MIDDLE SCHOOL MATHEMATICS TEACHERS' USE OF TEXTBOOKS AND INTEGRATION OF TEXTBOOK TASKS INTO PRACTICE: A MIXED METHODS STUDY

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ABSTRACT

MIDDLE SCHOOL MATHEMATICS TEACHERS' USE OF TEXTBOOKS AND INTEGRATION OF TEXTBOOK TASKS INTO PRACTICE: A MIXED METHODS STUDY

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The current study aimed to explore middle school mathematics teachers' use of mathematics textbooks and examine their integration of tasks in the textbooks into teaching. The framework of a mixed methods research design guided data collection in this study. A questionnaire called the Use of Mathematics Textbooks Questionnaire was developed and validated to identify the ways teachers benefit from textbooks. The factor analysis revealed four dimensions, namely Reading Student Edition Textbook, Selecting Questions from Workbook, Reading Teacher Edition Textbook, and Selecting Tasks and Problems from Auxilary Books.

The results of the study showed that teachers used the student edition textbook for mostly during class and for lesson preparation. Teachers also used the student edition textbook for explaining the topic and the introductory tasks. However, they rarely used it for selecting problems and examples. Teachers read the student edition textbook mostly during and prior to class; and mostly use it for topic explanation, but rarely for problems and examples. They stated that they frequently

selected questions from the workbook that were not included in the textbook. However, they occasionally picked questions to use during lessons. They frequently used auxilary books to select questions similar to the ones in the high school entrance exam problems.

In examining the process of teachers' use of mathematics textbooks, it was argued that there were interpretive processes as teachers engage with and use textbooks. The analysis of interviews and observations showed that teachers read textbooks and select tasks and questions from those books. In their decisions about using tasks from textooks, teachers usually considered the nature of tasks and students' characteristics.

Keywords: Mathematics Textbooks, Mathematics Teachers' Use of Textbooks, Teachers' Documentational Work, Middle School

ÖZ

İLKÖĞRETİM MATEMATİK ÖĞRETMENLERİNİN DERS KİTABI KULLANIMLARI VE KİTAPLARDA YER ALAN GÖREVLERİ UYGULAMAYA DÖNÜŞTÜRMELERİ: KARMA ARAŞTIRMA YÖNTEMİ ÇALIŞMASI

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Bu çalışmanın amacı, ilköğretim matematik öğretmenlerinin matematik ders kitaplarının kullanımlarını araştırmak ve kitaplardaki örnek, problem ve tanımların uygulamada nasıl kullanıldığını incelemektedir. Bu çalışmada, karma araştırma yöntemi kullanılmıştır.

Matematik öğretmenlerinin ders kitaplarının kullanımlarını ölçmek ve araştırma sorularına cevap vermek üzere, farklı zaman aralıklarında veri toplanmıştır. Bunun için dört farklı zaman diliminde nitel ve nicel veri toplama yöntemleri kullanılmıştır. Çalışma kapsamında, matematik öğretmenlerin ders kitaplarının kullanım yollarının açığa çıkarılmasını sağlayan Matematik Ders Kitaplarının Kullanımı Ölçeği geliştirilmiştir. Bu ölçeğin yardımıyla daha sonra

öğretmenlerin kitaplarda yer alan örnek, problem, tanım, açıklama gibi bileşenleri nasıl uygulamaya dahil ettikleri incelenmiştir. Bunun için öğretmenlerle görüşmeler düzenlenmiş ve ders gözlemleri yapılmıştır. Ayrıca öğretmenlerin ders kitapları ve ders notları gibi derste kullandıkları dokümanlar da incelenmiştir.

Veri analizi sonuçlarına göre, öğretmenler matematik ders kitabını, çalışma kitabını, öğretmen kılavuzunu ve yardımcı kitapları bir bütün olarak ele almakta ve bunları matematiğin öğretilmesi için önemli kaynaklar olarak görmektedir. Özellikle, ders kitabı konuya girişte günlük hayat ilişkileri kurulurken, diğer derslerle bağlantı kurulurken kullanılmakta; fakat derste çözülecek sorular ve problem kapsamında daha çok çalışma kitabı ve yardımcı kitaplar tercih edilmektedir. Öğretmenler matematiksel soru ve problem kaynağı olarak yardımcı kitapları görmektedir. Bu bağlamda, öğretmenler matematiğin öğretilmesi için sıklıkla ders kitaplarına ve yardımcı kaynaklara başvurmakta, kitaplardaki örnek ve problemleri aynen kullanmakta, nadiren kendi geliştirdikleri materyalleri kullanmaktadırlar. Ayrıca, öğretmenlerin kitap kullanımları bunları yorumlama, kitapların içeriğinde yer alan görevleri seçme, bunları öğrencinin ilgisine, deneyimlerine ve sınırlılıklarına göre değerlendirme ve bunları entegre etme süreçlerini de içermektedir.

Anahtar Kelimeler: Matematik Eğitimi, Matematik Ders Kitapları, İlköğretim Matematik Öğretmenlerinin Ders Kitaplarının Kullanımı

To My Parents
Süheyla Özgeldi, İsmail Özgeldi

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LIST OF ABBREVIATIONS

MoNE : Ministry of National Education
SBS : Level Determination Exam
EFA : Exploratory Factor Analysis
KMO : Kaiser-Meyer-Olkin Measure of Sampling Adequacy
PCA : Principal Component Analysis
CFA : Confirmatory Factor Analysis
WLS : Weighted Least Squares
WLSMV : Robust Weighted Least Squares
ULS : Unweighted Least Squares
DWLS : Diagonally Weighted Least Squares
RMSEA : Root-Mean-Square Error of Approximation
CFI : Comparative Fit Index
SRMR : Standardized Root Mean Square Residual
TLI : Tucker-Lewis index
NNFI : Nonnormed Fit Index
N : Sample Size
SD : Standard Deviation
p : Significance Level
M : Mean
f : Frequency

CHAPTER 1

INTRODUCTION

In school context, mathematics textbooks are among the most trusted materials that are directly related to teacher's teaching and student's learning (Beaton et al., 1996), and the most commonly used resources for mathematical domains, topics, and the pedagogical practices used in classrooms (Valverde et al., 2002). Teachers often rely heavily on textbooks for decisions such as what to teach, how to teach it, what kinds of tasks and exercises to assign to their students (Robitaille & Travers, 1992); and students often use textbooks for classroom exercises and homework assignments (Fan et al., 2004). It is reasonable to argue that mathematics textbooks constitute an important part of mathematics learning and teaching.

Textbooks have also an important role for interpreting a curriculum. They provide "an interpretation of policy in terms of concrete actions of teaching and learning" (Valverde et al., 2002, p. vii), and make possible a connection between the curriculum intentions and classroom activities constructed by teacher (Schmidt, McKnight, & Raizen, 2002). From this point of view, textbooks mediate the relationship between the curriculum objectives and the application of the instruction (Törnroos, 2005); and they are seen as mediators between the intentions of the curriculum and classroom instruction (Schmidt, McKnight, Valverde, Houang & Wiley, 1997; Stein & Kim, 2009). Therefore, mathematics textbooks are considered as curriculum materials in many studies due to their key role in interpreting the curriculum.

Taking the related literature into account, it can be proposed that curriculum materials are important parts of the lessons in which teachers and students work together. In particular, curriculum materials are generally considered as the resource for teachers to use in the instruction providing instructional and pedagogical

strategies (Eisenmann & Even, 2009). They are integral part of teachers' daily work and offer ongoing support for pedagogy and subject matter content throughout an entire school year (Collopy, 2003); and provide ideas and practices which frame classroom activities via text and diagrammatic representations and help teachers in achieving goals that they presumably could not or would not accomplish on their own (Brown, 2009). Therefore, curriculum materials are viewed to provide "uniquely intimate connection to teaching" (Ball & Cohen, 1996, p.6).

In recent years, there has been an increasing interest among the researchers in terms of analyzing the role of mathematics curriculum materials in learning and teaching of mathematics and teachers' use of curriculum materials (Lloyd, Herbel-Eisenmann, & Remillard, 2009). Researchers have attempted to analyze and examine the way of teachers' interaction with mathematics curriculum materials from different point of views (e.g., Brown, 2009; Haggarty & Pepin, 2002; Remillard, 1996, 1999, 2005; Sherin & Dake, 2004). Particularly, researchers have focused on factors that are helpful in understanding the teachers' stance toward curriculum materials and have an influence on teaching and teachers' use of curriculum materials, such as beliefs (Brown, 2002), experience (Frykholm, 2004, Nicol & Crespo, 2006), identity (Spillane, 2000), concern (Christou, Menon, & Philippou, 2004), and pedagogical content knowledge (Van Zoest & Bohl, 2002). Researchers have placed the teachers at the center of the teacher-curriculum material interaction and focused on how teachers interpret the curriculum and curriculum materials. Therefore, investigating teachers' use of curriculum materials is a critical problem in interpreting the teacher-curriculum material interaction considering that value of curriculum materials is likely to depend on the ways they are used (Cohen, Raudenbush, & Ball, 2003).

Researchers have recently paid more attention to explain the teacher-curriculum material interaction over time. Several studies on teachers using curriculum materials examined how teachers follow and implement curriculum materials. Consequently, the focus has been placed on what happens when teachers use curriculum materials or textbooks, how they use them, and why (Remillard, 2009). What is important to note is that the studies considered that curriculum

materials are important resources for curriculum objectives and teaching of mathematics and support teachers' professional activity.

Besides the growing field of research on teachers' use of curriculum materials, another line of research has focused on the interaction between mathematics teacher and resources and their consequences for professional growth. In this regard, the *documentational approach of didactics* (Gueudet & Trouche, 2009) informs the investigation of teachers' mathematical activities and their use of resources. Particularly, the documentational approach of didactics provides a similar perspective within the research studies on teachers' use of curriculum materials in terms of teachers' interaction with curriculum materials, but focuses more precisely on what a teacher needs to do for designing and enacting his/her teaching: looking for resources, selecting/designing mathematical tasks, planning their succession, integrating and adapting them in his/her teaching, implementing them in practice, sharing it with colleagues, and managing available resources (Gueudet & Trouche, 2009). Gueudet and Trouche (2009) called this work *teachers' documentational work* which is considered within the studies related to selecting and adapting mathematical tasks (e.g., Ball & Cohen, 1996; Sherin & Drake, 2004). Therefore, teachers' documentational work is important in understanding of teachers' selecting, integrating, and adapting tasks in resources and plays a key role in making sense of teachers' use of resources. The scope of the current study allows to frame teachers' selection, adaptation, and implementation of tasks from mathematics textbooks.

Gueudet and Trouche (2009) provided a comprehensive framework to understand teachers' use of resources. They focused not only on curriculum materials but also on everything as a resource which plays a crucial role for a teacher who draws on them in his/her activity such as textbook, piece of software, student sheet, discussion with a colleague or with students, etc. Significantly, Gueudet and Trouche (2009) did not isolate resources from one another; they noticed that resources should be remained as "a set of resources" (p. 200). However, the conceptualization of set of resources in many research studies on teachers' use of curriculum materials has not received sufficient attention; in fact it is often ignored. Therefore, the documentational approach of didactics provides a framework for investigating

teachers' use of textbooks, as well as their use of personal records, discussion with students, and supportive materials in the current study.

In particular, the documentational approach of didactics (Gueudet & Trouche, 2009) explains the interaction between mathematics teacher and resources, and their consequences for professional growth. As a new area of research, little is known about this approach focusing on the ways of teachers' documentation work in mathematics. However, there has been a growing interest in the studies of investigating the teacher-resource interaction (e.g., Kieran, Tanguay, & Solares, 2011; Maschietto & Trouche, 2010; Rezat, 2011; Sabra & Trouche, 2011). Therefore, the current study may help to render the elementary concepts of the documentational approach in a very diverse context and provide information about teachers' integration of textbooks into practice and the role of textbooks as teaching resource.

In the current study, mathematics textbooks were considered as curriculum materials in terms of exploring teachers' use of textbooks since textbooks mediate the relationship between the curriculum objectives and the enactment of the instruction. Additionally, mathematics textbooks are considered as resources for teaching and learning of mathematics since set of mathematics textbooks (e.g., student edition textbook, workbook, teacher edition textbook, and auxiliary book) provide materials for students and teachers. In this regard, it could be interpreted that the documentational approach of didactics provides a comprehensive framework in terms of examining teachers' integration of tasks from the textbooks into practice and teachers' interaction with textbooks.

1.1 Mathematics Textbooks in Turkish Schools

Mathematics textbooks have official status in Turkey and reflect official mathematics curriculum. To be used in schools, any mathematics textbook needs to be approved by the Turkish Ministry of National Education (MoNE). Among the approved mathematics textbooks, the ministry of education decides which textbook can be used by which public schools, and distributes them free of charge to students and teachers. There are six major textbook publishers which commercially produce

middle school mathematics textbooks (i.e., grades 6-8). There is no significant variation in content among the mathematics textbooks from different publishers considering that all textbooks are designed to reflect the national curriculum.

Particularly, mathematics textbooks (i.e., grades 1-8) are prepared in triple sets consisting of student edition textbook, workbook and the teacher edition. The student edition includes problems, examples, definitions, and activities that support student learning in mathematics. The workbook contains additional problems and exercises. The teacher edition is designed to help teachers prepare lessons and includes step-by-step teaching notes, expected learning outcomes, curriculum objectives, suggestions for enrichment exercises and activities, answer keys, and additional comments. Moreover, the structure of the teacher edition comprises a copy of the student edition textbook and workbook pages with solutions and answers on it. In this study, ues of sixth, seventh, and eight grade students edition, workbook, and teacher edition textbooks were analyzed separately.

1.2 Purpose of the Study

Regarding the existing literature on mathematics teachers' use of resources (in particular curriculum materials and textbooks) and the relationship between teachers and resources, the present study aimed to explore middle school mathematics teachers' use of mathematics textbooks and examine teachers' integration of tasks in the textbooks into practice. In particular, a questionnaire was developed to explore teachers' use of textbooks considering that there was no questionnaire available designed to identify teachers' use of textbooks and selection of tasks from textbooks. Moreover, in a follow-up study, teachers' integration of tasks from textbooks into practice was examined. The reason for the qualitative follow-up data was to contextualize the initial quantitative results to better explain the interaction between teachers and textbooks.

1.3 Research Questions

The central research question of this study was: "How do middle school mathematics teachers use mathematics textbooks and integrate tasks from mathematics textbooks into practice?" This question was examined using a mixed method design which provided a framework and logic to guide the implementation of the research methods. The exploratory design and the explanatory design procedures were employed subsequently in two stages. Particularly, the purpose of the exploratory design was to explore the middle school mathematics teachers' use of textbooks. The purpose of the explanatory design was to examine teachers' integration of tasks from textbooks into practice.

Employing a mixed methods research design, the study addresses the following three research questions:

1. What is the nature and the number of factors that affect the mathematics teachers' use of mathematics textbooks?

2. Do middle school mathematics teachers' use of textbooks differ for teachers with differing demographics?

2.1. Is there a statistically significant difference in teachers' use of textbooks between male and female teachers, as elicited by Use of Mathematics Textbooks Questionnaire?

2.2. Is there a statistically significant difference in teachers' use of textbooks between teachers with different level of teaching experience, as elicited by Use of Mathematics Textbooks Questionnaire?

2.3. Is there a statistically significant difference in teachers' use of textbooks between teachers who have different numbers of student in classroom, as elicited by Use of Mathematics Textbooks Questionnaire?

3. How do middle school mathematics teachers integrate the tasks in the mathematics textbooks in their instructional practices?

In summary, it was necessary to use both quantitative and qualitative approaches to answer the research questions.

1.4 Significance of the Study

Understanding the relationship between teacher and resources (e.g. textbooks and curriculum materials) is important to be able to support learning and teaching of mathematics. The contemporary issues in the study of teachers' use of curriculum materials (e.g. Remillard, 2005; Remillard & Bryans, 2004; Sherin & Drake, 2004), and the teachers' use of textbooks (e.g. Brown, 2009; Haggarty & Pepin, 2002; Johansson, 2007) suggest that the interaction between teacher and resources need to be carefully examined since there are a bidirectional relations between teachers and resources. Particularly, examining mathematics teachers' use of textbooks and the interaction between teacher and mathematics textbooks may enable us to better understand the teaching process in mathematics.

Researchers have placed teachers at the center of the teacher-curriculum material interaction and focused on how teachers interpret the curriculum materials and textbooks. However, there are still unanswered questions about how the features of curriculum materials influence the teachers' interaction with mathematics curriculum materials (Remillard, 2009). According to Remillard (2005), the characteristics of curriculum and curriculum materials should be encountered and figured in the participatory relationship that shapes how teachers interact with curriculum materials and how they use them in planning and enacting instruction. For this reason, it can be confirmed that there is a necessity of specifying the characteristics of textbooks to examine the interaction between teacher and textbooks. In this regard, the documentational approach of didactics might provide valuable information and a more comprehensive framework in terms of examining teachers' integration of tasks from the textbooks into practice and teachers' interaction with mathematics textbooks. In this regard, the current study will attempt to fill a gap in literature.

In the literature, there has been no study that explicitly explored the teachers' use of set of textbooks (e.g., student edition textbook, workbook, teacher edition textbook, and auxiliary books) and the interaction between teachers and the set of those textbooks. In this regard, the documentational approach of didactics and the main process of teachers' engaging with curriculum materials (Remillard, 1999;

Sherin & Drake, 2004) lead to a comprehensive framework for the investigation of the interactions between and teachers and textbooks. By this way, it will be possible to evaluate some of the existing research regarding mathematics teachers' use of textbooks. Therefore, this research will contribute to the body of research that curriculum developers, textbook publishers, educators, and teachers can benefit in developing curriculum and textbooks.

The teachers' interaction with the resources, associating in particular textbooks, in Turkey has not received sufficient attention by the researchers. These interactions have not so far clearly emphasized as potential influences on teaching of mathematics in the middle school level. Generally, such kinds of considerations have been largely ignored in educational studies in Turkey. For this reason, it could be claimed that there is a need for specifying the interaction between teachers and textbooks and the role of textbooks in teachers' works. The current study is intended to fill this gap in the literature. In this context, as Haggarty and Pepin (2002) reported, different cultural and educational values certainly have particular meaning in providing a representative picture of a country and also promote a shared understanding and principle for components of framework for use of textbooks and curriculum materials. Owing to that, the data from Turkish educational context provides a particular cultural educational characteristic about using mathematics textbooks and additional information for the related literature on textbook use and teachers' documentational work.

1.5. Definitions of Important Terms

In this section, the definitions of important terms used in this study were presented.

Mathematics Textbook: According to Howson (1995), textbook is defined as the "kernels of instruction-theorems, rules, definitions, procedures, notions, and conventions which have to be learned as knowledge" (p.25). In this study, Howson's (1995) definition was adapted for analyzing teachers' use of mathematics textbook. Moreover, mathematics textbook refers to the textbooks officially approved by the Turkish Ministry of National Education and distributed free of charge to students and

teachers. It includes student edition textbook, its workbook and the teacher edition textbook.

Student Edition Textbook: In this study, student edition textbook refers to the book used by a student in which problems, examples, definitions, and activities are included.

Workbook: In this study, workbook refers to the book used by a student in which additional problems and activities are included.

Teacher Edition Textbook: In this study, the teacher edition textbook refers to the book which is designed to help teachers prepare lessons and includes step-by-step teaching notes, expected learning outcomes, curriculum objectives, suggestions for enrichment exercises and activities, answer keys, and additional comments. Moreover, the structure of the teacher edition textbook comprises a copy of the student edition textbook and workbook pages.

Auxiliary Book: In this study, auxiliary book refers to the mathematics textbooks which were commercially produced by textbook publishers and particularly designed to help students to prepare for the national examinations (i.e. High School Entrance Exam).

Curriculum Material: Curriculum materials refers to "instructional guides that place substantial emphasis on both pedagogy (the how of teaching) and mathematics (the what of teaching)" (Stein, Remillard, & Smith, 2007, p.323). In this study, curriculum material was considered as a critical resource for students' learning of mathematical content and teachers' mathematical instructional decisions. Particularly, mathematics textbooks were considered as curriculum materials to explore teachers' use of textbooks in this study.

