itself". Then, he started giving 5, 7, and 11 as some examples of prime numbers, and he asked the students to offer other examples. When one student enquired whether 1 was a prime, T11 changed the definition of a prime number to a number that only possesses two positive integer dividends. Furthermore, when T11 was interviewed about the weaknesses of the textbooks, he especially complained about definitions having limitations concerning the meaning of the concept and theoretical statements (rules or facts) without being supported by reasonable proofs. Hence, he stated that he sometimes had to change the definitions or provide concrete proofs for the theories (e.g., Pythagorean theory).

Other teachers changed the order in which the mathematic topics were given in the textbooks. For instance, the fifth-grade textbooks present problems about addition at the end of the section on the addition of natural numbers and problems about subtraction at the end of the section on subtraction of natural numbers. However, after presenting the addition operation, T5 skipped addition problems, and instead referred to the subtraction

of natural numbers. Then, she moved on to solve problems about the addition and subtraction of natural numbers in the textbook. When the researcher asked why she had changed the order of the topics about operations with natural numbers in the textbook, T5 replied as follows:

> T5: Because it is meaningless to give problems about addition after teaching the addition operation. If I follow the order of the textbook, students do not engage in reasoning about problems. However, after I teach all the operations with natural numbers, the students can explore and decide which operations are necessary for each problem.
>
> Researcher: In my observation, I recognized you asked some questions that are not in textbooks? Why did you follow the questions in the compulsory textbook?
>
> T5: The problems in the textbook have similarities. For this reason, I found different questions from other sources to guide students in reasoning which operation they needed to use to solve problems.

The explanations given by T5 revealed that she considered textbook as a guide for what to teach, but she made some elaborations on the content of the textbooks. She sometimes changed the nature of problems and found different kinds of problems given in the textbooks.

An example of a creating teacher

In a classroom observation, T7 introduced the order of fractions as the following story that was not included in the textbook: She said, "I inherited money from my grandfather when he died. I wanted to share this money with my brothers and sisters but how would we do it? Then, we realized that our grandfather had written a letter about how we should share the money…" The teacher continued by explaining how they would share money using fractional numbers. Then, she asked the students which person received more money than the others. In the interview, when asked which source she used to prepare this story, she stated: "I always examine different books and social networking websites to find interesting introductory activities. However, this story came to my mind after the death of my close friend's grandfather."

When the researcher asked the reason why T7 did not choose to use the introductory activity (see Figure 1) in the sixth-grade textbook, she criticized the activity in the textbook stating that it was uninteresting. Thus, this interview data showed that the teacher examined the textbook with a critical eye for potential and limitation in deciding what and how to teach order of fractions to her class.

[INTRODUCTION When the fractions at the right and their magnitudes are considered; which fraction is larger: $\frac{1}{3}$ or $\frac{1}{4}$?

Figure 1. An activity about fractions in the sixth-grade mathematics textbook

Teachers' Ideas about the Ideal Mathematics Textbook

Table 6 shows the frequencies regarding the teachers' content preferences in mathematics textbooks. The most mentioned item was textbooks' inclusion of exercises in a quantitative manner, while some teachers also stressed the qualitative specification of the problems relating to real-life to make students think. The teachers also more frequently mentioned that textbooks are expected to provide correct terms and definitions, comply with the curriculum (in terms of the sequence of topics), fit the students' cognitive level, and be interesting. More than half of the teachers preferred textbooks that used markers for important ideas, rules, and definitions. Some teachers also highlighted their preferences for textbooks that gave directions for activities and experiments for students to perform, addressed a wide range of student abilities, were sensitive to misconceptions, and contained extra topics for students to investigate.

Table 6
Teacher's Preferences for Mathematics Textbooks

Preferences	Frequency (n = 17)
Contains a sufficient number of exercises	14
Complies with the curriculum (order of the content)	12
Gives correct terms and definitions	12
Fits the students' cognitive level	10
Interesting	10
Gives markers for important ideas, rules, and definitions	8
Contains real-life problems to make students think	5
Addresses a wide range of student abilities	5
Contains directions for activities and experiments for students to perform	4
Sensitive to misconceptions	3
Contains extra topics for students to investigate	3

To illustrate the teachers' preferences about textbooks in detail, some explanations obtained in the interviews and the semi-structured questionnaire are presented. For example, when T5 was interviewed about the ideal mathematics textbook, she explained:

> T5: I would never start with a definition in the textbook. I want to see some interesting activities at the beginning of each topic. Furthermore, textbooks must have a simple and easy-to-follow approach. Some textbooks include many unnecessary coloured pictures.