Resource: In this study, resource was defined as everything which played a crucial role for a teacher who used them in his/her activity (Gueudet & Trouche, 2009). In particular, Gueudet and Trouche's (2009) definition of resources was adapted into the current study and were particularly considered as material resources such as textbook, curriculum guidebook, student workbook, teacher edition textbook, teaching notes, work sheets, auxiliary books, and internet while planning and enacting instruction.

Use of Mathematics Textbook: The meaning of *use* included "how teachers engage or interact with these resources [pedagogical activities] as well as how and the extent to which they rely on them in planning and enacting instruction, and the role resources play in teachers' practice" (Lloyd et al., 2009, p.7). In this study, mathematics textbook was considered as a resource, and this definition was adapted for analyzing the use of textbook.

Teachers' Documentational Work: Teachers' documentational work was called to mean what a teacher needs to do for designing and enacting his/her teaching: looking for resources, selecting/designing mathematical tasks, planning their succession, integrating and adapting them in his/her teaching, implementing them in practice, sharing it with colleagues, and managing available resources (Gueudet & Trouche, 2009). In this study, the teachers' documentation work encompassed the interactions between teacher and resources.

Document: In this study, document was developed by teachers through a documentation work and was considered as an outcome of teachers' professional activity (Gueudet & Trouche, 2009).

1.6 Organization of the Dissertation

The current dissertation is divided into six main chapters. The first chapter presents the importance and significance of study by giving a summary of related theoretical background. Chapter 1 gives also definitions of the important terms used in this study. Chapter 2 provides a detailed review of literature about the teachers' use of textbooks and resources and the theoretical background of the documentational approach. The methodological issues are presented in Chapter 3 about research design, participants, settings, and data analysis. Chapter 4 gives the results of quantitative results comprising the descriptive and the inferential statistics in the light of the research questions. Moreover, Chapter 4 provides the findings of the qualitative data analysis constructed on the results of the descriptive data. Finally, Chapter 5 discusses the findings by relating the results with the pertinent literature. Additionally, the conclusions drawn from the results of the study, implications, limitations, and suggestions for future research are also given in the last chapter.

CHAPTER 2

REVIEW OF RELEVANT LITERATURE

The purpose of this review is to provide a framework for exploring the middle school mathematics teachers' use of mathematics textbooks and examining the teachers' integration of tasks in the textbooks into practice. To accomplish this purpose, published works in the educational literature (especially in mathematics and science education) are reviewed and presented in two main sections. The first section presents the documentational approach of didactics developed by (Gueudet & Trouche, 2009). This section deals with the theoretical background and constitution of the critical components and concepts of the instrumental approach. The second section of this review deals with the research studies related to use of textbooks and curriculum materials and highlights the interaction between teacher and resources by presenting the contemporary issues in relation to teaching activities.

2.1 Documentational Approach of Didactics

At all levels of mathematics education, resources play a critical role in teaching and learning mathematics; and the integration of resources into mathematical practice has been a motivation for researcher. There are different approaches to describe how teachers integrate a tool or resource into their practice and what kinds of resources are appropriate for their students and allow an understanding of process of appropriation of resources and tools. In this regard, the *documentational approach of didactics* (Gueudet & Trouche, 2009) attempts to the interaction between mathematics teacher and resources, teachers' integration of a resource into the practice, and their consequences for professional growth. It informs the investigation of teachers' integration of a resource into their practice and their use of resources.

In this approach, the concepts of *documentation work, documentational genesis, teachers' documentation, and the dialectical relationship between resources and document* have been introduced and discussed within the methodology that is used for studying mathematics teachers' documentation. These elementary concepts were developed based on the instrumental approach in mathematics (Guin, Ruthven, & Trouche, 2005) and the work of Rabardel (1995). Significantly, the instrumental approach brings into question of teachers' professional practice and their choices regarding integration of technological tools (e.g. spreadsheet, calculator). Moreover, this approach helps in understanding the influence of tools and resources upon mathematical activity and knowledge building (Guin et al., 2005); and the ways in which resources were used by teachers and students for their mathematical activities (e.g. Guin et al., 2005; Haspekian, 2005; Maschietto & Trouche, 2009; Ruthven, 2002).

According to Gueudet, Pepin, and Trouche (2011), a number of concepts were also derived from *document management* (Pédauque, 2006) and *curriculum material* (Remillard, 2005). Moreover, they stated that the contemporary issues in the study of teachers' use of curriculum materials (e.g. Arbaugh & Brown 2005; Ball & Cohen, 1996; Christou et al., 2004) were used in the development of this documentational approach. Therefore, different kinds of approaches considerably provide the underlying theoretical framework for the documentational approach.

The following sections represent a discussion of the elementary concepts of this approach: *teachers' documentation work, dialectic relationship between resources and document, and documentational genesis.* In addition, the review of the relevant studies relying on teachers' uses of resources and curriculum materials were elaborated in the context of the documentational approach.

2.1.1 Dialectic Relationship between Resources and Document

Teachers' documentation work is called what a teacher needs to do for designing and enacting his/her teaching: looking for resources, selecting/designing mathematical tasks, planning their succession, integrating and adapting them in his/her teaching, implementing them in practice, sharing it with colleagues, and

managing available resources (Gueudet & Trouche, 2009). The documentation work encompasses the interactions between teacher and resources. The *design* and *enacting* processes are intertwined in this work (Gueudet, Pepin, & Trouche, 2011). Therefore, the notion of "*documentation*" means the teachers' work with resources and the outcomes of the design and enactment process. This approach acknowledges the process of mathematics teachers' work with resources and their use of resources.

Teachers' choices and professional activity is at the heart of the documentational process in which resource is turned into a *document* (Gueudet & Trouche, 2009). The concept of document was developed based on the concept of *instrument*. According to Verillon and Rabardel (1995), an instrument is developed by the subject from an artifact which is a material or abstract object (e.g. a calculator or an algorithm) produced by a subject (e.g. user, operator, or worker) to support the performance of a type of tasks and solve a given problem. According to this view, there is no instrument exists in itself. There has been always a relationship between a subject and an instrument. Therefore, instrument is developed by the subject through his or her relation with the artifact for an activity or for others to solve a given problem (Verillon & Rabardel, 1995).

Verillon and Rabardel (1995) characterized the relations or interactions between subject and object based on a model, namely the Instrumented Activity Situations (IAS) proposed by Rabardel and Verillon (1985). This model (Figure 2.1) represents the subject-object interaction, which highlights the intermediary status of instrument. Even though it seems a bipolar relation between subject and object, other interactions should be considered: "interactions between the subject and the instrument, interactions between the instrument and that upon which it enables action to be taken and, finally, the subject-object interactions mediated by the instrument" (Verillon & Rabardel, 1995, p.10). For example, when a baby is learning to use a spoon (subject-object interaction); she/he has to learn how to keep some milk in the spoon (instrument-object interaction). In this process, she/he learns about the liquids (subject-object interaction mediated by the instrument).

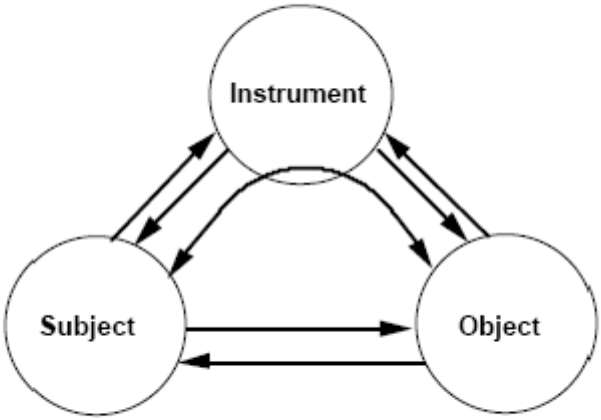

Figure 2.1 IAS Model: The Triad Characteristic of Instrumented Activity Situations (Verillon & Rabardel, 1995, p.11)

The subject uses her/his knowledge for the artifact, evaluates its constraints and possibilities, and obtains an instrument. This is the process of instrumental genesis. Particularly, the instrument is developed through the instrumental genesis process. Rabardel (1995) defined this process as instrumentalization of the artifact. Then, Guin et al. (2005) combined this approach into the didactics of mathematics in order to study students' mathematics learning process related to their use of symbolic calculators. They focused on the ways in which artifacts (e.g. spreadsheet, calculator) turn into instruments for teachers and students for their mathematical activities. They suggested a more comprehensive description about the transformation of technological tool into an instrument for their mathematical learning.

Guin et al. (2005) highlighted the critical elements and relations in the diagram of an instrumental genesis which was then used for the documentational approach. Figure 2.2 represents the instrumental genesis points the complexity of using artifacts. The figure shows that an instrument is developed through the process in which there is a bidirectional relationship between a subject (her/his knowledge) and an artifact (its constraints and possibilities). The process consists of two

components: *instrumentalization* (directed toward the artifact) and *instrumentation* (directed toward the subject).

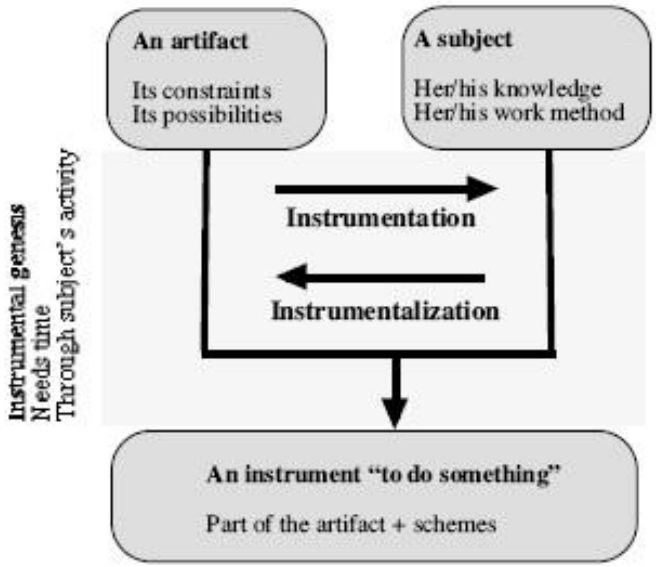

Figure 2.2 Diagram of an instrumental genesis (Guin et al., 2005, p.144)

According to Guin et al. (2005), the *instrumentalization* is the indication of a subject's activity; for example, the subject thinks about the purpose of the calculator and its use. Rabardel (2002) used the term instrumentalization process in line with the evolution of artifact: "selection, regrouping, production and institution of functions, deviations and catachresis, attribution of properties, transformation of the artifact (structure, functioning etc.)" (p.103). It is a kind of elaboration about the artifact, and involves adaptation and forming of artifact (Rabardel & Bourmaud, 2003). Thus, the instrumentalization tends to improve an artifact. On the other side, *instrumentation* is a process in which the constraints and potentialities of an artifact *shape* the subject (Guin et al., 2005, p.148). Rabardel (2002) stated that instrumentation process deals with the emergence of utilization schemes: "their constitution, their functioning, their evolution by adaptation, combination coordination, inclusion and reciprocal assimilation, the assimilation of new artifacts to already constituted schemes, etc." (p.103). Therefore, this process consists of development or adaptation of utilization schemes (Rabardel & Bourmaud, 2003).

Based on the instrumental approach, the documentational approach provides the genesis as a process in which teachers adapt and form the resources. In the documentational approach, the intertwined process between teacher and resources corresponds to the relationship between artifact and subject, as described in the instrumental approach. Particularly, the intertwined process is represented by *instrumentation* (resources supporting teacher's activity) and *instrumentalization* (teacher working on resources) (see Figure 2.3). It includes how teachers engage and interact with resources as well as what kinds of constraints and potentialities of resources shape the teacher. The interaction between a set of resources and teachers has a dual nature in terms of documentational genesis (Gueudet & Trouche, 2011). Within this interaction, a new vocabulary is introduced, i.e. *document* and *documentational genesis* (Gueudet & Trouche, 2009).

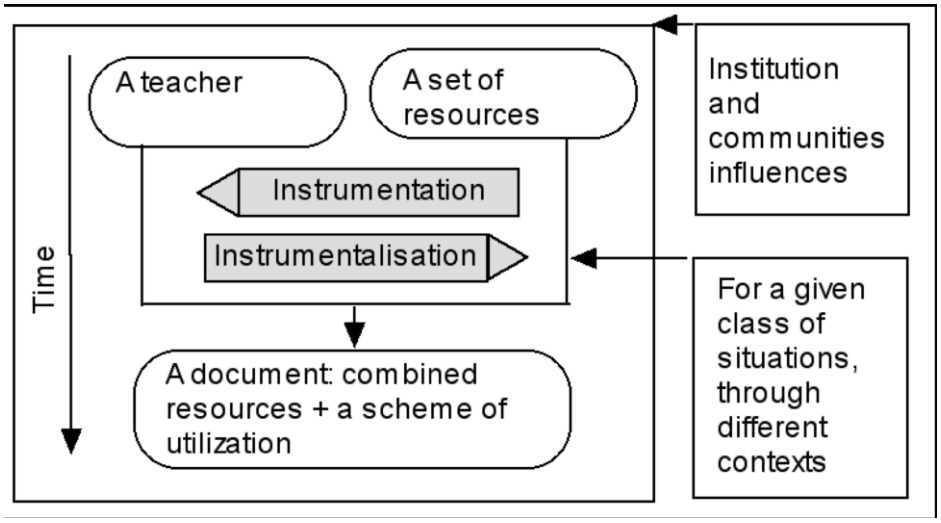

Figure 2.3 Schematic representation of a documentational genesis (Gueudet & Trouche, 2011, p.5)

Figure 2.3 represents the ongoing process for documentation, namely the documentational genesis. The bidirectional relationship between teacher and resources is specified by the instrumentalisation and instrumentation, based on the instrumental approach by Guin et al. (2005). Particularly, the instrumentalisation dimension indicates teachers' appropriation and reshaping processes, and the instrumentation dimension indicates the influence on the teacher's activity of the

resources (Gueudet & Trouche, 2009). Furthermore, there are a number of factors influencing teachers' documentational process such as institutional and contextual issues, and teachers' practice, beliefs, and knowledge. This process can be illustrated by the equation:

Document = Resources + Scheme of Utilization

In this equation, *document* is represented as a verb: "to support something (here the teacher's professional activity) with documents" (Gueudet & Trouche, 2009, p.205). It is developed by teachers through a documentation work, and evolved through documentational geneses. It can be considered as an outcome of the teachers' professional activity. This equation actually represents a dialectical relationship yielded between resource and document. Gueudet and Trouche (2009) stated that different kinds of resources bring out a new resource and document is as an output of the interaction between those resources and the teacher. This kind of process cannot be isolated from the teachers' professional activity and professional development because a document is developed by teachers' use of the set of resources and specifically shaped by teacher' activity and experience through the classroom context (Gueudet & Trouche, 2009). Furthermore, this equation denotes a dynamic relationship between resources and document; however, it is a static equation (Gueudet, Pepin, & Trouche, 2011). The dynamic relationship indicates that the documentational genesis continues with the involvement of other documents in the process. This process goes on: "the document gives birth to a new resource, likely to combine with others, to be involved in new geneses" (Gueudet & Trouche, 2009, p.214). Therefore, the documentational genesis reveals a new resource and a scheme of utilizations of this resource.

A scheme of utilization can be identified by both an invisible and observable part. The invisible part refers to the *operational invariants,* which entail the cognitive structure of the teachers' action (Gueudet & Trouche, 2009). On the other side, the observable part denotes "the regularities in the teacher's action for the same class of

situations through different contexts" (Gueudet & Trouche, 2009, p.208). This part is called *usages*. Then, the equation can be represented in a more detailed way:

Document = Resources + Usages + Operational Invariants

The following section describes the scheme of utilizations and the dialectical relationship between document and resources.

2.1.2 Scheme of Utilization and Usages

Guin et al. (2005) expressed that "a subject builds an instrument *in order to perform a type of task*; this instrument is thus composed of both artifact (actually *a part* of the artifact used to perform these tasks) and subject's *schemes* allowing her/him to perform tasks and control her/his activity" (Guin et al., 2005, p.145, italics in the original). This description can be interpreted as a scheme is a substantial component of the characterization of the instrument entity in which the instrumental genesis takes place. Particularly, the notion of utilization scheme comes from the work of Rabardel (2002). Rabardel identified four ingredients of a scheme, namely:

> - anticipations of the goal to be reached, expected effects and possible intermediary stages;
> - rules of action along the lines of "if-then" which allow the sequencing of subjects' actions to be generated;
> - inferences (reasoning) that allow the subject to calculate rules and anticipations based on information and the operational invariants system he/she disposes of;
> --operational invariants that pilot the subject's recognition of elements pertinent to the situation and information gathering on the situation to be dealt with (Rabardel, 2002, p.79).

From the description of utilization schemes, schemes are related to subject's activity, which is oriented to reach the goal; therefore, using a scheme is a purposeful activity to reach a goal. Therefore, a scheme of utilization is "an invariant organization of the activity to achieve a type of task" (Gueudet, Pepin, & Trouche, 2011, p.5). It can be adapted to new context, and connected to other schemes.

In particular, “operational invariants” are most important for the identification of utilization of schemes because they allow identifying the characteristics of situations that subjects truly take into consideration (Rabardel, 2002). In the teacher’s documentational work, the operational invariants are the inference of the teachers’ anticipations and actions. They are inferred from teachers’ beliefs and outcomes of their activity through their documentational work with a set of resources. They are based on teachers’ experience in teaching with resources.

Moreover, operational invariants can be categorized into *general* and *specific operational invariants*. Gueudet and Trouche (2009) mentioned that *general operational invariants* are related to teachers’ experience regarding instruction and ideas about learning of mathematics. These operational invariants are the inference of the teachers’ anticipations and actions. They are inferred from teachers’ beliefs and outcomes of their activity through their documentational work with a set of resources. On the other side, *specific operational invariants* are more specific evolution in teacher’s practice. For instance, the observation of mathematics teachers’ activity showed that “students understand and memorize better a formula when a class discussion is organized before the teacher writes the formula on the board”; “immediate application exercises support the understanding of a formula” (general); “the association side-horizontal and height-vertical must be avoided”; “students must make precise the unit when they compute an area” (specific) (Gueudet & Trouche, 2009, p.209).

2.1.3 Resources

Resources have different meaning and naming in line with their context (Adler, 2000; Cohen et al., 2003). Particularly, Adler (2000) examined the resources and their use in school mathematics, and classified three kinds of resources that enable their examination and their use in school mathematics context: *human* resources (persons and processes), *material* resources (technologies, school mathematics materials, mathematical objects, everyday objects), and *social and cultural* resources (language and time). Certainly, this type of categorization provides their examination and their use in their related context.

Cohen et al. (2003) proposed a more comprehensive approach to Adler's view of resources. They distinguished the types of resources into three categories: *conventional* resources (teachers' formal qualifications, books, facilities, class size, and time), *personal* resources (practitioners' will, skill, and knowledge), and *environmental and social* resources (state guidance for instruction, academic norms, professional leadership, and family support). These types of resources were based on the view of causality between the school resources and student achievement. According to this view, resources are the causal variable and student achievement is the outcome. Therefore, resources can enable or constrain the causality, and have moderating impact on student achievement (Cohen et al., 2003).

According to Cohen et al. (2003), teachers use the resources to design lessons, evaluate students' work, and manage time and settings. In this sense, teachers need to "use knowledge, coordinate instruction, mobilize incentives for performance, and manage environments" (p.124). What is significant to note is that Cohen et al. emphasized the importance of teaching skill, will, and knowledge which is the requisite for using resources. For example, teachers, who know a subject and know how to present it to learners, will be more likely to make good use of a mathematics text than teachers who don't know the subject or know it but not know how to present it to learners. With this perspective, a resource is an outcome of teacher activity, and elaborated for a teacher activity with a particular aim.

Gueudet and Trouche (2009) retained a similar conceptualization in terms of resources with Adler (2000) and Cohen et al. (2003). Significantly, Gueudet and Trouche (2009) did not isolate resources from one another; they noticed that resources should be remained as "a set of resources" (p.200). They include everything which plays a crucial role for a teacher who draws on them in his/her activity. Therefore, in the documentational approach, the word of *resource* corresponds to a variety of things in teachers work: textbook, piece of software, student sheet, discussion with a colleague or with students, etc.

Gueudet and Trouche (2009) clarified the distinction between *resources* and *document* based on the instrumental approach. The distinction between them was introduced by the instrumental approach (Rabardel, 1995), between *artifact* and

instrument. In this sense, a resource can be an artifact (i.e. it is an outcome of human activity (Rabardel, 1995)) but it exceed artifact (Gueudet, Pepin, & Trouche, 2011). Therefore, resources are not limited to technological tools in the documentational approach (whereas the mostly used resources are technological tools in the instrumental approach). More generally, Gueudet et al. (2011) considered resources as material resources and non-material resources in the documentational approach. Particularly, non-material resources such as a discussion with a colleague, or interactions in class with students are more difficult to determine. On the other side, material resources have a particular meaning from a methodological point of view in the documentation work because the teacher-resource interaction can be observable (Gueudet, Pepin, & Trouche, 2011). For instance, teachers' notes on a book, modifications on a book or a file, or a slide used by teachers are visible through the documentation work. In this sense, teachers often benefit from different types of material resources, comprising curriculum materials (especially curriculum guides and textbooks), digital resources, and other written resources.

To sum up, the documentational approach represents a theoretical approach for the study of teachers' documentation work (i.e. selecting resources, combining and using them, and revising amongst others etc.), conceptualizing the articulation between documentation work and professional growth. In this study, this theoretical approach provided to examine teachers' selecting, using, and combining tasks in the mathematics textbooks. Particularly, the mathematics textbook was considered as a primary resource for teachers' documentational work in this study. In this process, two components, *instrumentalization* (directed toward the textbooks) and *instrumentation* (directed toward the teacher), provided a basis to examine and interpret the interaction between teacher and textbooks.

2.2 Research on Use of Curriculum Materials

The contemporary issues in the study of teachers' use of curriculum materials (e.g. Remillard, 2005; Remillard & Bryans, 2004; Sherin & Drake, 2004), and teachers' use of textbooks (e.g. Brown, 2009; Haggarty & Pepin, 2002; Johansson, 2007) have an important role in relation to the documentational approach. These

kinds of studies are useful to render the elementary concepts of the documentational approach. Therefore, these studies will lead to a more comprehensive framework for the investigation of the interactions between and teachers and resources.

There are some important factors in explaining the teachers' use of curriculum materials: teachers' experience (Van Zoest & Bohl, 2002) and teachers' concern (Christou et al., 2004, 2009). Particularly, Christou et al. (2004) was examined how beginning teachers' concerns differed from the concerns of experienced teachers in using new mathematics curriculum materials. Examining the teachers' concern regarding the implementation of a new mathematics curriculum and the adopted new mathematics textbooks, Christou et al. (2004), asserted that teachers' concerns differ with respect to their involvement in the innovation and their teaching experiences. The findings of Christou et al.'s (2004) study showed that beginning teachers had less worries about the implementation of the curriculum and using the new textbooks; however, they were more concerned about their preparation of their daily work and the collaboration with other colleagues. In contrast, experienced teachers were largely interested in the consequences of the innovation for their students and had less information about the adoption of the innovation.

In the following sections, the role of curriculum materials and textbooks is examined in relation to their use by teachers. Moreover, the reviewed studies are outlined by considering the associations with the key processes in teachers engage as they use curriculum materials.

2.2.1 Curriculum and Textbook

Many researchers have recommended their own preferred definition of curriculum in their studies. One useful starting point when studying what is curriculum is to consider three levels, namely *intended*, *implemented*, and *attained* curriculum (Robitaille et al., 1993). The intended curriculum is functional at the educational system level and includes the aims and goals embodied in official documents (Schmidt et al., 1997). The implemented curriculum deals with the application of the instruction that students get. The attained curriculum refers to the outcome of the instruction referred to the skills and knowledge that students acquire.

As noted by Kilpatrick (1996) and Schwartz (2006), curriculum is considered as a complex construct with several facets consisting of goals, content, instruction, assessment, and materials.

Besides the curriculum levels, curriculum refers to what is enacted in the classroom (Schmidt et al., 1997). Curriculum is often used as the written resources (e.g. textbooks, teachers' guide) provided to teachers and students for their instruction. This is used to refer to the *potentially implemented curriculum* as the intermediate stage between the intended and the enacted curriculum (Törnroos, 2005). In this sense, the textbooks and the other written resources are connected to the potentially implemented curriculum.

For the sake of clarity, the word *curriculum* has been considered as the *enacted curriculum* in most educational studies; however the curriculum mentioned in this study refers to the intended curriculum noticing to the instructional goals and objectives. In this context, the potentially implemented curriculum deals with the curriculum material or written curriculum resources throughout this study. Therefore, the word *curriculum* varies with the meaning and is considered in its context.

2.2.2 Perspectives on Teachers' Use of Curriculum Materials and Textbooks

Teachers' use of mathematics curriculum materials has drawn considerable attention in recent years (e.g. Christou et al., 2004; Brown, 2002, 2009; Haggarty & Pepin, 2002; Remillard, 1996, 1999, 2005; Sherin & Dake, 2004). Researchers have attempted to analyze and examine the way of teachers' interaction with materials from different point of view. Some researchers assume that the main objective is to implement curriculum materials as developed, and thus they conceptualize the fidelity between teaching and curriculum materials or curriculum material use as following the text; therefore, they consider a degree of fidelity between the intended curriculum and the implemented curriculum (what teachers do in the classroom). Conversely, other researchers take a different perspective because the fidelity between teaching and written words in the curriculum resources is not possible in their view. Similarly, as Lloyd, Herbel-Eisenmann, and Remillard (2005) state,

> [whereas] research revealing the ways that teachers shape or transform curriculum materials raises questions about the possibility of curricular fidelity…it would be inaccurate and irresponsible to conclude that all interpretations of a written curriculum are equally valid. The field is in need of ways to characterize reasonable and unreasonable variations or instantiations of a particular curriculum that are tied to features most central to its design (p. 1).

From this point of view, they focus on how teachers interpret and adapt the curriculum and curriculum resources into the classroom and assume an active participation between teacher and curriculum materials and concentrate on the factors that are helpful in understanding the teachers' stance toward curriculum materials (Brown, 2002). In the following sections, two perspectives are outlined by considering their associations with teachers' activity.

2.2.2.1 Following Curriculum Materials (Textbook Integrity)

Research from the fidelity perspective in curriculum studies involves the determination of the degree to which curricular knowledge created and developed by the experts is implemented by teachers and students in classroom as planned (Synder, Bolin, & Zumwalt, 1992). In this perspective, teachers are the implementers of textbooks and texts are the primary resource for students' opportunities for learning. In an effort to address this issue, Freeman and Porter (1989) examined four elementary mathematics teachers' use of textbooks and compared the content taught by teachers with the textbook content in elementary school mathematics. The authors highlighted the different types of textbook use: textbook bound, focus on the basic, and focus on district objectives. The results of the study showed 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.

The results of another investigation appear to provide additional evidence that teachers used textbooks as the "primary guide" to decide about contents, student activities, and pedagogical approach in designing instruction (Chval, Chávez, Reys, & Tarr, 2009). Chval et al. (2009) have developed -*textbook integrity*- a more clearly

defined perspective on curriculum fidelity and implementation. They described the textbook integrity as "the extent to which the district-adopted textbook serves as a teacher's primary guide in determining the content, pedagogy, and the nature of student activity over an identified period of time" (p.72). They stated that teachers covered a comparable amount of the textbooks (on average 58%) and used their textbooks in lessons (on average 87%). These findings indicated that the construct of textbook integrity provides the interpretation of student achievement and the relationship between student achievement and curriculum materials cannot be ignored.

In this regard, researchers examining textbook integrity focus on the degree to which their teaching practices match the curriculum standards. The primary emphasis places on documenting teachers' work to determine the influence of textbooks on student learning. This view offers insights into the teacher-textbook relationship, but provides few details about its nature. For that reason, the details about the teacher-textbook relationship and the factors affecting this relationship need to be carefully examined.

2.2.2.2 Interpreting and Adapting Curriculum Materials

Studies over 30 years on characterizing and studying the knowledge of curriculum use addressed the teachers' interactions with curriculum materials and the role of the curriculum materials. Research has shown that when teachers interact with curriculum materials, they do so in dynamic and constructive ways rather than a straightforward process (Brown, 2002, 2009; Remillard & Bryans, 2004; Remillard, 1999, 2005, 2009). Teachers frequently make changes in the curriculum intentions and modify them according to the structure and the purpose of lessons. In doing so, the availability, quality, and flexibility of the curriculum materials play a critical role in teachers' decisions.

In line with this perspective, researchers seek to understand when teachers use curriculum materials, and why. An underlying assumption of the studies is that "teachers are central players in the process of transforming curriculum ideals, captured in the form of mathematical tasks, lesson plans and pedagogical

recommendations, into real classroom events" (Lloyd et al., 2009, p.3). Therefore, the critical point for understanding the curriculum use depends on the process of understanding what teachers do with mathematics curriculum materials and why as well as how their choices influence classroom environment (Remillard, 2009).

In particular, Remillard's (2005) study was based on a teacher-curriculum relationship framed by the previous empirical research on the use of curricular resources. This study was based on a teacher-curriculum relationship framed by the previous empirical research on the use of curricular resources and assumed that the interaction between teacher and curriculum is highly interactive and multifaceted rather than a straightforward process. Remillard (2005) mentioned that understanding the relationship between teacher and curriculum would explain how teachers use the curriculum materials. To highlight this relationship, Remillard (2005) used the term *participatory relationship* between teacher and curriculum.

The participatory relationship is embedded in the local and global context. Specifically, the school context influences the way of teachers' reading and using mathematics curriculum materials. The characteristics of teacher such as knowledge, beliefs, goals, experiences, capacities, and perceptions are the factors for identifying the participatory relationships between the teacher and the curriculum. On the other side, the structure of curriculum such as representation of concepts and tasks, material objects, structures, voice, and look are other factors for identifying the relationships between the teacher and the curriculum. Therefore, the characteristic of teacher and curriculum influences and shapes the way of the teacher-curriculum participatory relationship (Remillard, 2005).

Within the dynamic and constructive perspective, Remillard's (2005, 2009) work represented a growing body of literature in using curriculum materials. Remillard (1996, 1999) studied two experienced mathematics teachers using a reform-oriented textbook for the first time and examined the interaction between teachers and the textbook through a qualitative study. The analysis indicated that there were several factors influencing teachers' using and reading textbook. Particularly, the variety of teachers' beliefs and decisions had an impact on using textbook. For instance, teachers read the same parts of the textbooks (e.g. exercises

or activities) but not for the same purposes. As a result, teachers' using textbooks differed with respect to their purposes and different uses of textbook let students have different opportunities to learn mathematics.

Guided by this perspective, Remillard and Bryans (2004) analyzed the teachers' perspectives on mathematics learning, teaching, and the role of the curriculum materials in teaching. They mentioned that the teachers' process of enacting Standards-based curriculum changed when the teachers examined the unfamiliar tasks. The researcher indicated that teachers' ideas about mathematics learning and teaching challenged and changed through using the curriculum over an extended period of time and the teachers generated their individual learning opportunities in the enacting process.

The model proposed by Remillard and Bryans (2004) "teacher's orientation toward curriculum materials" is grounded on the relationship among the curriculum materials, the enacted curriculum, and the possibilities for teacher learning. The construct of *orientation toward curriculum* is defined as the mediator that represents the teachers' perspectives and dispositions about mathematics teaching, learning, and curriculum which are the critical factors influencing the teachers' use of curriculum in the classroom and the subsequent opportunities for both student and teacher learning (Remillard & Bryans, 2004).

The teachers' use of curriculum is the main structure of the orientations because the orientations are categorized according to the similarities in dispositions among the teachers. Particularly, the orientations were identified with three categorizations: *intermittent and narrow*, *adopting and adapting*, and *through piloting*. According to this categorization, the teachers preferred to use the curriculum materials as a primary source for their teaching, and to make adaptations to fit their teaching; or not to use in their teaching. Therefore, the categorization provides information about how the teachers use the curriculum materials in their teaching.

The first category of the orientations -*intermittent and narrow*- represents the minimal use of the curriculum materials (Investigations) by the teachers. The teachers generally rely on their own routine mathematics teaching and tend to use

their own materials which they use over the years. They use the curriculum materials only for selecting the tasks which are appropriate to their teaching routines. The second category of the orientations –*adopting and adapting*- includes the use of the materials as a guide, that is, "what topics to teach and how to sequence them, as well as many tasks they presented students to work on" (p.374). The teachers are generally inclined to use the curriculum materials through their modifications. When the teachers tend to adopt the mathematical tasks from the curriculum materials, they select the pedagogical strategies and suggestions from the guides. The third category of the orientations –*through piloting*- includes the use of the materials as a primary guide in mathematics teaching, that is, the teachers use all parts of the materials for structuring the lesson. They tend to follow the suggestions and guidance of the materials -specifically the curriculum guide-.

Generally, the teachers' stance toward mathematics learning and teaching is similar and they see the curriculum material as a *guide* or *partner* in their teaching. Therefore, their orientations are categorized as *piloting* because the teachers try the curriculum out. It is also worth noting that the teachers see the curriculum materials not just as the primary guide for students also as a resource for them.

Building on Remillard's (2005) work, Brown's (2009) perspective was rooted in the notion that teaching is a design activity in which teachers use curriculum materials. Brown (2009) presented Design Capacity for Enactment Framework (DCE), for considering the relationship between curriculum materials and their use by teachers (see Figure 2.4). According to the DCE framework, teachers are engaging in design when they use curriculum materials as tool in order to transform an existing material or a particular situation to a desired or literal one. This framework represents a dynamic relationship which occurs between teacher and curriculum materials as teachers interact with curriculum materials. This interaction is a type of curriculum use: *offloading*, *adapting*, and *improvising with* curriculum materials (Brown, 2009, p.24).

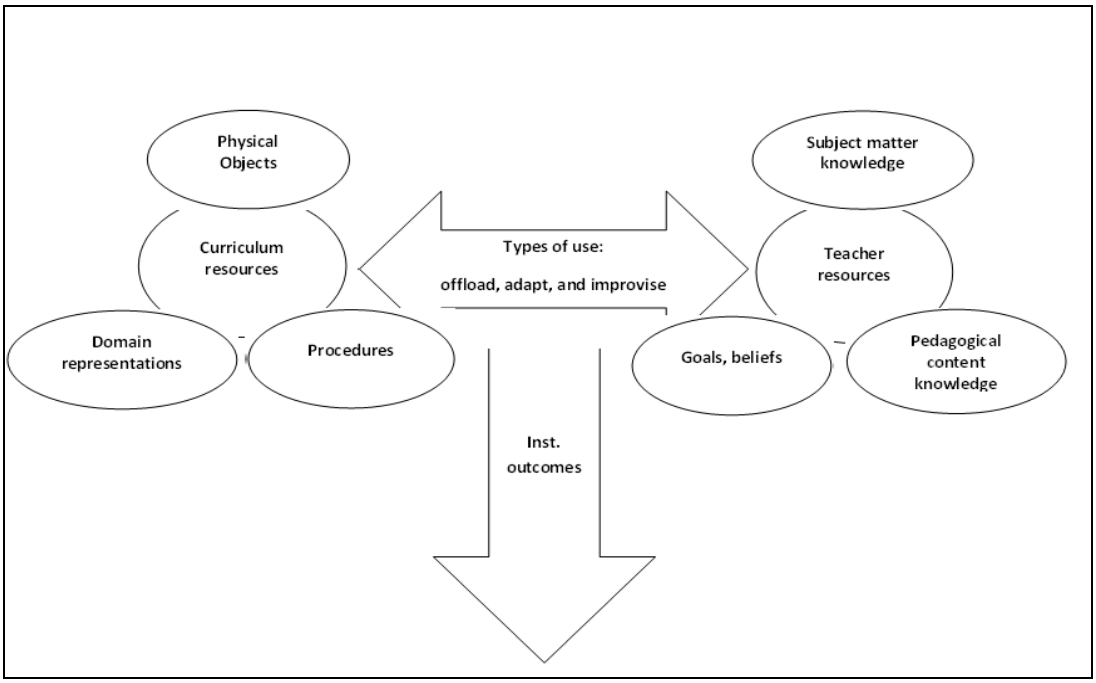

Figure 2.4 The Design Capacity for Enactment Framework (Brown, 2009, p.26)

Brown (2009) defined this type of curriculum material use as the teacher strategy for describing teacher's use of curriculum materials. For instance, teacher relies on the pedagogical steps in tasks from the curriculum materials and follows them as much as possible (offloading) when she/he is drawing on resources. In this situation, she/he offloads a degree of instructional agency onto the materials for guiding the instruction. Otherwise, she/he may spontaneously develop her/his own instructional strategy with minimal reliance on the material (improvising). In this regard, she/he offloads the degree of agency onto herself/himself. Moreover, when teacher realize that the structure of the lesson given in the material matches with the format of the lesson, she adapts the curriculum materials by using the guidance of the material and her personal strategies. This relationship is actually more specified when it is compared with framework components of teacher–curriculum relationship (Remillard, 2005).

Not surprisingly, researchers from different perspectives have pursued different research designs and analyses. Researchers, who view curriculum material use as dynamic and constructive relationship between teacher and material, also tend

to analyze this relationship differently. As a result, they commonly identify their own categories that are used for the analyses of the process. On the other hand, there are overlaps among the studies in terms of the interpretation of the curriculum use. They include how teachers interact with resources as well as how they use them in planning and enacting instruction. In the following section, the primary processes in teachers engage as they use of mathematics curriculum materials are presented.

2.2.3 Main Processes of Teachers' Engaging with Curriculum Materials

Research has shown that teachers interpret the curriculum with respect to their own beliefs and experience to frame their teaching and make changes in the curriculum intentions and modify them according to the structure and the purpose of lessons (Brown, 2002; Davis & Krajcik, 2005; Remillard, 2005). Therefore, understanding the teachers' interactions with curriculum materials requires an integrated analysis of their uses in the classroom teaching and learning context. For example, Brown (2009) has revealed a kind of interaction between teacher and curriculum materials which involves multiple steps. According to this interaction, teachers first *select* materials; however, the options offered to the teachers are often restricted by higher organs in the educational hierarchy. Second, they *interpret* these materials in planning and during instruction with regard to their perception of materials. Third, they *reconcile* their perceptions of the intended plan with their own goals and with the limitations of the setting. Fourth, they *accommodate* the students' interests, experiences, and limitations. Finally, they *modify* the setting according to their own decisions and to their students' capacities. These steps proposed by Brown partly reflect the dynamic and constructive relationship between teachers and curriculum materials.

Defining the way of teachers engaging with curriculum materials, Sherin and Drake (2004) proposed a more comprehensive explanation for the processes involved in teachers' use of curriculum materials. Sherin and Drake (2004) examined the key interpretive activities "*reading, evaluating,* and *adapting* the curriculum materials" (p.4) in the process before, during, and after instruction. Their findings indicated that

teachers tended to use their own approaches to curriculum use; thus the pattern of use or curriculum strategies differed across teachers.

In particular, the main processes in teachers engage as they use curriculum materials can be summarized as follows:

2.2.3.1 Selecting Tasks

T*ask selection* is framed by the teachers' assumptions about content and pedagogy because they are influential factors on teachers' ideas about learning and teaching of mathematics. There are mainly two approaches to task selection: *appropriation* and *invention* (Remillard, 1999). When teachers appropriate tasks from textbooks, teachers represent tasks directly from textbooks and show them to students. Generally, the tasks that teachers *appropriate* are related to problems of day and basic exercises on students' textbook. On the other hand, when teachers do not prefer to select tasks from textbooks, they use textbooks as a resource for representing the mathematical ideas. Then, teachers tend to adapt and *invent* their own tasks. Generally the tasks that teachers invent tasks represent teachers' ideas because teachers believe that their ideas are more important than the ideas given in textbooks.

The presentation of tasks by textbooks plays a role in selecting and designing of tasks (Remillard, 1999). Generally, a textbook provides a variety of supplemental, exploratory, and problem-solving tasks that offer a set of activities for a lesson to teachers. This variety can be an advantage for teachers because it gives possibility to teachers to choose different tasks. On the other hand, the variety can weaken the text's ability to support the related tasks consistently because it increases the likelihood of selecting the familiar tasks. Therefore, the presentation of tasks in textbooks might influence the teachers' task decision.