On the other hand, in the semi-structured questionnaire, T11 complained about definitions being complicated and of an algebraic nature for the sixth-grade level, and he stated that textbooks must be prepared according to the students' cognitive level. As shown in Table 6, 14 teachers suggested that textbooks must include many questions and various exercises by criticizing the similar computational nature of problems and questions in compulsory textbooks. For instance, T6 believed that an ideal textbook must include different exercises that prompt students to engage in reasoning about real-life situations mathematically. In contrast, in the interview, T8 considered that an ideal textbook should not present all information directly to the students because the students need to explore mathematical rules or problems in the textbooks with their teachers in the classroom. For this reason, he stated that textbooks should not present problems with their solutions; rather, he believed that textbooks should involve real-life problems to make students think and give extra topics for students to investigate.

Discussion and Conclusion

This study examined a group of Turkish middle school mathematics teachers' use and interpretation of compulsory textbooks in the instruction. The study focused on both what the teachers think about compulsory textbooks and how they use the textbooks in mathematics classrooms. Several previous studies have noted teachers' relatively high dependence on textbooks in the planning and preparation of mathematics lessons (Fan et al., 2013; Johansson, 2006). Similarly, our results revealed that the teachers used textbooks mainly for pedagogical purposes and student assignments. Regarding to pedagogical purposes, the teachers used textbooks mostly to provide questions for students and set the teaching agenda. Observations and interview results indicated that the teachers' use of textbooks facilitated much of their work (lesson preparation and instruction), rather than enriching the learning process. Furthermore, there was little emphasis on students' learning more deeply or exploring conceptual meanings (reading to consolidate or explore theoretical knowledge).

Most of the teachers (n = 15) complained about the questions in the compulsory textbooks, more specifically about the predominance of reproduction, the lack of problem-solving tasks, and incompatibility with their students' cognitive level. Nevertheless, the results revealed that teachers used questions/exercises in the compulsory textbooks as assignments for the students either for classroom work or homework, which is similar to the results obtained in other studies (Gracin & Matić, 2016). Our observations and interviews indicated that the effect of central examinations and the use of the compulsory textbooks determined by MoNE are evident in teachers' purposes of using mathematics textbooks in terms of question/exercise-focused perspective. The research literature identifies association between the curricula, textbooks, and examinations (e.g., Tamir & Ziv, 2006). Studies also support the idea that Turkish teachers' textbook preferences are influenced by central national high-stakes examinations (e.g., Özmantar et al., 2017). In his study, Au (2011) proposed that teachers adopt a teaching style based on the direct transfer of knowledge by considering the questions posed in central examinations. In current study, the results from the observations and interviews supported this idea since the mathematics teachers generally viewed compulsory textbooks and other resources (e.g., smart books) as a question bank.

In this study, another significant result is that while textbooks were used in the classroom for whole class work (e.g., solving the exercise and reading the explanation) there was less use of textbooks for group works. Some researchers obtained similar results concerning teachers omitting group work tasks provided in the textbooks (Drake & Sherin, 2006; Eisenmann & Even, 2011). This may be due to teachers focusing more on the teaching time available or the central examinations or being inadequate in terms of conducting group work. It has been considered that small group work in the area of mathematics is recommended as an instructional way to develop students' higher-order thinking skills and problem-solving abilities (Kutnick et al., 2017; Noddings, 1989; Webb et al., 2014). Effective group work requires more than simply seating children around a table and giving them opportunities to develop cognitive-based explanations and justifications when they share ideas (e.g., Emmer & Gerwels, 2002). We suggest that it is necessary to investigate how Turkish teachers conduct group work in their classes using mathematics textbooks to determine the teachers' perceptions, abilities, and attitudes toward group work.