2.2.3.2 Reading of Curriculum Materials

Remillard (1999) mentioned that tasks selection can be varied due to the different ways of *reading of curriculum materials*. According to Remillard (1999), reading means "making meaning through engaging written text" (p.318). When

teachers read the text, they attend to the some parts of text and dismiss others. In this sense, "reading" involves the teacher's attempt to understand what is written in the materials, "without imposing on it one's own convictions" (Ben-Peretz, 1990, p.66). Therefore, they bring their interpretation to what they read. For example, when two teachers read similar suggestions in textbook, one of them might appropriate and follow the steps directly and other might pay attention the underlying concepts of the suggestions. This is because reading text involves "a series of tacit decisions about what to attend to and how to interpret it" (Remillard, 1999, p.324).

Reading of curriculum materials occur when teachers read the materials to "get inside the intentions of the curriculum" (Sherin & Drake, 2004, p.6). Teachers read the curriculum materials to plan what kinds of activities or examples are suggested in the text (or in the curriculum) and what students are expected to learn. The decisions are related to planning activities for instruction prior to class. Therefore, it is mostly examined before the implementation to plan the instruction.

In examining the process of reading the curriculum, Sherin and Drake (2004) identified three general approaches. One of the approaches is related to teachers' reading the big ideas of a lesson to get an overview of the lesson without examining the details of the lesson, specifically prior to instruction. For example, in reading curriculum materials such as teacher guide, teachers outline the activities in lesson and focus on main activities. On the contrary, the second one is connected to teachers' reading the curriculum for lesson details prior to instruction. For instance, teachers examine concepts of lesson in detail and suggestions about how to implement lesson. In other saying, they pay attention to "the pedagogical strategies" defined in the curriculum (Sherin & Drake, 2004, p.25).

The last one is considered reading for big ideas prior to and for details during instruction. Teachers read for the big ideas of a lesson prior to instruction, and then examine the ideas during instruction to be more focused on the details of language. For example, they give precise wording of examples from the teacher guide in lesson. They select "appropriate examples or read an explanation word-for-word from the teachers' guide" during instruction (Sherin & Drake, 2004, p.25).

2.2.3.3 Evaluating of Curriculum Materials

Remillard (1999) stated that there are the factors which influence the approach of teachers' readings: "thought about the contents and nature of the mathematical terrain" and "the views each held about teaching and learning" (p.326). If teachers believe that mathematics learning occurs through knowing concepts and relationships, then they focus on the conceptual understanding in reading the text. Moreover, if teachers believe that mathematics learning occurs through exploring ideas and problem, then they focus on exploring mathematical tasks in reading the text. From this view, the *beliefs* and *knowledge* about the nature of mathematics and teaching mathematics make differences in reading text.

Besides reading of curriculum materials, evaluating is an inseparable part of the identifying key processes. Actually, e*valuating of curriculum materials* is occurred when teachers read and interpret them based on teachers' knowledge and beliefs (Sherin & Drake, 2004). Significantly, evaluating of the materials depends on teachers' interpretation of the materials with respect to the audience. The audiences are sometimes the teacher, the students, or other constituents, such as parents or administrators.

In examining the process of evaluating the curriculum, Sherin and Drake (2004) asserted that each teacher evaluated the curriculum and curriculum materials in a different way and the different ways or curriculum strategies differed across students, teachers, and parents. Considerably, their evaluation is strictly related to students' understanding of mathematics and meeting the needs and their own understanding of teaching and learning of mathematics.

2.2.3.4 Adapting of Curriculum Materials

Remillard (1999) mentioned that teachers adapt and adjust the tasks to facilitate students' work with them. Teachers adapt the tasks not only with respect to students' responses to the activities, but also with respect to their own beliefs and perspectives. For example, teachers might improvise by posing a new question when they observe their students' inaccurate approaches to a combination problem. In that case, teachers adapt the initial task based on their goal of developing an approach to

solving problem because they believe that this improvisation would help students develop an efficient approach to solving problem. Thus, teachers' beliefs and perspectives become important to interpret how tasks should be enacted and adapted in the classroom.

By means of *adaptation*, Sherin and Drake (2004) referred to "significant changes that teachers make in the intended curriculum such as changes in the structure of a lesson, in the activities that comprise the lesson, or in the purpose of the lesson" (p. 30). In the analysis of adaptation, they identified three approaches: a) *creating* new activities, tasks, or materials; b) *replacing* one part of a lesson with something different; and c) *omitting* part of a lesson. The three approaches occurred exclusively during instruction.

Teachers make significant changes with respect to their own understanding of mathematics and students' understanding. For example, a teacher can omit a part of a lesson in term of her/his understanding of mathematics, if she/he does not understand the lesson topic; or she/he can create new parts of the lesson to help students to make connections between activities. The important point is that teachers tend to modify the suggestions in accordance with their students' need (Remillard & Bryans, 2004). Therefore, *evaluating* and *adapting of the curriculum* takes place together during the same instructional period (Sherin & Drake, 2004).

2.2.4 Role of Using Curriculum Materials in the Documentational Approach

The notion of "documentation work" indicates teachers' work with resources and encompasses the two way interaction between teacher and resources, namely instrumentation and instrumentalization (Gueudet & Trouche, 2009). It includes how teachers engage and interact with resources as well as what kinds of constraints and potentialities of resources shape the teacher. In particular, a similar interpretation with this perspective is considered in the studies on the participatory relationships between teacher and curriculum materials. The participatory relationship shapes how teachers interact with resources as well as how they use them in planning and enacting instruction, and the role of resources play in teachers' practice (Remillard, 2005). Therefore, the participatory relationship between teacher and curriculum

materials might be viewed as a form of interaction between teacher and resources and help in understanding the role of curriculum materials in teachers' documentation work.

According to the documentational approach, the word of resources encompasses a variety of things in teachers work such as material resources (e.g. textbook, student sheet), and non-material resources (e.g. discussion with a colleague or with students). In particular, curriculum materials have a particular meaning in the documentational approach, because material resources are more observable than non-material resources in the context of determining the teacher-resource interaction (Gueudet, Pepin, & Trouche, 2011). Thus, curriculum materials and textbooks have a key role in analyzing the teacher-resource interaction. Moreover, documentation work includes what a teacher needs to do for teaching such as selecting mathematical tasks, planning their succession, integrating and adapting them in his/her teaching, implementing them in practice, and sharing it with colleagues (Gueudet & Trouche, 2009). It is clear that the processes can play an important role in shaping the teaching practice. As the researchers discussed above have indicated, the ways that teachers engage with curriculum materials provide a more comprehensive explanation for the processes involved in teachers' interaction with resources. Therefore, the main processes provide to characterize the ways of teachers' practice and form the teachers' documentation work.

To sum up, the frameworks involve a participatory relationship between the teacher and the curriculum and gives directions to the discussion for the teachers' documentation work. However it sums up the important factors which are discussed in the preceding examination of the literature, it needs effort to be improved.

2.3 Summary

Research studies have indicated that researchers have placed the teachers at the center of the teacher-curriculum material interaction and focused on how teachers interpret the curriculum materials and textbooks. However, there have been unanswered questions about how the features of curriculum materials influence the teachers' interaction with mathematics curriculum materials and textbooks (Remillard, 2009). More research is needed to investigate how curriculum materials and textbooks support teacher's instructional practice.

Over the years, research studies have shown that curriculum materials and textbooks have an important role in teaching and learning of mathematics and they are considered as resource for teachers and students. Researchers have offered insights into the relationship between teacher and curriculum materials and textbooks; and there has been a growing interest in this area. However, there is no study that explicitly explored the teachers' use of set of textbooks (i.e. student edition textbook, workbook, teacher edition textbook, and auxiliary books) and the interaction between teachers and the set of those textbooks. Research is needed to better understand the interaction between teachers and the set of textbooks.

The documentational approach of didactics (Gueudet & Trouche, 2009) as a new area of research explains the interaction between mathematics teacher and resources, teachers' integration of a resource into the practice, and their consequences for professional growth. It informs the investigation of teachers' integration of a resource into their practice and their use of resources and offers to analyze the constraints and potentialities of the resources that shape the teachers' activity. Yet, little is known about how the affordances and constraints of the textbooks influence the teachers' uses of textbooks and how mathematics teachers adapt and integrate the textbooks within their teaching practice. Further studies are needed to provide an insight into the interaction between teachers and set of textbooks and to investigate the affordances and constraints of textbooks influence the teacher's activity.

The teachers' interaction with the resources, associating in particular textbooks, in Turkey has not been sufficiently acknowledged by researchers. These

interactions have not so far emphasized as potential influences on teaching of mathematics in the middle school level. Generally, such kinds of considerations have been largely ignored in the studies in Turkey. However, the interaction was found as important factors by previous research. For this reason, it could be claimed that there is a need for specifying the interaction between teachers and textbooks and the role of textbooks in teachers' documentational works.

The current study was built based on the literature in these areas and, by using a mixed methods study, sought to explore and explain the middle school mathematics teachers' use of textbooks and the mathematics textbooks' role as teaching resource as well as the interaction between teachers and textbooks. This study is intended to fill the gap in the related literature. It is hoped results from this study will serve to assist the role of teachers and mathematics textbooks as teaching resource in supporting teacher's practice.

CHAPTER 3

RESEARCH DESIGN AND METHODOLOGY

In the previous chapters, purpose and significance of the study were discussed and related literature was reviewed. In this chapter, an overview of the mixed methods research design and a rationale for choosing it, major characteristics of the participants, instruments of the study, data collection and analysis procedures, and validation issues will be presented.

3.1 Research Design: Rationale for Using Mixed Methods Research

In recent years, mixed methods research has been often used in many studies. Tashakkori and Teddlie (2003) called this kind of research "third methodological movement" (p. ix). It has become mixed approach methodology that integrates qualitative and quantitative approaches in all phases of the study (i.e. problem statement, data collection, data analysis, and discussion) and involves a transformation of the data from one approach to another. This means that mixed methods research represent a separate research design which includes both qualitative and quantitative data and their related analyses.

Mixed methods research is not only an accepted term but also has a common definition as a research design among the researchers. Bergman (2008) defined the mixed methods research as "the combination of at least one qualitative and at least one quantitative component in a single research program" (p.1). From this view, mixed methods research includes a philosophical assumption based on mixing the qualitative and quantitative approaches in many phases of the research; and a methodological approach based on collecting, analyzing, and mixing the data gathered throughout the qualitative and quantitative research (Creswell & Plano Clark, 2007). Furthermore, a mixed methods research provides complementary strengths and nonoverlapping weakness of both qualitative and quantitative research

(Creswel & Plano Clark, 2007; Johnson & Turner, 2003). This helps to increase the quality of the research since both qualitative and quantitative research methods have different strengths and weaknesses. For instance, the quantitative results somehow could not provide adequate explanations of outcomes, and the qualitative data can support to overcome the problem by enhancing and explaining the quantitative results in the words or texts. Thus, a mixed methods research can be the preferred research.

In this study, the mixed methods research provided a framework and logic to guide the implementation of data collection. In other words, it was more manageable for this study and best matched to the research problems. The classification and the procedural guidelines developed by Creswell and Plano Clark (2007) were chosen as the mixed methods design in this study.

3.1.1 Mixed Methods Design Classification

In educational research, there are some classifications of mixed methods design (e.g. Creswell, 2003; Creswell & Plano Clark, 2007; Tashakkori & Teddlie, 2003). These classifications have different names and features but they have more similarities than differences among them. Specifically, the classification of mixed methods design specified by Creswell and Plano Clark (2007) is more advanced among others because it relates the other design methods and the variants. This classification also integrates the timing, weighting, and mixing decisions of the design explicitly.

Based on the timing, weighting, and mixing decisions, there are four major types of mixed methods designs: triangulation, embedded, explanatory, and exploratory. The timing decision describes the use of concurrent or sequential timing for collecting and analyzing the qualitative and quantitative data. In addition to the timing, weighting refers to the priority or importance of the qualitative and quantitative methods with respect to the research questions. The weighting options are based on the equal or unequal weighting of the qualitative and quantitative methods. The third consideration for the mixed methods design is the mixing

decisions “how the two types of data can be merged, one can be embedded within the other, or they can be connected” (Creswell & Plano Clark, 2007, p. 83).

In this study, the exploratory design and the explanatory design procedures were used respectively in two stages. Particularly, the exploratory design procedures were used to represent the development of the quantitative data collection instrument. The explanatory design procedures were used to provide a general understanding of the research problems and explain why statistical results occurred by exploring participants’ views in more depth. The subsections provide information about the design procedures of the study.

3.1.1.1 First Part of the Research Design: Exploratory Design

In the first part of the design, exploratory design procedures were employed which included two distinct phases: qualitative followed by quantitative (Creswell & Plano Clark, 2007). In this study, according to this design (see Figure 3.1), the researcher first gathered the qualitative data consisting of open-ended questions throughout the semi-structured interviews with middle school mathematics teachers. Then, the researcher analyzed the qualitative data to explore and develop an instrument. The rationale for this approach was that the qualitative data and their subsequent analysis provided to develop the instrument. Particularly, the qualitative findings guided the development of items and scales for the quantitative instrument. After developing the instrument, the quantitative data collection was constructed on the qualitative data collection, and two phases complemented each other. Finally, the quantitative data and their analysis were used to generalize results to different groups (Creswell, 2003; Morse, 1991, Tashakkori & Teddlie, 1998).

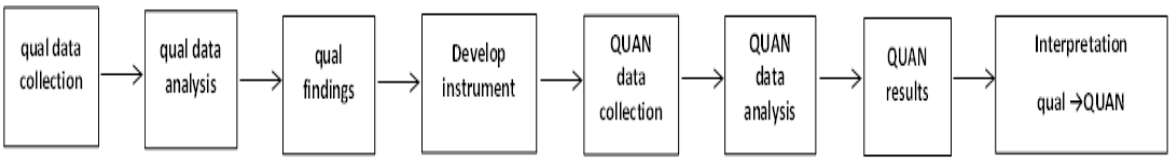

Figure 3.1 Exploratory Design: Instrument development Model (QUAN emphasized) Based on Creswell and Plano Clark (2007)

In this study, according to this model, interviews were conducted in order to explore Turkish mathematics teachers' use of textbooks and curriculum materials. The findings of the interviews with teachers and the results obtained from related literature were used to develop the instrument. Through this design, the quantitative data collection instrument was constructed based on the qualitative data collection and analysis. Although both methodologies were used, the quantitative phase for the first data collection and analysis was considered to be of higher priority for the first part of the research design. That is, the weighting of this study was heavier for the quantitative data collection and analysis. Therefore, the notation of "qual→QUAN" was used to illustrate the sequential design of this study and the weighting of the quantitative findings was considered as a priority (Creswell, 2003; Creswell & Plano Clark, 2007).

3.1.1.2 Second Part of the Research Design: Explanatory Design

In the second part of the design, explanatory design procedures were utilized which included two distinct phases: quantitative followed by qualitative (Creswell, Plano Clark, et al., 2007). According to this design (see Figure 3.2), the researcher first collected and analyzed the quantitative data, subsequently collected and analyzed the qualitative data to refine the quantitative results. The qualitative data collection was constructed on the quantitative data collection, and two phases were complemented on each other in the study. The rationale for this approach was that the quantitative data and their subsequent analysis would provide a general understanding of the research problem. The qualitative data and their analysis

explained why those statistical results occurred by exploring participants' views in more depth.

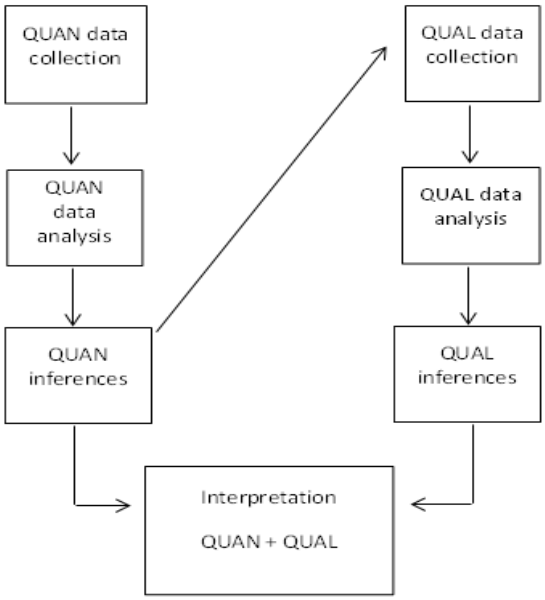

Figure 3.2 Explanatory Mixed Design utilized in the study. Based on Teddlie and Tashakkori (2006).

According to the Figure 3.2, the left side of the diagram represented the quantitative data collection from data collection through quantitative inferences. The right side of the diagram represented the qualitative phase of the study. The diagonal arrow from quantitative inferences to the qualitative data collection represented the follow-up procedure. Through this way, the quantitative findings served to develop the qualitative research. In the last step, both quantitative and qualitative inferences were combined to develop "meta-inferences", in which both separate quantitative and qualitative data and inferences were combined into a meaningful whole (Tashakkori & Teddlie, 2003, p.686).

According to this design, the emphasis was on the quantitative and qualitative phases. That is, the weighting of this study was heavy for both quantitative and qualitative data collection and analysis. According to Teddlie and Tashakkori (2003), "the issue of dominance or priority of one methodological approach (e.g., "QUAL-quan", "qual-QUAN") over another is not very important" (p. 41) since the important

issue is to combine a strong inference. Therefore, the notation of "QUAN→QUAL" was used to illustrate the sequential design and the weighting of the quantitative and qualitative findings for this part of the study.

In this study, the quantitative data obtained throughout the instrument were gathered and statistically analyzed. The follow-up procedure was conducted to examine teachers' integrating of tasks in the textbooks into practice. Then, in-depth qualitative data throughout the interviews, observations, and textbook analysis were gathered and analyzed. In the end, the quantitative results and qualitative findings were interpreted together in order to try to make general inferences.

To sum up, in this study, the qualitative and quantitative datasets were mixed in the way of bringing them together and connecting them by building one dataset on the other. The procedure began with the qualitative data collection. After analyzing the qualitative data, the quantitative data was collected through the instrument that was administered later to a sample of the mathematics teachers. The process was followed up with the interviews and observations with teachers to learn more detail about the survey responses. Figure 3.3 represents the overall design procedure of the study. More detailed information about design procedure is provided in Appendix A.

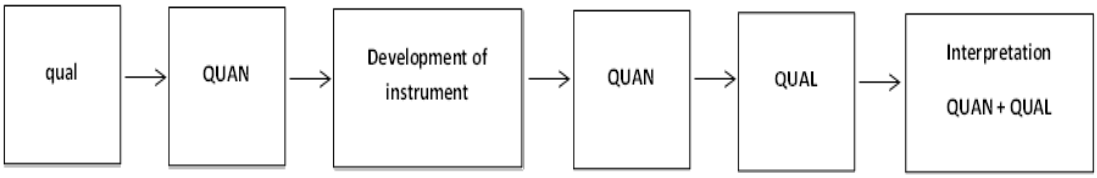

Figure 3.3 Overall design phases of this study

3.2 Data Collection

In this study, there were two purposes guiding data collection: (i) to develop and validate an instrument and (ii) to provide a general understanding of the research problems. For these reasons, the data were collected at four different time intervals through different methods (i.e. qualitative and quantitative). This section provides information about the data collection procedure. The overall process was summarized in Table 3.1.

Table 3.1 Overall data collection and analysis procedure

Phases	Data Collection	Data Collection Timeline	Data Collection tools	Purpose of Data Collection	Participants	Analysis
(I)	Qualitative data collection	October - November 2009	Semi-structured Interviews	To determine the boundaries of the instrument and generating items from the statements derived from the interview data	13 middle school math teachers	Thematic analysis
(II)	Quantitative data collection	April - May 2010	Questionnaire	To explore factor structure of the instrument	189 middle school math teachers	Exploratory Factor Analysis
(III)	Quantitative data collection	December 2010 - January 2011	Questionnaire	To validate and confirm the number of factors of the questionnaire	531 middle school math teachers	Exploratory and Confirmatory factor analysis
				To see whether the teachers differ on the identified factors according to their gender, the level of teaching experience, and class size	8 middle school math teachers	MANOVA, etc.
(IV)	Qualitative data collection	February - April 2011	Semi-structured Interviews, Observations, Document analysis	To follow-up on the quantitative results and explain the quantitative results		Thematic analysis

3.2.1 Data Collection in Phase I

The data collection began with the qualitative data collection to develop an instrument. The qualitative data collection provided to determine the boundaries of the instrument and to generate items from the statements derived from the interview data. In this process, the semi-structured interviews were conducted to identify Turkish mathematics teachers' use of textbooks and curriculum materials. 13 middle school mathematics teachers, who were teaching at grades 6-8, were interviewed about how they used mathematics textbooks and what other resources they used to plan and implement the mathematics lessons. The interviews were conducted in teachers' schools and took about 40 to 60 minutes with each teacher in October-November 2009. The data collection procedures for these participants took place in the following three months.

In this process, the researcher designed the questions in such a way to help the participants think about how they used the mathematics textbooks and other relevant curriculum materials (see Appendix B for the interview questions). The first four questions required to indicate the participants' background information such as years of teaching experience and the graduation. The next six questions (5-10) entailed describing the use of curriculum resources (e.g. textbooks, teacher notes, mathematics syllabus, and websites) that were available to teachers. The following eight questions (11-18) required the use of mathematics textbooks and accompanying student workbook, teacher edition textbook, and other written resources. Question #19 concerned the ideal textbook for teachers. The last three questions entailed describing the mathematics curriculum materials. These questions helped to identify specific types of mathematics textbooks uses.

3.2.2 Data Collection in Phase II

After developing an initial set of items, the quantitative data was collected to explore the factor structure of the instrument, namely Mathematics Teachers' Use of Textbooks Questionnaire. The quantitative data was collected for pilot testing of the instrument. The data was collected from 15 different schools randomly selected from

each of Çankaya and Keçiören districts in Ankara by the researcher in April-May 2010. 189 middle school mathematics teachers from those schools were involved in the pilot study. The data was examined in terms of the factor structure through exploratory factor analysis (EFA) using SPSS 17. EFA was performed using the principal component analysis (PCA).

3.2.3 Data Collection in Phase III

After pilot testing of the instrument, the quantitative data was collected to validate and confirm the number of factors of the questionnaire. EFA and confirmatory factor analysis (CFA) were conducted to validate the questionnaire. The data was collected by the Educational Research and Development Department (EARGED) in December 2010-January 2011. 531 middle school mathematics teachers from 515 elementary schools in 15 different cities in Turkey were involved in the study.

3.2.4 Data Collection in Phase IV

To provide a general understanding of the research problems (i.e. the second purpose of the data collection), the qualitative data were collected after the analysis of the quantitative data were obtained from the questionnaire. The purpose was to follow-up on the quantitative results and to explain the quantitative results. The qualitative data was collected in Ankara in February-April 2011 through interviews, observations, and analysis of teachers' personal records and textbooks. 8 middle school mathematics teachers were interviewed and observed in their school context. The semi-structured interviews were audiotaped. Each interview lasted approximately one hour. Interviewees were informed that the purpose of the research was to explore: (a) how they planned the lesson prior to classroom, (b) what kinds of resources they used for preparing the lesson (i.e. ratio and proportion lesson), (c) how they used these resources, (d) what kinds of activities and questions they prepared for introducing the ratio and proportion, (e) how they used the ratio and proportional activities, examples, and problems in the textbooks, and (f) how they adapted the activities, examples, and problems into the class. The questions were followed by additional questions in order to understand the detailed

explanations. Interviewees were encouraged to reflect their experiences about their uses of resources. All interviewees gave the permission to tape-record their responses to the questions.

In this process, the researcher observed the teachers' ratio and proportion lessons and kept records during the lessons. Each teacher observed two times in the classroom. The classroom observations were used as a method of validating the teacher responses in their interviews. Additionally, teachers' personal records were used as additional source of information. Therefore, the primary qualitative data came from interviews and the secondary data came from classroom observations and analysis of teachers' notes and textbooks. Particularly, the worksheets prepared by the teachers and the several related documents created by the teachers were analyzed.

Briefly, the procedure began with the qualitative data collection. Then, the quantitative data were collected for exploratory and confirmatory factor analysis procedures. Finally, the qualitative data was collected after the analysis of the quantitative data to follow-up on the quantitative results.

3.3 Participants and Settings

As indicated in data collection procedure, the data were collected from different participants. Therefore, participant selection procedures were performed using different methods. Table 3.1 also displays the participants of the current study. The subsections provide information about the selection of the participants.

3.3.1 Participants in Phase I

In the instrument development process, interviews were conducted with middle school mathematics teachers to examine what mathematics teachers do with curriculum resources and how they use them for mathematics. The participants were selected through criterion-based or purposeful sampling techniques (Fraenkel & Wallen, 2006; Patton, 1990) to ensure that a variety of teachers with different teaching experiences would be questioned. The data were collected through semi-structured interviews. 13 mathematics teachers (4 male, 9 female) voluntarily participated in the interviews for

how they used the curriculum materials, specifically textbooks. Moreover, the teachers were selected to be interviewed according to their professional experiences and their school contexts.

First to be considered was their professional experience: the interviewees had a minimum of five years of experience in teaching mathematics. In particular, three teachers had five years of experience; seven teachers had taught for over 10 years, and two teachers had taught for 25 years or more at elementary school level. By varying the participants in this way, the researcher was better able to examine different points of the way of uses of the textbooks.

Second to be considered was their school context: the interviewees working in 11 different schools selected from a district of western Turkish town İzmir were invited to participate in this study. At the time of the data collection, the mathematics teachers were teaching at sixth through eighth grade levels. They were using mathematics textbooks from the same publisher. Among 18 mathematics teachers in these schools, 13 mathematics teachers voluntarily participated in the study.

3.3.2 Participants in Phase II

After developing an initial set of items, the quantitative data was collected to explore the factor structure of the instrument. In this step, cluster random sampling was integrated with convenience sampling method. Çankaya and Keçiören districts of Ankara, from which the sample was chosen, were selected by considering of access. The schools which were thought as clusters were randomly selected from the districts. 15 elementary schools were randomly selected from each of Çankaya and Keçiören districts.

The questionnaire was initially pilot tested with 189 teachers from 15 schools randomly selected from each of Çankaya and Keçiören districts. From those schools, middle school mathematics teachers were participated in the study. At least five cases for each of the variables are generally sufficient in most cases for factor analysis (Tabachnick & Fidell, 2007); therefore the predetermined sample size was kept as large

as possible at this stage. Detailed information about the mathematics teachers was provided in Table 3.2.

Table 3.2 Frequency distribution of demographic characteristics of the mathematics teachers

	Frequency (*f*)	Percentage (%)
Gender		
Male	66	35
Female	123	65
Total	189	100
Years of Experience		
0-5	5	2.6
6-10	18	9.5
11-15	49	26
16-20	30	15.9
21- above 21	87	46
Total	189	100

3.3.3 Participants in Phase III

After pilot testing of the instrument, the quantitative data was collected to validate and confirm the number of factors of the questionnaire. In this step, the stratified random sampling techniques (Frankel & Wallen, 2006) were used to produce representative samples. All sixth, seventh, and eighth grade mathematics teachers in public schools in Turkey were identified as the target population of this study. Since it was not possible to obtain accurate estimates of target population, it was appropriate to define an accessible population. The accessible population was determined as all sixth, seventh, and eighth grade mathematics teachers in the public schools in Turkey. The results of the study will be generalized to this population.

The criteria of the State Planning Organization (SPO) were used to group the cities according to their socio-economic development levels. The socio-economic development levels according to "Survey on the Ranking of Provinces and Regions by Socio-Economic Development Levels" prepared in Turkey (2003) was used to select the subgroups. Selecting participants using this categorization, it was intended to achieve two primary goals:

(1) The first goal was to achieve heterogeneity in mathematics *teaching experience and vocational experiences* because more experienced teachers generally located in Western Turkey more than East.

(2) The second goal was to select participants using different textbook series because there were seven textbooks series in use at the elementary school level throughout Turkey. This criterion allowed the investigation of uses of different textbooks series by teachers.

In the report, 58 socio-economic variables were used to group cities into five categories from the most developed to the least developed. Dinçer, Özaslan, and Kavasoğlu (2003) stated that all 81 Turkish cities were included in the grouping in 2003. The schools, which were listed in the Education Statistics of Turkey (EST), were selected in terms of five socio-economic development levels. Group of cities based on socio-economic development levels were presented in Appendix C in Table 3.3.

The three cities from each socio-economic development levels were randomly selected. Six percent of the elementary schools were randomly selected from each city (see Table 3.4). Totally, 515 elementary schools in 15 different cities and 531 mathematics teacher from those schools were involved in the study.

Table 3.4 Number of elementary schools based on socio-economic development levels

Group of cities	Randomly selected cities	The number of elementary school between 2009-2010	The number of selected elementary schools
1	İstanbul	1621	108
	İzmir	980	65
	Kocaeli	369	25
2	Eskişehir	234	16
	Muğla	393	26
	Mersin	558	37
3	Samsun	901	60
	Karaman	173	12
	Afyon	454	30
4	Kastamonu	290	19
	Aksaray	270	18
	Tokat	484	32
5	Batman	403	27
	Iğdır	169	11
	Bitlis	441	29

3.3.4 Participants in Phase IV

The qualitative data was collected after the analysis of the quantitative data to provide a general understanding of the research problems. The purpose was to follow-up on the quantitative results and to explain the quantitative results. In this step, participants were selected according to specific criteria. Particularly, teachers were selected to be interviewed and observed according to their professional experience because the main purpose of the interviews was to examine how teachers use resources and specifically textbooks as they teach the ratio and proportion throughout the seventh grade level. Their experience in teaching ratio and proportion with textbooks and other resources were very important in order to understand the interactions between teacher and resources. Therefore, the participants, who had mathematics teaching experience more than five years and were actively working in a public school in Ankara, were contacted and asked to participate in the study.

The selection criteria for teachers were not depended on representing a best teaching model or a good documentation work. The teachers were not chosen as ideal or model teachers. They spend probably more time on their teaching work especially for planning lessons, managing available resources, and preparing out of class activities. Consequently, eight mathematics teachers (3 male, 5 female) voluntarily participated in the study. Two teachers had 10 years of experience; two teachers had taught for over 15 years, and four teachers had taught for 25 years or more at the elementary school level. By varying the participants in this way, the researcher was better able to examine different points of uses about resources and textbooks.

3.3 Quantitative Data Collection Instrument

The quantitative data collection instrument used in this study was developed to identify and explore middle school mathematics teachers' using mathematics textbooks, partly focusing on reading textbooks and selecting tasks from textbooks. The reason for developing this questionnaire was to assist the relevant literature on textbook use and to provide Turkish contextual factors into the literature. In the following subsections, the process of the instrument development, demographical characteristics of the instrument, and examination and validation of factor structure were explained in detailed.

3.3.1 Process of Quantitative Data Collection Instrument Development

Although there is little variation between models for developing a scale by different authors, the methodology of this part of the study was adapted from the process proposed by DeVellis (2003) in which steps were constructed for new instruments. The development steps were employed to complete the instrument: (a) determining the measure clearly through reviewing of the related literature on teachers' using textbooks and interviewing with 6th-8th grade mathematics teachers to determine the contextual factors, (b) generating an item pool, (c) determining the format for measurement (d) having experts review the initial item pool, (e) considering inclusion of validation items, (f) administering items to a development sample, (g) evaluating the items, and (h)

optimizing scale length. These instrument development steps were employed to complete the process and described in detail throughout this section.

In the instrument development, the first step was to define the construct based on a thorough review of the literature on teachers' using textbook and curriculum materials. According to DeVellis (2003), this step was very important for determining the boundaries of the construct; therefore the boundaries of the construct of the instrument were established through the review of related literature and the following contextual description derived by asking a sample of participants.

In this step, the focus was on how teachers used textbooks for planning, implementing, and evaluating the mathematics instruction. The purpose was to determine the way of teachers' using textbooks and curriculum materials. The comprehensive review of the literature resulted in the identification of the teachers' uses of textbooks and curriculum materials. The main processes in teachers engaged as they used curriculum materials could be summarized as follows: selecting tasks from curriculum materials, reading of curriculum materials, evaluating of curriculum materials, and adapting of curriculum materials (Brown, 2009; Sherin & Drake, 2004; Remillard, 2005). These processes were used to determine the general boundaries of the questionnaire.

In this step, the contextual factors were also examined through the interviews with middle school mathematics teachers. The reason for obtaining data from the teachers was to provide the Turkish contextual factors about teachers' using textbooks since the literature review showed that the contextual factors such as national curriculum could be very important to understand the uses of curriculum materials. Consequently, the interviews were conducted to identify Turkish mathematics teachers' use of textbooks and curriculum materials.

The next step was to generate a pool of items through the review of literature and the findings of the interviews. Items were generated from the statements derived from the detailed literature review and the interview data. There are two main approaches for item generation: deductive and inductive approaches (Hinkin, 1995). Deductive scale development method entails a classification prior to data collection and a detailed review

of the literature and an understanding of constructs. On the other side, inductive scale development method is used when there is little research about the relevant issue and involves attempts to identify classification by asking respondents to provide description about the related study. In this step, deductive scale development method was implemented for the item generation.

In determining the format for measurement, the questionnaires of the study were designed in Likert-scale format because of its extensive use and success in presenting opinion, belief, or other constructs (DeVellis, 2003). The format of the items was determined in early stages of the study and occurred simultaneously with item generation to ensure compatibility. In this study, a 5-point Likert scale constructed that ranged from 1 for *never* to 5 *always* for the part of the uses of textbooks and from 1 for *very poor* through 5 for *very good* for the part of general characteristics of the student edition textbook in the instrument. Moreover, items were worded so that they represented the positive aspect of each opinion.

Another critical step in the process was to assess item quality by a number of experts. As DeVellis (2003) stated, experts or knowledgeable people in the content area should be asked to contribute in reviewing the item pool to support the validity of the scale. In order to maximize the construct validity of the instrument, three experts, who were experienced (10 years or more) in their domains, were involved in this process. One of the experts, who had a bachelor of arts in Turkish, evaluated the item clarity, grammar, and reading level (i.e. face validity). Other two experts, who had a PhD degree in mathematics education, reviewed the items in order to analyze which items were reflected the construct (i.e. the construct validity). Their suggestions were helpful at this step for framing the statements and reflecting the instrument's purpose. The experts were asked to review 150-item pool for the part of the uses of textbooks. As a result, the item pool was comprised of 46 items for the uses of textbooks. Moreover, the experts reviewed 75-item pool for the part of general characteristics of the student edition textbook. Consequently, the item pool included 31 items for the part of general characteristics of the student edition textbook. The complete instrument has been included in Appendix D.

After developing an initial set of items, items were administered to a group of 10 teachers to evaluate their quality. The items were further subjected to assessments for evidence of validity and reliability. Through the application of factor analysis, the nature of latent variables from a large number of observed variables were determined. To provide additional evidence for the construct validity of the questionnaire, factor analyses were conducted to check whether the expected dimensions of the instrument were confirmed with the results of the pilot testing or not. As Worthington and Whittaker (2006) stated, researchers should first conduct an EFA and then a CFA when developing a new scale. Thus, EFA was applied to assess the construct validity and examine the underlying factor structure. Then, CFA was performed to help support the validity of the scale following EFA. Reliability analysis was also performed by using Cronbach alpha coefficients.

3.3.1.1 Characteristics of Quantitative Data Collection Instrument

The quantitative data collection instrument developed for the current study was entitled as the Mathematics Teachers' Use of Textbooks Questionnaire. This instrument has three distinct parts. The first part of the questionnaire known as the Demographical Questionnaire was designed to provide information about the participants. The second part contains the Use of Mathematics Textbooks Questionnaire. The last part of the instrument containing General Characteristics of Student Edition Textbook Questionnaire was designed to provide information about the general characteristics of the student edition textbook. In the following subsections, each data collection instrument is explained in detailed.

3.3.1.1.1 Demographical Questionnaire

This questionnaire was designed by asking four separate questions about (1) the gender, (2) the years of teaching experience, (3) the number of student in classroom, and (4) the evaluation of some resources used for mathematics teaching. In the analysis for years of teaching experience, the grouping was for 0-5 years, 6-10 years, and 11 years and above. In particular, Turkish mathematics textbook adoptions were usually made in

every 5 years. This would enable to compare teachers' responses to their uses of textbooks over years. Furthermore, in the analysis for number of student in classroom or class size, the grouping was for 16-24 (small class size), 25-34 (medium class size), and 35 and over (large class size) number of student in classroom.

3.3.1.1.2 Use of Mathematics Textbooks Questionnaire

Preliminary scale was evaluated in a focus group interview with four middle school mathematics teachers. The specific goals of the focus group were to (a) obtain feedback on the clarity of the questionnaire; (b) understand teachers' reactions to the questionnaire; and (c) remove redundant items. On the basis of views and reactions from the teachers, some confusing items were eliminated. It requires teachers' responses to items in a five point Likert scale (1 = "never" through 5="always"). The use of textbooks was measured by asking four separate questions about (1) the use of student edition textbook (2) the use of workbook, (3) the use of teacher edition textbook, and (4) the use of auxiliary books. The questionnaire measures the frequency of the use of textbooks by mathematics teachers along four dimensions, namely Reading Student Edition Textbook, Selecting Questions from Workbook, Reading Teacher Edition Textbook, and Selecting Tasks and Problems from Auxiliary Books.

3.3.1.1.3 General Characteristics of Student Edition Textbook Questionnaire

This questionnaire was designed primarily to provide information about the general characteristics of the student edition textbook used by teachers. In this regard, teachers' evaluation played a key role in efforts to explain their uses because teachers' responses to the use of textbooks were related to their responses to the general characteristics of the student edition textbook. This part of the questionnaire considers teachers' evaluation of the characteristics of the student edition textbook. It requires teachers' responses to items in a five point Likert scale (1 = "very poor" through 5="very good").

3.3.1.2 Examination of Underlying Factor Structure of Use of Mathematics Textbooks Questionnaire

Phase II provides valuable data to examine the factor structure of the Use of Mathematics Textbooks Questionnaire. The questionnaire was initially tested with 189 teachers from 15 schools randomly selected from each of Çankaya and Keçiören districts. The data was examined in terms of the factor structure through exploratory factor analysis.

Tabachnick and Fidell (2007) suggested that variables with pattern coefficients of .32 or larger are generally acceptable for item inclusion. Based on this suggestion, it was decided that Item 5, Item 7, Item 8, Item 9, Item 11, Item 16-Item 20, and Item 26 were removed because the pattern coefficient was less than .32 (Appendix D for the items). As a result, 11 items were removed from the 46 item-questionnaire.

Inspection of the correlation matrix revealed the presence of all coefficients of .30 and above. It has been suggested that the value of .60 and higher are required for good factor analysis (Tabachnick & Fidell, 2007). Thus, the Kaiser-Myer-Oklin test showed that the correlation matrices were factorable (KMO= .89) and the quality of sampling was good. Barlett's Test of Sphericity reached statistical significance ($\chi^2(595) = 4006.049$, $p < .001$). Then, PCA was performed on the 35 items for in-service mathematics teachers. The initial analysis extracted 10 factors with eigenvalues greater than one. This solution accounted for 66.19% of the total variance. The eigenvalues of the first ten factors were: 15.254, 5.177, 2.980, 2.474, 1.908, 1.666, 1.561, 1.266, 1.094, and 1.040. Then, the data were analyzed by oblique (direct oblimin) methods of transformation.

The scree plot examination showed that there was a sharp break indicating four or five factors. In deciding the number of factors to retain, the process was further supported by the results of Parallel Analysis (Horn, 1965). The parallel analysis revealed that four components with eigenvalues exceeding the corresponding criterion values for a randomly generated data matrix of the same size (35 variables x 189 respondents). In 95% of the datasets generated, the first four eigenvalues were larger than the criterion value (1.92, 1.80, 1.71, and 1.63) from parallel analysis. Therefore, the result of parallel

analysis supported the decision from scree plot to retain four factors for further investigation.