In terms of the textbooks use approaches, the most interesting result was that in their fifth- and sixth-grade lessons, the adhering teachers mostly used smart books in a literal manner following the established contents as closely as possible due to their requirements of time-saving presentations and easy tracking questions. It is important to understand why teachers use smart books in those grade levels. In Turkey, until the 2012-2013 academic year, 72-month children began school. In a regulation published in the official gazette in 2012, MoNE increased compulsory education from eight to twelve years and allowed children who had completed 66 months to register in the first grade of primary school. This practice has been widely discussed in Turkey due to the lack of empirical and scientific research concerning the age at which children should start compulsory education. Studies in Turkey reported that 66-month-old students who started schools based on the 4+4+4 years education system had more difficulty in writing and reading due to insufficient psychomotor readiness (Boz & Yıldırım, 2014; Cerit, Akgün, Yıldız, & Soysal, 2014). In current study, the fifth- and sixth-grade children started schools based on the new age regulation. In interviews, the teachers complained about fifth- and sixth-graders' insufficient psychomotor abilities in being able to write mathematical terms and draw shapes. In their instruction, the teachers preferred to use smart books instead of compulsory textbooks. Smart mathematics textbooks, in general, possess features, such as: being action-based; focusing on problem solving; making connections between and among mathematical representations, and elaborating on mathematical concepts (Lew, 2016). However, not all smart books used in Turkey do necessarily possess these features; some of them only blend textbooks and notebooks in terms of having definitions, explanations, rules, examples, and practise exercises. Textbooks which are not designed for teacher learning (Ball & Cohen, 1996) could not provide opportunities to answer 'learning how to teach' question. In this regard, those smart books seem to be practising question/exercise banks prepared according to the centralized examinations instead of offering opportunities to reason about mathematical concepts and real-life problems.

On the other hand, the use of textbooks in class and out of class (homework) points to the use of books for drill and practise purposes. This is supported by the perception that the achievement in mathematics is associated with success in solving practise questions/exercises. This perception of the teachers is integrated with the national examinations consisting of low-level and final-product (rather than process)-oriented, closed-ended questions. The teachers who wanted to solve more questions and complained about time management tended to use smart books. Therefore, knowing mathematics or success in mathematics is highly dependent on practising rather than problem solving. These results can inform policymakers about the negative effects that the top-down educational reforms implemented in Turkey have had on the teachers' textbook use and learners' reactions and reveal the necessity of systematic educational reforms. We believe that it is crucial to close the gaps between the intended policies (top-down reformations) and the implemented policies (teachers' pedagogical practices) since the top-down policies failed to stimulate a change in the teachers' practice and beliefs (e.g., Yu, 2015).

The results of the current study revealed that the majority of the teachers can be considered as elaborating teachers in mathematics teaching. These teachers considered the text as the main resource but extended it with other resources to make their instruction less abstract and more meaningful for their students. Our observations showed that a vast majority of the teachers used resources other than the compulsory textbooks and

encouraged their students to acquire resource books either directly or indirectly. For the elaborating teachers, the main reasons for acquiring other resources were the nature of central examinations and their dissatisfaction with the compulsory textbooks. In Turkey, both the textbooks and central examinations are often changed in terms of content and presentation by MoNE. Although teachers are considered to be the mediators of new knowledge, they need to be supported to understand what this practice is, how it is constructed (Özmantar et al., 2017; Werstch, 1998), and how to interpret and adapt the changes of the school mathematics textbooks in Turkey. The main aim of compulsory textbooks for teachers is to make the content understandable and present it to their students. However, the pressure of preparing their students to central examination in the eighth grade dominates the development of their students' understanding of mathematics. Therefore, changes in the format of central examinations (such as the use of open-ended questions, weighting on related questions) can lead to the use of other resources to provide learning outputs in the achievement of skills and goals targeted by the curricula.

Finally, in light of the results obtained, some future studies are warranted. In current study, we found that the teachers criticized the textbooks from different aspects. We suggest examining teachers' textbook design capacity to deeply explore the relationships between teachers and textbooks (e.g., Even et al., 2016). In addition, considering the relationships between the textbook and students' learning outcomes might offer ideas about the role of using different textbooks in the learning process (Fan et al., 2013). In this study, we observed the teachers' use of some technological resources to extend their lessons. Despite the rapid growth of digital mathematics textbooks, there is a lack of well-structured studies on the use and development of digital textbooks in mathematics in comparison with traditional textbooks. In addition, teachers may need professional learning concerning the compulsory textbooks and their use following the curriculum reforms. In particular, we think that teachers may need professional learning regarding to how to adapt the tasks in mathematics textbooks, and how to conduct group work activities given in the textbooks.

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