The PCA for a four-factor solution was conducted using oblique rotation (direct oblimin with delta=0) with Kaiser Normalization. The results are presented in Table 3.5, wherein factor loadings of pattern and structure matrices are shown. The four factors accounted for 57.95% of the total variance, with eigenvalues of 11.136, 4.941, 2.510, and 1.694 for factors 1, 4, 3, and 2, respectively. Factor 1 was named as *reading student edition textbook*, Factor 2 as *selecting questions from workbook*, Factor 3 as *reading teacher edition textbook*, and Factor 4 as *selecting tasks and questions from auxiliary books*.

The rotation solution in Table 3.5 revealed the presence of simple structure, with four components showing a number of strong loadings, and most of the variables loading substantially on only one component. Factor 1 was made up of 10 items, namely Item 1, Item 2, Item 3, Item 4, Item 6, Item 10, Item 12, Item 13, Item 14, and Item 15. Factor 2 had 6 items, namely Item 21, Item 22, Item 23, Item 24, Item 25, and Item 27. Factor 3 had 10 items, namely Item 28, Item 29, Item 30, Item 31, Item 32, Item 33, Item 34, Item 35, Item 36, and Item 37. Factor 4 had 9 items, namely Item 38, Item 39, Item 40, Item 41, Item 42, Item 43, Item 44, Item 45, and Item 46. There were no significant cross-factor loadings.

There was a weak positive relationship between Factor 3 and Factor 4 (r=.12); a moderate positive relationship between Factor 1 and Factor 2 (r= .39); a moderate negative relationship between Factor 1 and Factor 3(r=-.49); and a weak negative relationship between Factor 1 and Factor 4 (r= -.20), Factor 2 and Factor 4 (r= -.12), and Factor 2 and Factor 3 (r= .30). This means that they were related but independent constructs.

Table 3.5 Factor loadings from pattern and structure matrix and communalities (h2) of the items in the Use of Mathematics Textbooks Questionnaire for PCA with oblimin rotation of four factor solution

Item#	Pattern Matrix				Structure Matrix				h^2
	F1	F4	F3	F2	F1	F4	F3	F2	
12	**.752**	-.079	-.108	.005	**.822**	-.243	-.487	.340	.691
6	**.746**	-.023	-.055	.025	**.788**	-.181	-.431	.336	.624
3	**.736**	-.030	.105	.151	**.750**	-.183	-.305	.410	.588
4	**.709**	.099	-.044	.049	**.730**	-.054	-.394	.327	.545
10	**.699**	-.043	-.015	.126	**.764**	-.200	-.400	.408	.600
2	**.695**	.059	-.066	.027	**.726**	-.091	-.407	.311	.535
13	**.662**	-.091	-.095	.199	**.805**	-.258	-.491	.497	.702
1	**.634**	.055	-.152	-.149	**.639**	-.072	-.411	.137	.443
14	**.620**	-.153	.003	.212	**.732**	-.301	-.383	.471	.599
15	**.562**	-.098	-.044	.292	**.717**	-.250	-.419	.536	.602
44	-.077	**.840**	-.017	-.037	-.251	**.858**	.134	-.161	.743
42	-.110	**.823**	-.006	-.071	-.300	**.853**	.169	-.210	.750
40	-.036	**.816**	-.020	.025	-.179	**.817**	.089	-.079	.669
41	-.239	**.767**	-.118	.163	-.271	**.782**	.043	.015	.662
39	-.086	**.766**	-.060	.122	-.162	**.762**	.039	.016	.598
45	.218	**.761**	.003	-.190	-.010	**.740**	.046	-.196	.598
38	-.040	**.757**	.104	-.050	-.261	**.783**	.230	-.186	.636
43	.076	**.697**	.102	.009	-.110	**.693**	.147	-.074	.489
46	.136	**.673**	.044	-.034	-.033	**.655**	.069	-.074	.442
32	.163	-.017	**-.792**	-.146	.497	-.128	**-.829**	.158	.717
30	.020	-.040	**-.786**	.048	.432	-.145	**-.815**	.298	.670
36	-.054	.040	**-.771**	.142	.371	-.059	**-.782**	.348	.630
34	.142	.083	**-.769**	-.025	.493	-.035	**-.821**	.253	.692
35	-.025	.064	**-.731**	.087	.355	-.030	**-.737**	.290	.554
33	.181	-.093	**-.719**	-.194	.476	-.193	**-.761**	.104	.631
37	-.109	.060	**-.713**	.154	.289	-.023	**-.699**	.319	.515
28	.209	-.102	**-.644**	-.110	.502	-.209	**-.726**	.177	.574
29	-.027	-.144	**-.594**	-.034	.279	-.206	**-.588**	.151	.366
31	.039	.076	**-.464**	.281	.360	-.021	**-.558**	.427	.391
24	.066	.095	-.039	**.690**	.336	-.004	-.268	**.716**	.526
22	.103	-.008	-.035	**.667**	.382	-.112	-.288	**.719**	.530
27	.008	-.101	-.112	**.646**	.335	-.192	-.323	**.695**	.508
23	.094	-.062	-.050	**.615**	.371	-.160	-.288	**.674**	.473
25	.095	-.028	.080	**.584**	.289	-.106	-.145	**.600**	.370
21	.248	-.024	-.146	**.576**	.549	-.159	-.444	**.719**	.619

Note. Major Loadings for each item are bolded. Factor labels: F1: Reading Student Edition Textbook; F2: Selecting Questions from Workbook; F3: Reading Teacher

Edition Textbook; F4: Selecting Tasks and Questions from Auxiliary books

The reliability of the dimensions was found .92, .80, .91, and .92, respectively. The reliability analysis yielded sufficient Cronbach alpha for the four dimensions (see Table 3.6). To sum up, the 35-item Use of Mathematics Textbooks Questionnaire was found to measure four dimensions of the teachers' use of textbooks.

Table 3.6 Dimensions of textbook use, corresponding items, and the internal consistencies

Factor	Items	Dimensions	Cronbach Alfa	n
F1	1-4, 6, 10, 12-15	Reading Student Edition Textbook	.92	10
F2	21-25, 27	Selecting Questions from Workbook	.80	6
F3	28-37	Reading of Teacher edition textbook	.91	10
F4	38-46	Selecting of Tasks and Questions from Auxiliary books	.92	9

Note. Factor labels: F1: Reading Student Edition Textbook; F2: Selecting Questions from Workbook; F3: Reading Teacher Edition Textbook; F4: Selecting Tasks and Questions from Auxiliary books

3.4.3.1 Validation and Confirmation of Factor Structure of Use of Mathematics Textbooks Questionnaire

Phase III provides valuable data to validate and confirm the factor structure of the Use of Mathematics Textbooks Questionnaire. This part of data analysis indicated EFA and CFA results for the questionnaire. 515 elementary schools in 15 different cities in Turkey and 531 middle school mathematics teacher from those schools were involved in the study. After the listwise deletion of missing cases, the remaining the sample (N=503) was randomly divided into two subsamples. Data from the first subsample (n_1=243) were subjected to EFA using SPSS 17.0 for Windows. EFA was performed using the PCA. Data from the second subsample (n_2=260) were used to validate the

identified factor structure through CFA using LISREL 8.8 (Jöreskog & Sörbom, 2007). The following subsections provide the EFA and CFA results for the questionnaire.

3.4.3.1.1 Reporting EFA Results

The pilot study revealed that the four-factor structure was appropriate for the Use of Mathematics Textbooks Questionnaire after 11 items were removed from the 46 item-questionnaire. The second EFA was repeated for the validation of the questionnaire for 35 items.

Inspection of the correlation matrix revealed the presence of all coefficients of .30 and above. It has been suggested that the value of .60 and higher are required for good factor analysis (Tabachnick & Fidell, 2007). Thus, the Kaiser-Myer-Oklin test showed that the correlation matrices were factorable (KMO= .89) and the quality of sampling was good. Barlett's Test of Sphericity reached statistical significance ($\chi^2(595) = 4592.360$, $p < .001$). Then, PCA was performed on the 35 items for mathematics teachers. The data were analyzed first by oblique (direct oblimin) methods of transformation and then by orthogonal (varimax). Both transformations revealed four factors similar to the initial analysis.

The scree plot examination showed that there was a sharp break indicating four factors. In deciding the number of factors to retain, the process was further supported by the results of Parallel Analysis (Horn, 1965). The parallel analysis revealed that four components with eigenvalues exceeding the corresponding criterion values for a randomly generated data matrix of the same size (35 variables x 244 respondents). In 95% of the datasets generated, the first four eigenvalues were larger than the criterion value (1.80, 1.69, 1.61, and 1.55) from parallel analysis. Therefore, the result of parallel analysis supported the decision from scree plot to retain four factors for further investigation.

The PCA for a four-factor solution was conducted using oblique rotation (direct oblimin with delta=0) with Kaiser Normalization. The results are presented in Table 3.7, wherein factor loadings of pattern and structure matrices are shown. The four factors accounted for 55.61% of the total variance, with eigenvalues of 10.137, 5.280, 2.241,

and 1.810 for factors 3, 4, 1 and 2, respectively. Factor 1 was named as *reading student edition textbook*, Factor 2 as *selecting questions from workbook*, Factor 3 as *reading teacher edition textbook*, and Factor 4 as *selecting tasks and questions from auxiliary books*.

The rotation solution in Table 3.7 revealed the presence of simple structure, with four components showing a number of strong loadings, and most of the variables loading substantially on only one component. Factor 1 was made up of 10 items, namely Item 1, Item 2, Item 3, Item 4, Item 6, Item 10, Item 12, Item 13, Item 14, and Item 15. Factor 2 had 6 items, namely Item 21, Item 22, Item 23, Item 24, Item 25, and Item 27. Factor 3 had 10 items, namely Item 28, Item 29, Item 30, Item 31, Item 32, Item 33, Item 34, Item 35, Item 36, and Item 37. Factor 4 had 9 items, namely Item 38, Item 39, Item 40, Item 41, Item 42, Item 43, Item 44, Item 45, and Item 46. There were no significant cross-factor loadings. It may also be observed in Table 3.7 that Item 4 (Factor 1 = .539 and Factor 3 = .301) had cross factor loadings. These cross loadings can be neglected, as the primary loadings were significantly higher than the secondary ones.

There was a weak negative relationship between Factor 3 and Factor 4 (r =.05), Factor 1 and Factor 4 (r =-.26), Factor 2 and Factor 3 (r =-.30), and Factor 1 and Factor 2 (r =-.33); and a weak positive relationship between Factor 2 and Factor 4 (r = .14); and a moderate positive relationship Factor 1 and Factor 3 (r = .41). This means that they were related but independent constructs.

Table 3.7 Factor loadings from pattern and structure matrix and communalities (h2) of the items in the Use of Mathematics Textbooks Questionnaire for PCA with oblimin rotation of four factor solution

Item#	Pattern Matrix				Structure Matrix				h^2
	F3	F4	F1	F2	F3	F4	F1	F2	
37	**.740**	.113	.117	.073	**.760**	.052	*.367*	-.168	.599
33	**.734**	-.018	.057	-.083	**.783**	-.084	*.389*	-.321	.625
28	**.730**	-.002	.115	.095	**.750**	-.058	*.385*	-.159	.577
29	**.722**	-.058	-.027	.215	**.650**	-.061	.215	.002	.468
34	**.712**	.001	.109	-.126	**.794**	-.083	*.441*	-.372	.661
32	**.707**	-.063	.037	-.148	**.769**	-.132	*.391*	-.377	.623
36	**.699**	.109	.097	-.099	**.762**	.033	*.387*	-.321	.605
30	**.698**	-.114	.001	-.168	**.754**	-.176	.372	-.391	.613
31	**.639**	-.089	-.098	-.222	**.669**	-.129	.259	-.391	.501
35	**.566**	.082	.218	-.136	**.691**	-.024	*.473*	-.363	.542
42	-.007	**.829**	-.037	-.028	-.059	**.835**	-.246	.099	.699
38	-.030	**.820**	-.073	.014	-.109	**.843**	-.303	.158	.719
44	.027	**.797**	-.152	.057	-.096	**.842**	-.367	.206	.736
41	.069	**.791**	-.026	.000	.015	**.794**	-.203	.096	.634
40	.044	**.790**	.051	-.003	.023	**.774**	-.135	.075	.606
39	-.042	**.778**	-.009	-.057	-.071	**.775**	-.210	.064	.605
46	-.065	**.776**	.039	-.008	-.089	**.769**	-.187	.105	.595
45	-.089	**.751**	.140	.118	-.107	**.735**	-.129	.201	.567
43	.050	**.663**	-.149	-.149	-.004	**.679**	-.253	-.025	.492
10	-.008	-.002	**.737**	.040	.283	-.188	**.722**	-.196	.522
2	.137	.093	**.678**	.064	.391	-.082	**.690**	-.182	.502
13	-.048	-.141	**.674**	-.182	.290	-.339	**.750**	-.405	.613
14	-.111	-.178	**.669**	-.231	.242	-.378	**.745**	-.439	.640
12	-.040	-.069	**.652**	-.245	.304	-.269	**.733**	-.453	.595
15	-.069	-.131	**.616**	-.137	.231	-.306	**.666**	-.333	.480
6	.186	-.070	**.583**	.098	.400	-.219	**.646**	-.155	.451
4	*.301*	-.020	**.539**	.033	.513	-.172	**.657**	-.232	.504
1	.207	-.046	**.503**	-.023	.422	-.192	**.607**	-.253	.408
3	.177	.046	**.489**	.006	.373	-.090	**.548**	-.198	.329
22	.047	-.056	.046	**-.723**	.283	-.170	.314	**-.760**	.587
23	.048	-.065	-.049	**-.708**	.240	-.151	.216	**-.715**	.517
21	-.080	-.075	.248	**-.680**	.226	-.227	.454	**-.746**	.619
24	.003	.089	.242	**-.589**	.272	-.055	.411	**-.656**	.482
27	.299	-.015	-.177	**-.561**	.393	-.061	.131	**-.594**	.429
25	.024	.104	.096	**-.532**	.215	.005	.251	**-.556**	.325

Note. Major Loadings for each item are bolded. Factor labels: F1, Reading Student Edition Textbook; F2, Selecting Questions from Workbook; F3, Reading Teacher

Edition Textbook; F4, Selecting Tasks and Questions from Auxiliary books

The reliability of the dimensions was found .89, .79, .91, and .92, respectively. The reliability analysis yielded sufficient Cronbach alpha for the four dimensions (see Table 3.8). Based on the analysis reported here, the 35-item Use of Mathematics Textbooks Questionnaire was found to measure four dimensions of the teachers' use of textbooks.

Table 3.8 Dimensions of textbook use, corresponding items, and the internal consistencies

Factor	Items	Dimensions	Cronbach Alfa	n
F1	1-4, 6, 10, 12-15	Reading Student Edition Textbook	.88	10
F2	21-25, 27	Selecting Questions from Workbook	.79	6
F3	28-37	Reading Teacher Edition Textbook	.91	10
F4	38-46	Selecting Tasks and Questions from Auxiliary books	.92	9

Note. Factor labels: F1: Reading Student Edition Textbook; F2: Selecting Questions from Workbook; F3: Reading Teacher Edition Textbook; F4: Selecting Tasks and Questions from Auxiliary books

3.4.3.1.2 Reporting CFA Results

In many studies in behavioral sciences, CFA is widely used for determining hypothesized relations among ordinal variables (e.g. Likert-type items). These kinds of variables are not continuously distributed and are often observed on a dichotomous or ordinal scale of measurement. When at least one factor indicator is categorical (i.e. dichotomous, ordinal), maximum likelihood based on the sample product–moment correlation or covariance matrix among ordinal observed variables should not be used to estimate CFA models because CFA produce undesirable estimates of the correlations among indicators and incorrect test statistics, standard errors, and parameter estimates

(Brown, 2006). Therefore, the techniques in the use of ordinal variables in models are different from those which are used for continuous variables (Jöreskog, 1994).

An alternative method for CFA models for ordinal observed data includes the analysis of polychoric and polyserial correlations using either weighted least squares (WLS) or robust weighted least squares (WLSMV), and unweighted least squares (ULS) (Flora & Curran, 2004). According to Flora and Curran (2004), WLSMV indicated accurate test statistics, standard errors, and parameter estimates when the sample size ranged from 100 to 1,000. In particular, diagonally weighted least squares (DWLS) estimation procedure based on polychoric correlations and asymptotic covariances results better than WLS method when the sample size is not very large (Kline, 2011). This study showed that DWLS performed well with the sample size for each subsamples (n_1 = 244, n_2=262).

To validate the identified factor structure, CFA performed using LISREL 8.8 program (Jöreskog & Sörbom, 2007) was used. According to Schumacker and Lomax (2004), there are three main criteria in judging the statistical significance and substantive meaning of a theoretical model. The first criterion is the non-statistical significance of the chi-square test and the root-mean-square error of approximation (RMSEA) both of which are indicated to be global fit measures. A non-significant chi-square value indicates the similarity between the sample covariance matrix and the reproduced model-implied covariance matrix. Ideally, a statistically nonsignificant chi-square value indicates a well-fitting model; however, a statistically significant chi-square value specifies differences between the groups' factor patterns (Vandenberg & Lance, 2000). The second criterion is the statistical significance of individual parameter estimates for the paths included in the model which are the values computed by the division of the parameter estimates by their respective standard errors. This is known as t value which should be greater than 1.96 at α =.05 for the significance of the relationships between variables. The third criterion is related with the magnitude and direction of the parameter estimates, paying attention to whether a positive or negative coefficient is meaningful for the parameter estimate (Schumacker & Lomax, 2004).

Goodness of fit was evaluated by using four fit indexes most widely reported in the literature: Root Mean Square Error of Approximation (RMSEA; Steiger, 1990), Comparative Fit Index (CFI; Bentler, 1995), Standardized Root Mean Square Residual (SRMR; Bentler, 1995), and Tucker-Lewis index (TLI; Tucker & Lewis, 1973), often referred to as the nonnormed fit index (NNFI). These are the commonly used fit indexes recommended by researchers (Brown, 2003, 2006; Hu & Bentler, 1999). Their acceptable fit interpretations were also presented in Appendix C in Table 3.9. Moreover, there is no consensus on the exact value of the χ^2/df ratio needed to indicate good fit. The general understanding is that the range of 2:1 to no more 5:1 indicates good fit (Marsh & Hocevar, 1985).

CFA was conducted to examine the construct validity of the Use of Mathematics Textbooks Questionnaire. A four-factor model was specified and tested using CFA. Data from the subsample were used to validate the identified factor structure using LISREL 8.8 (Jöreskog & Sörbom, 2007). The CFA model fits were assessed with the chi-square index and the fit of the competing models was compared with the chi-square difference test (Satorra & Bentler, 2001). As shown in Table 3.10, it was found that four-factor solution was fit to the subsample.

Table 3.10 Confirmatory Factor Analysis of the Use of Mathematics Textbooks Questionnaire: Overall Model Fit

	χ^2	df	RMSEA	(90% CI)	SRMR	CFI	NNFI
Subsample (n=262)							
Four-factor model	2321.11*	554	.075	(.069-.081)	.081	.95	.94

*90% CI, 90% confidence interval for RMSEA, *p< .001*

As indicated in Table 3.10, the four-factor model that was obtained from the EFA was fit to the data. All fit indices for each subsample were consistent with good model fit. The overall goodness-fit statistics implied that the data from subsample fitted the proposed CFA model reasonably well, although the SRMR values were somewhat high. It should be noted that the interpretation of SRMR values could not perform well in CFA models based on categorical indicators (Yu, 2002). Thus, the four-factor structure

provided an acceptable good fit to the data in the subsample. The results of factor loadings and measurement error variances of the CFA model are provided in Figure 3.4. All indicators in the model had statistically significant unstandardized factor loadings to their common latent factors ($p<.001$), corroborating the presence of significant relationships among measured indicators and their latent variables.

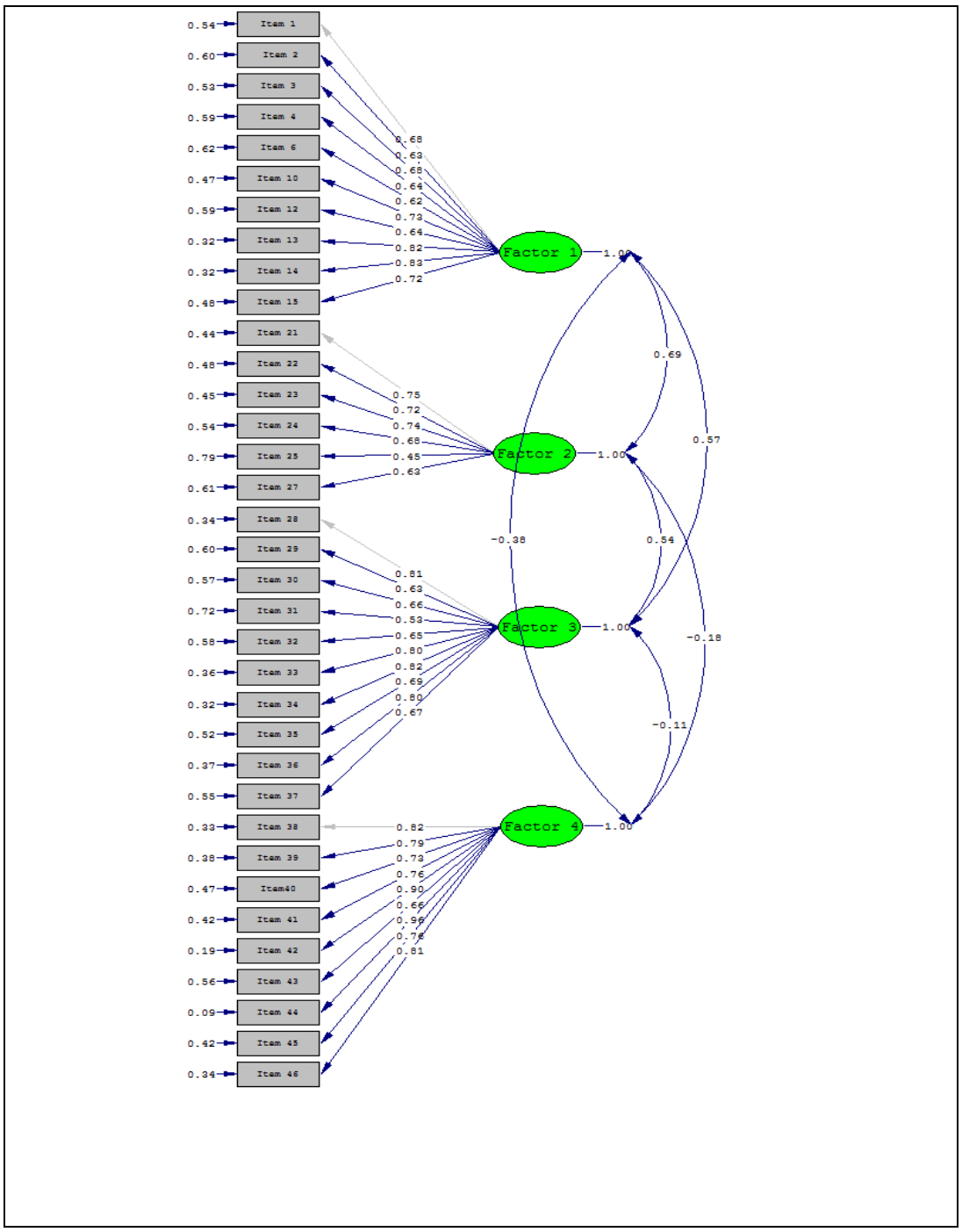

Figure 3.4 Standardized loadings for the four-factor model of teachers' use of textbook (All coefficient are significant at p<.01)

3.4 Data Analysis

As indicated in data collection procedure, the data were collected at four different time intervals through different methods (i.e. qualitative and quantitative). Therefore, data analysis procedures differed greatly. The subsections provide information about the data analysis procedures.

3.4.1 Data Analysis in Phase I

Using Miles and Huberman's (1994) suggestions for coding qualitative data, the researcher identified and categorized all processes that the participants described in the interviews. The researcher completed this process in several iterations. First, the researcher read the transcriptions to obtain an overall idea of the interviewees' responses. Next, the researcher generated labels to reflect the initial coding. From these labels, the researcher developed a general category scheme of the participant responses.

Second, the researcher began to identify themes by sorting the initial scheme into concrete categories and subcategories. The categorization reflected similarity of responses and frequency of responses. Next, the researcher reread the transcripts and field notes and looked for frequently occurring expressions. The researcher categorized the responses according to several initial themes, such as using student edition textbook, workbook, teacher edition textbook, and the auxiliary books. As a result, the researcher combined the initial themes into two parts: (i) mathematics teachers' use of student edition textbook, workbook, teacher edition textbook, and auxiliary book and (ii) mathematics teachers' evaluation about general characteristics of the student edition textbook.

In general, teachers' explanations indicated that teachers used the student edition textbook and workbook as a primary resource for the instruction. Teachers mentioned that they used them mostly to plan what kinds of activities or examples were suggested in the student edition textbook and workbook and to select questions and problems. They also intended to use auxiliary books for selecting questions and problems. Particularly, they claimed that they used questions similar to the ones in the common exam questions (i.e. High School Entrance Exam) that were in the textbook and

auxiliary books. Therefore, these were most remarkable findings for the contextual factors and considered in the determination of the boundaries of the construct.

3.4.2 Data Analysis in Phase II

Factor analysis is a technique used to inform of score validation or to identify or confirm a smaller number of factors from a large number of observed variables (Thompson, 2004). There are two main categories of factor analysis: EFA and CFA. When used for scale development, researchers generally use CFA after they apply EFA (Worthington & Whittaker, 2006). Thus, in the current study, EFA was conducted for the Use of Mathematics Textbooks Questionnaire prior to CFA.

Responses to items assessing the components of textbook use were analyzed using EFA. Items with loadings lower than .32 were omitted from the questionnaire. EFA was performed using PCA. Prior to performing PCA, the suitability of data for factor analysis was assessed for the questionnaire. The examination of the underlying factor structure of the Use of Mathematics Textbooks Questionnaire (EFA results) was detailed in the process of quantitative data collection instrument.

3.4.3 Data Analysis in Phase III

This part of data analysis indicated EFA and CFA results for the Use of Mathematics Textbooks Questionnaire. After the listwise deletion of missing cases, the remaining the sample (N=503) was randomly divided into two subsamples. Data from the first subsample (n_1 = 243) were subjected to EFA using SPSS 17.0 for Windows. Data from the second subsample (n_2 = 260) were used to validate the identified factor structure through CFA using LISREL 8.8 (Jöreskog & Sörbom, 2007). The validation and confirmation of the factor structure of the Use of Mathematics Textbooks Questionnaire was detailed in the process of quantitative data collection instrument.

The quantitative data analysis proceeded from descriptive analysis to inferential analysis. Frequencies and percentages for teachers' responses were analyzed using descriptive statistics. Additionally, series of one-way multivariate analysis of variances (MANOVAs) were conducted using the whole sample to see whether the teachers differ

on the identified factors according to their gender, the level of teaching experience, and class size.

3.4.4 Data Analysis in Phase IV

The data analysis was conducted in order to identify each participant's strategy used for the textbooks and resources to teach ratio and proportion lesson. The uses of resources through the theme of ratio and proportion were investigated in order to detect teachers' documentation work. The data obtained from semi-structured interviews with teachers, classroom observations, analysis of teachers' teaching notes, and sixth and seventh grade mathematics textbooks were analyzed for common themes across participants' uses of textbooks.

Semi-structured interviews were transcribed verbatim. The data was transcribed and coded by the researcher and a second coder to reduce bias in the data analysis and to increase the reliability of the qualitative results. The researcher coded the responses and comments that the teachers had given during the interview sessions. After coding the transcripts, the researcher examined themes and patterns. The interview transcripts were prepared and the coder worked on the same data. The interview transcripts were read several times by the researcher to gather the emerging data.

The classroom observations were scheduled on the same day before and after the interviews. The researcher took field notes on the teachers' activities in the classroom and engaged in the process as an observer. The observation data were checked in terms of the themes obtained from interviews. The teachers' notes and mathematics textbooks were also checked against the interview analysis.

3.5 The Validity of the Study

In mixed methods research, the validity techniques in the qualitative and quantitative research should be controlled at each stage of the process (Onwuegbuzie & Johnson, 2006). Using this recommendation, the validity procedures for quantitative and qualitative research were enacted in this study.

3.5.1 Quantitative Validity

For the present study, the Mathematics Teachers' Use of Textbooks Questionnaire was used. To ensure face and content validity of the instrument, five experts were involved in evaluating the instrument's purpose. To provide additional evidence for the construct validity of the questionnaire, factor analysis was performed to check the dimensions of the Use of Mathematics Textbooks Questionnaire. The detailed information about the validation procedure was explained in the process of instrument development.

3.5.2 Qualitative Trustworthiness

In qualitative research, the term of "trustworthiness" was preferred rather than "validity" (Lincoln & Guba, 1985). Particularly, there are several strategies organized from most frequently used for addressing "trustworthiness" in qualitative research including triangulation, member-checking, thick description, clarifying the bias of the researcher, presenting negative or discrepant information, spending prolonged time in the field, using peer debriefing, and using an external auditor (Creswell, 2003).

This study used the strategies of (1) triangulation, (2) member check, (3) peer debriefing, and (4) clarifying the bias of the researcher. In particular, first validity strategy was the triangulation of the data from several resources from several participants. This strategy was used in the data analysis. The researcher triangulated the interview transcripts, observation notes, and document analysis to build an evidence for codes and themes from the participants. Another strategy was member checking which was used to determine the accuracy of the qualitative findings. The researcher backed to the key participants in the study to determine whether the findings were accurate reflection. The third strategy was using peer debriefing. The total data in terms of written responses for the questions were independently analyzed by a mathematics education researcher who was familiar with the content and framework. Final strategy was clarifying the bias of the researcher. The role of the researcher was to participate in the discussion without influencing the participants' decisions. It was assumed that the

researcher did not have an effect on the participants' decisions while explaining their experience.

3.5.3 Mixed Methods Validity

It seems that there are contrasting views in the quantitative and qualitative research and different typologies and terms in terms of the validity. Considering the issues of the validity, mixed methods research involves complexity in combining quantitative and qualitative research. Recently, Onwuegbuzie and Johnson (2006) recommended that "validity in mixed research be termed legitimation in order to use a bilingual nomenclature" (p.48). They introduced a term of "legitimation" that was acceptable to both quantitative and qualitative researchers. According to Onwuegbuzie and Johnson (2006), legitimation was a comprehensive term for both quantitative and qualitative research and used in the context of discussing the principles for mixed method research.

There were nine types of legitimation processes suggested by Onwuegbuzie and Johnson (2006): sample integration, inside-outside, weakness minimization, sequential, conversion, paradigmatic mixing, commensurability, multiple validities, and political. Each of these legitimation types was defined in Table 3.11.

Table 3.11 Typology of Mixed Methods Legitimation Types (Onwuegbuzie & Johnson, 2006, p.57)

Typology of Mixed Methods Legitimation Types	
Legitimation Type	Description
Sample Integration	The extent to which the relationship between the quantitative and qualitative sampling designs yields quality meta-inferences.
Inside-Outside	The extent to which the researcher accurately presents and appropriately utilizes the insider's view and the observer's views for purposes such as description and explanation.
Weakness Minimization	The extent to which the weakness from one approach is compensated by the strengths from the other approach.
Sequential	The extent to which one has minimized the potential problem wherein the meta-inferences could be affected by reversing the sequence of the quantitative and qualitative phases.
Conversion	The extent to which the quantitizing or qualitizing yields quality meta-inferences
Paradigmatic mixing	The extent to which the researcher's epistemological, ontological, axiological, methodological, and rhetorical beliefs that underlie the quantitative and qualitative approaches are successfully (a) combined or (b) blended into a usable package.
Commensurability	The extent to which the meta-inferences made reflect a mixed worldview based on the cognitive process of Gestalt switching and integration.
Multiple Validities	The extent to which addressing legitimation of the quantitative and qualitative components of the study result from the use of quantitative, qualitative, *and* mixed validity types, yielding high quality meta-inferences.
Political	The extent to which the consumers of mixed methods research value the meta-inferences stemming from *both* the quantitative and qualitative components of a study.

According to Onwuegbuzie and Johnson (2006), the researchers were unable to address sequential legitimation and conversion legitimation. Therefore, these legitimation types were not considered in this study. Particularly, seven legitimation types were the most relevant for this study. Particularly, sample integration legitimation was enhanced by using large samples for the quantitative and qualitative phases. Inside–outside legitimation was improved by providing the participants' responses regarding their thoughts of using textbooks (i.e. insiders' views), as well as comparing their responses to the items in the Use of Mathematics Textbooks Questionnaire. Weakness minimization legitimation was optimized by bringing together the strengths of both quantitative research (i.e. empirical analyses) and qualitative research (i.e. descriptive analyses). Paradigmatic mixing legitimation was improved by implementing major processes of the mixed-methods research process. Commensurability legitimation was enhanced by reflecting a mixed worldview (e.g. integration of qualitative and quantitative research view) and teaching experience (e.g. mathematics teaching). Multiple validities legitimation was improved by using quantitative and qualitative validity strategies. Finally, political legitimation was optimized by using rigorous qualitative and quantitative components.

CHAPTER 4

RESULTS AND FINDINGS

This chapter presents the quantitative results and qualitative findings under two sections. In particular, the quantitative results present the results of the quantitative data analysis comprising the descriptive and the inferential statistics. The qualitative findings present the findings of the qualitative data analysis comprising the interview and observation data analysis.

4.1 Quantitative Results

In this section, the survey demographics and the factor structures of the questionnaire were investigated descriptively. Particularly, the results of the descriptive statistics part were used for the follow-up explanations that were used to explain teachers' use of resources. In the inferential statistics part, the impact of mathematics teachers' decisions to use textbooks in mathematics on teachers with differing demographics was determined and explained. The purpose of this chapter is to provide the reader with an overall summary of the quantitative data.

4.1.1 Descriptive Statistics

Descriptive statistics are presented in two parts: (i) survey results including participant demographic information and participants' evaluation of resources represented in the Demographical Questionnaire, (ii) the nature of factor structure of Use of Mathematics Textbooks Questionnaire, and (iii) descriptive results for the General Characteristics of Student Edition Textbook Questionnaire. In the first part, demographic information detailing gender and years of teaching experience and teaches' resource evaluation, associating in particular the evaluation of student edition textbook, student workbook, teacher edition textbook, auxiliary books, web sites, curriculum guidebook, previous years' textbooks, and personal records, was presented. In the

second part, the nature of factor structure that comprised the mathematics teachers' use of mathematics textbooks was identified. In the third part, the information about the general characteristics of student edition textbook was given. The mean scores, the range, and the modal values were primarily used to explain the mathematics teachers' decisions to use textbooks in mathematics.

4.1.1.1 Survey Demographics

This section provides general information about teachers' demographics (e.g. gender, years of teaching experience, and class size) and teachers' evaluation of resources in teaching mathematics.

4.1.1.1.1 Teacher Demographics

The gender composition of the sample was female (49.6%) and male (49.4%) as noted in Table 4.1. The results indicated that the sample was almost evenly split between female and male.

Table 4.1 Frequency distribution of demographic characteristics of mathematics teachers: Gender

Gender	Frequency	Percent
Female	249	49.6
Male	248	49.4
Missing	5	1.0

Information related to years of teaching experience was displayed in Table 4.2. According to Table 4.2, more than one third of the participants had five years or less teaching experience (37.6%).

Table 4.2 Frequency distribution of demographic characteristics of mathematics teachers: Years of teaching experience

Years of teaching experience	Frequency	Percent
0-5	189	37.6
6-10	115	22.9
11 and over	103	20.5
Missing	95	18.9

Information related to number of students in classroom was displayed in Table 4.3. The results indicated that the sample mostly consisted of medium class size (25-34 students in classroom) (42.6%).

Table 4.3 Frequency distribution of demographic characteristics of mathematics teachers: Class size

Class size	Frequency	Percent
16-24	105	20.9
25-34	214	42.6
35 and over	171	34.1
Missing	12	2.4

4.1.1.1.2 Teachers' Resource Evaluation

Teachers' resource evaluation represented the general evaluations about the teaching resources mostly used by teachers. In this context, the resources were referred to personal records, auxiliary books, web sites, teacher edition textbook, curriculum guidebook, student workbook, previous years' textbooks, and student edition textbook. This part required teachers' responses to items in a five point Likert scale ("1"=Very Poor, "2"=Poor, "3"=Sufficient, "4"=Good, and "5"=Very Good).

According to Table 4.4, the mean scores for personal records and auxiliary books were close to 4.00 on a five-point scale. Particularly, the mean score for the personal records was 3.82, which was the highest mean score among the resources. The mean score at the higher end of the 5-point scale implied that teachers found them good. On the other hand, the mean scores for student workbook, previous years' textbooks, and student edition textbook were below 3.00 on a five-point scale. The mean score implied that teachers found them poor.

Table 4.4 Descriptive statistics for teachers' resource evaluation

Resources	n	*M*	*SD*
Personal Records	447	3.82	.790
Auxilary Books	429	3.65	.818
Web Sites	447	3.35	.884
Teacher Edition Textbook	475	3.10	.968
Curriculum Guidebook	487	3.05	.887
Student Workbook	521	2.96	.956
Previous Years' Textbooks	475	2.70	.971
Student Edition Textbook	521	2.69	.927

Note. Mean scores were based on a Likert scale ranging from "1"=Very Poor to "5"=Very Good

Figure 4.1 portrays the distribution of teachers' resource evaluation. The vast majority of the teachers agreed that personal records, auxiliary books, and web sites were *good* at supporting mathematics teaching. On the other side, most of the teachers reported that previous years' textbooks and student edition textbook were *poor* at supporting mathematics teaching.

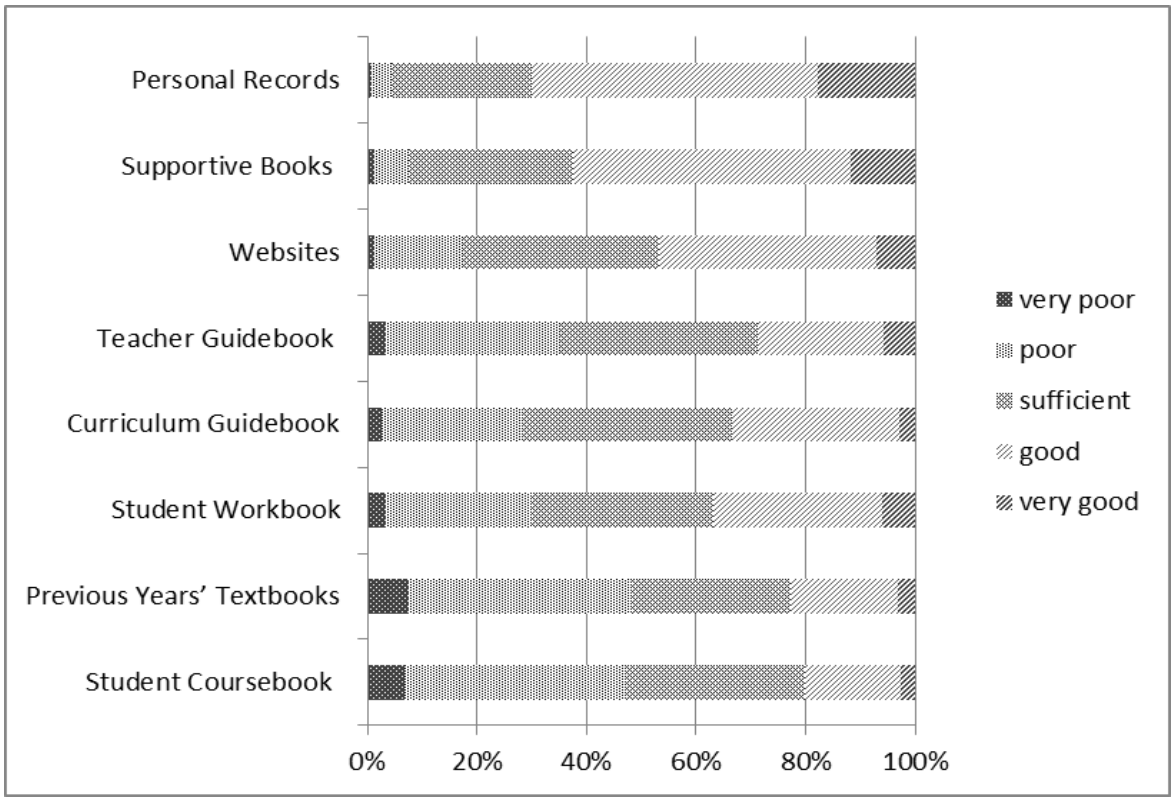

Fig. 4.1 Distribution of teachers' resource evaluation

Percentages of responses to the items of the "Resource Evaluation" were presented in Table 4.5 and 4.6. According to Table 4.5, 48% of the teachers agreed that personal records were *good* at supporting mathematics teaching. 45.6% of teachers agreed that auxiliary books were *good* at supporting mathematics teaching. According to this table, more than 36% of the teachers reported that web sites were *good* at supporting mathematics teaching. Almost 36% of the teachers agreed that teacher edition textbook and curriculum guidebook was *sufficient* for mathematics teaching. These results indicated that most of the teachers found personal records most supportive when compared with other books.

Table 4.5 Frequency distribution of teachers' resource evaluation

	Personal Records	Auxiliary books	Websites	Teacher Edition Textbook	Curriculum Guidebook
	n(%)	n(%)	n(%)	n(%)	n(%)
1	4(.8%)	6(1.1%)	7(1.3%)	18(3.4%)	14(2.6%)
2	18(3.4%)	31(5.8%)	79(14.9%)	168(31.6%)	130(24.5%)
3	125(23.5%)	144(27.1%)	174(32.8%)	189(35.6%)	195(36.7%)
4	255(48.0%)	242(45.6%)	194(36.5%)	121(22.8%)	155(29.2%)
5	87(16.4%)	57(10.7%)	35(6.6%)	30(5.6%)	15(2.8%)
Total	489(92.1%)	480(90.4%)	489(92.1%)	526(99.1%)	509(95.9%)
Missing	42(7.9%)	51(9.6%)	42(7.9%)	5(0.9%)	22(4.1%)

Note. Mean scores were based on a Likert scale ranging from "1"=Very Poor, "2"= Poor, "3"= Sufficient, "4"= Good, and "5"=Very Good

On the other hand, according to Table 4.6, 17.1% of the teachers agreed that student edition textbook was *good* at supporting mathematics teaching, whereas 39.5% of them found them *poor*. 38.4% of the teachers reported that previous years' textbooks were *poor* at supporting mathematics teaching. These results indicated that most of the teachers found student edition textbook least supportive when compared with other books.

Table 4.6 Frequency distribution of teachers' resource evaluation

	Student Workbook	Previous Years' Textbooks	Student Edition Textbook
	n(%)	n(%)	n(%)
1	17(3.2%)	38(7.2%)	36(6.8%)
2	132(24.9%)	204(38.4%)	210(39.5%)
3	169(31.8%)	147(27.7%)	174(32.8%)
4	155(29.2%)	98(18.5%)	91(17.1%)
5	30(5.6%)	16(3.0%)	14(2.6%)
Total	503(94.7%)	503(94.7%)	525(98.9%)
Missing	28(5.3%)	28(5.3%)	6(1.1%)

Note. Mean scores were based on a Likert scale ranging from "1"=Very Poor, "2"= Poor, "3"= Sufficient, "4"= Good, and "5"=Very Good

A summary of these descriptive statistics could indicate that a great deal of the teachers found auxiliary books and their personal records very satisfactory for teaching mathematics. They also found web sites and student workbook good for teaching mathematics; however, they found student edition textbook and previous years' textbooks poor for teaching mathematics. The important point to consider was that these results gave information about teachers' preferences in reading and selecting tasks from those resources.

4.1.1.2 Nature of Factor Structure of Use of Mathematics Textbooks Questionnaire

This section presents the nature of factor structure of the Use of Mathematics Textbooks Questionnaire. As discussed in detail in Chapter 3, the results of the factor analyses signified a four factor structure for the Use of Mathematics Textbooks Questionnaire that comprised the mathematics teachers' decisions to use textbooks in mathematics. The analysis of the PCA for a four-factor solution was conducted using oblique rotation with Kaiser Normalization. The results are presented in the previous chapter in Table 3.7, wherein factor loadings of pattern and structure matrices were shown. The four factors accounted for 55.61% of the total variance, with eigenvalues of 10.137, 5.280, 2.241, and 1.810 for factors 3, 4, 1 and 2, respectively. Factor 1 was named as reading student edition textbook, Factor 2 as selecting questions from workbook, Factor 3 as reading teacher edition textbook, and Factor 4 as selecting tasks and questions from auxiliary books. Moreover, the reliability of the dimensions was found .89, .79, .91, and .92 for Factor 1, Factor 2, Factor 3, and Factor 4 respectively. The reliability analysis yielded sufficient Cronbach alpha for the four dimensions (see Table 3.9). To sum up, the 35-item Use of Mathematics Textbooks Questionnaire was found to measure four dimensions of the teachers' use of textbooks and relevant resources.

The four-factor structure was further examined with the CFA approach. The four-factor model that was obtained from the EFA was fit to the data (see Table 3.10). This model fit the data well, $\chi^2(554) = 2321.11$ ($P<.001$, RMSEA=.075 (90% CI=.069, .081), SRMR=.081, CFI=.95, and NNFI=.94. The overall goodness-fit statistics implied

that the data fitted the proposed CFA model reasonably well. The four-factor structure provided an acceptable good fit to the data.

The Use of Mathematics Textbooks Questionnaire required teachers' responses to items in a five point Likert scale ("1"=Never, "2"=Rarely, "3"=Sometimes, "4"=Often, and "5"=Always). Since "5" was the most favorable result and "1" was the least favorable result on the five point Likert scale, "3" was considered to be the midpoint. Therefore, teachers' responses on questionnaire items with a mean of 3.00 or greater were referred to as favorable result (i.e. teachers were likely to be frequent users of textbooks), responses with means less than 3.00 were referred to as less unfavorable responses (i.e. teachers were likely to be infrequent users of textbooks). Moreover, since the responses of "4"=Often and "5"=Always were the most favorable results for the five-point scale, the frequency distribution for teachers' responses on questionnaire items was referred to teachers *frequently* used the textbooks. On the other side, since the responses of "1"=Never and "2"=Rarely were the least favorable results for the five-point scale, the frequency distribution for teachers' responses on questionnaire items was referred to teachers used the textbooks *rarely* or *never*.

4.1.1.2.1 Description of "Reading Student Edition Textbook" Dimension (Factor 1)

Descriptive statistics results revealed that mathematics teachers generally used the student edition textbook for reading tasks and activities as indicated by the mean scores on 10 items ranging from 3.01 to 3.76 on a five-point scale. For the "reading student edition textbook" dimension (Factor 1), the mean score was 3.36 (SD=.644) (see Figure 4.2). The position of mean score of this dimension represented the higher mean scores of the five-point scale implied that teachers frequently used student edition textbook for reading topics, introductory tasks, and definitions. A mode of 3.40 could be considered as an additional evidence for this interpretation. This dimension had a large range, from 1.20 to 4.89. Moreover, the frequency distribution of teachers' responses with means greater than 3.5 showed that while most of the teachers (46.9%) frequently used student edition textbook for selecting questions, some teachers (26.1%) used them rarely or never.

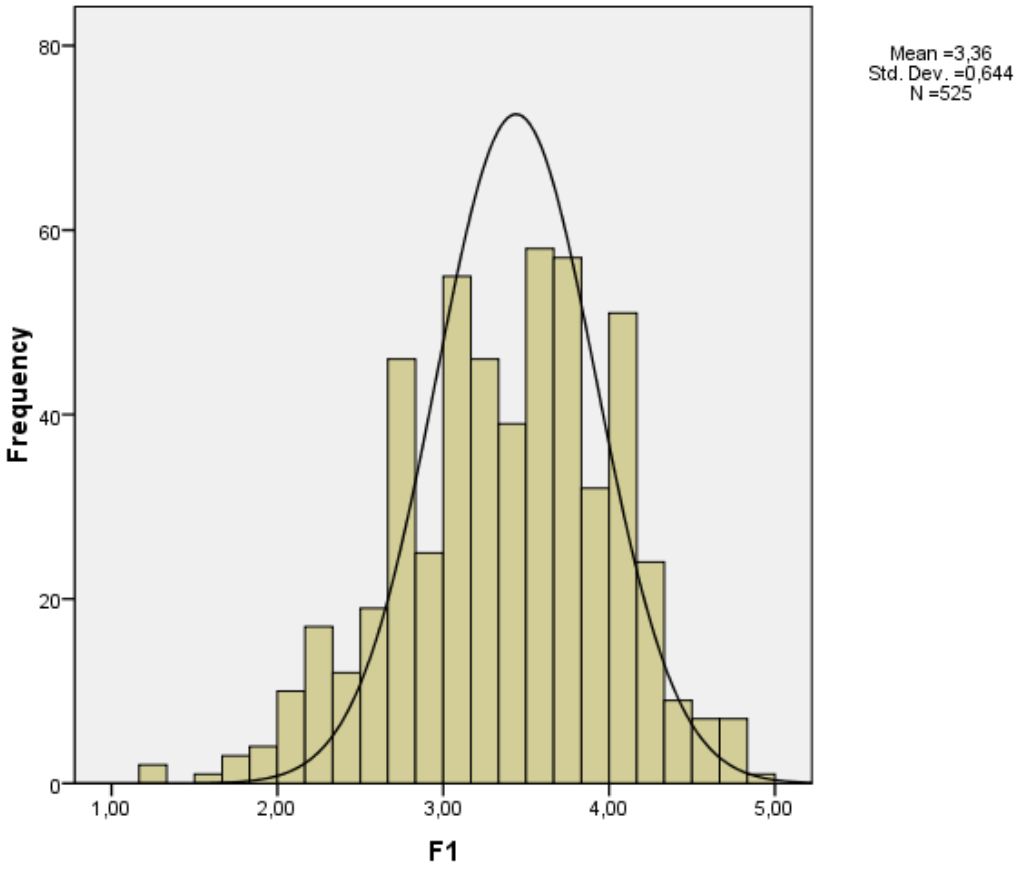

Figure 4.2 Frequency distribution of F1 (Factor 1)

For the reading student edition textbook dimension, means and standard deviations were computed for 10 items (see Table 4.7). For this dimension, teachers' responses resulted in higher means on item 10 (i.e. *I use the student edition textbook during class*). The mean score was 3.76 (SD=1.024) which is very close to 4 on a five-point scale. The mean score at the higher end of the 5-point scale implied that teachers most of time used student edition textbook during the class. A mode of 4.00 can be considered as an additional evidence for this interpretation. Moreover, the frequency distribution for this item revealed that most of the teachers (65.1%) frequently used student edition textbook during the class, whereas few teachers (13.6%) used them rarely or never (see Appendix E).

Table 4.7 Item descriptive summaries for the "Reading Textbook" dimension, mean values sorted in descending order

Items	*M*	*SD*
10. I use the student edition textbook during class	3.76	1.024
1. I use the student edition textbook to prepare for the lesson	3.75	.949
6. I explain the subject similarly to the student edition textbook	3.45	.946
2. I do the introduction just as shown in the student edition textbook	3.37	.946
12. I use the student edition textbook when/if I make definitions	3.37	1.008
15. I pick the mathematical references (graphics, tables, presentations etc.) from the student edition textbook	3.37	.890
3. I connect the concepts with daily life as shown in the student edition textbook	3.30	.842
4. I use the student edition textbook to relate the subject to other/different lessons.	3.21	.963
13. I pick the examples that I use during the class from the student edition textbook	3.04	.902
14. I pick the problems that I refer to during class from the student edition textbook	3.01	.903

Note. Teachers' use of textbook scores were based on a Likert scale ranging from "1"= never to "5"= always

According to Table 4.7, teachers' responses resulted in higher mean on item 1 (i.e. *I use the student edition textbook to prepare for the lesson*). The mean score for this item was closer to the mean score of item 10. The frequency distribution for item 1 showed that about 64% of the teachers frequently used the student edition textbook prior to the class for preparing the lesson, whereas around 10% of the teachers used it rarely or never. Moreover, the mean score for item 6 was 3.45 (SD=. 946) which is close to 3.5 on a five-point scale. The frequency distribution for item 6 (i.e. *I explain the subject similarly to the textbook*) revealed that almost 54% of the teachers frequently explain the subject similarly to the student edition textbook, whereas around 17% of the teachers explained the subject similarly to the student edition textbook rarely or never. On the

other hand, teachers' responses resulted in lower means on item 14 (i.e. *I pick the problems that I refer to during class from the textbook*) and item 13 (i.e. *I pick the examples that I use during the class from the textbook*). The frequency distribution for these items revealed that while about 30% of the teachers frequently used the student edition textbook for problems and examples, whereas about 25% of the teachers used it rarely or never.

In summary, teachers used the student edition textbook for mostly during the class and for preparing for the lesson. Their tendency was to use the student edition textbook for explaining the subject similarly to the student edition textbook. They also used the student edition textbook for explaining the topic and the introductory tasks; however, they rarely used it for selecting problems and examples. These results indicated that teachers read the student edition textbook mostly during the class and prior to class; and mostly read it for the topic, but rarely for problems and examples.

4.1.1.2.2 Description of "Selecting Questions from Workbook" Dimension (Factor 2)

Descriptive statistics results revealed that mathematics teachers generally used workbook for selecting questions and problems as indicated by the mean scores on 6 items ranging from 3.01 to 3.75 on a five-point scale. For the "selecting questions from workbook" dimension (factor 2), the mean score was 3.38 (SD=.659) (see Figure 4.3). The position of mean score of this dimension implied that teachers frequently used the workbook for selecting questions. This was also evidenced by a modal value of 3.67. This dimension had a large range, from 1.00 to 5.00. Moreover, the frequency distribution of teachers' responses with means greater than 3.5 showed that while most of the teachers (49.9%) frequently used workbook for selecting questions, some teachers (20.8%) used it rarely or never.

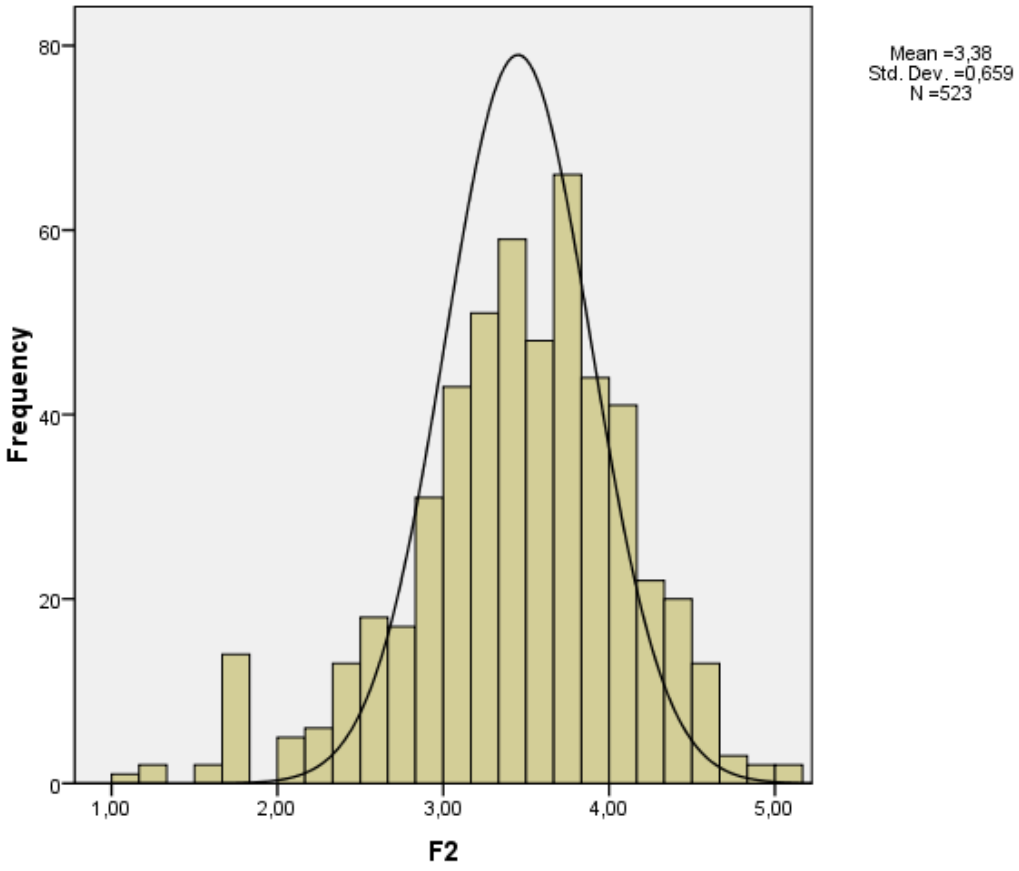

Figure 4.3 Frequency distribution of F2 (Factor 2)

For this dimension, means and standard deviations were computed for 6 items (see Table 4.8). For this dimension, teachers' responses resulted in higher means on item 23 (i.e. *I prefer questions similar to the ones in the common exam questions (i.e. High School Entrance Exam) that are in the workbook)*). The mean score was 3.75 (SD = .87) which was very close to 4 on a five-point scale. The mean score implied that teachers most of time used questions in the workbook similar to the ones in the high school entrance exam questions. A mode of 4.00 can be considered as an additional evidence for this interpretation. The frequency distribution for this item revealed that most of the teachers (67.4%) frequently questions similar to the common exam questions, whereas few teachers (8.1%) used them rarely or never (see Appendix F).

Table 4.8 Item descriptive summaries for the "Selecting Questions from Workbook" dimension, mean values sorted in descending order

Items	*M*	*SD*
23. I prefer questions similar to the ones in the common exam questions (i.e. High School Entrance Exam) that are in the workbook	3.75	.870
25. I try and pick questions from the workbook that are not included in the student edition textbook	3.50	.957
27. I assess the students' success on the subject with the questions in the workbook.	3.43	.980
22. I answer the questions in the workbook during class	3.31	.957
24. I try and pick questions from the workbook similar to the ones in the student edition textbook	3.26	1.008
21. I pick the questions that I answer during class from the workbook	3.01	.933

Note. Teachers' use of textbook scores were based on a Likert scale ranging from "1"= never to "5"= always

According to Table 4.8, teachers' responses resulted in higher means on item 25 (i.e. *I try and pick questions from the workbook that are not included in the* student edition textbook). The mean scores for this item 3.50 (SD=.957). The frequency distribution for this item showed that almost 55% of the teachers mentioned that they frequently selected questions from the workbook that were not included in the student edition textbook, whereas almost 14% of the teachers mentioned that they selected them rarely or never. On the other hand, teachers' responses resulted in lower means on item 21 (i.e. *I pick the questions that I answer during class from the workbook*). The mean score was 3.01 (SD=.933) which close to 3 on a five-point scale. The frequency distribution for this item revealed that some of the teachers (31.3%) frequently picked the questions from the workbook, whereas others (26.5%) picked them rarely or never.

Briefly, teachers pointed out that they frequently used questions in the workbook similar to the ones in the high school entrance exam questions. They stated that they frequently selected questions from the workbook that were not included in the textbook; however, they occasionally picked the questions to use during the lesson.

4.1.1.2.3 Description of "Reading Teacher Edition Textbook" Dimension (Factor 3)

Descriptive statistics results revealed that mathematics teachers generally used the teacher edition textbook as indicated by the mean scores on 10 items ranging from 2.75 to 4.30 on a five-point scale. For the "reading teacher edition textbook" dimension (factor 3), the mean score was 3.37 (SD=.758) (see Figure 4.4). The position of mean score of this dimension indicated that teachers frequently used teacher edition textbook for guiding activities. A mode of 3.60 could be considered as an additional evidence for this interpretation. It is interesting to note that this dimension had a quite large range from a maximum of 5.00 to a minimum of 1.00. Moreover, the frequency distribution of teachers' responses with means greater than 3.5 showed that while most of the teachers (47.3%) frequently read teacher edition textbook, some of them (27.1%) used them rarely or never.

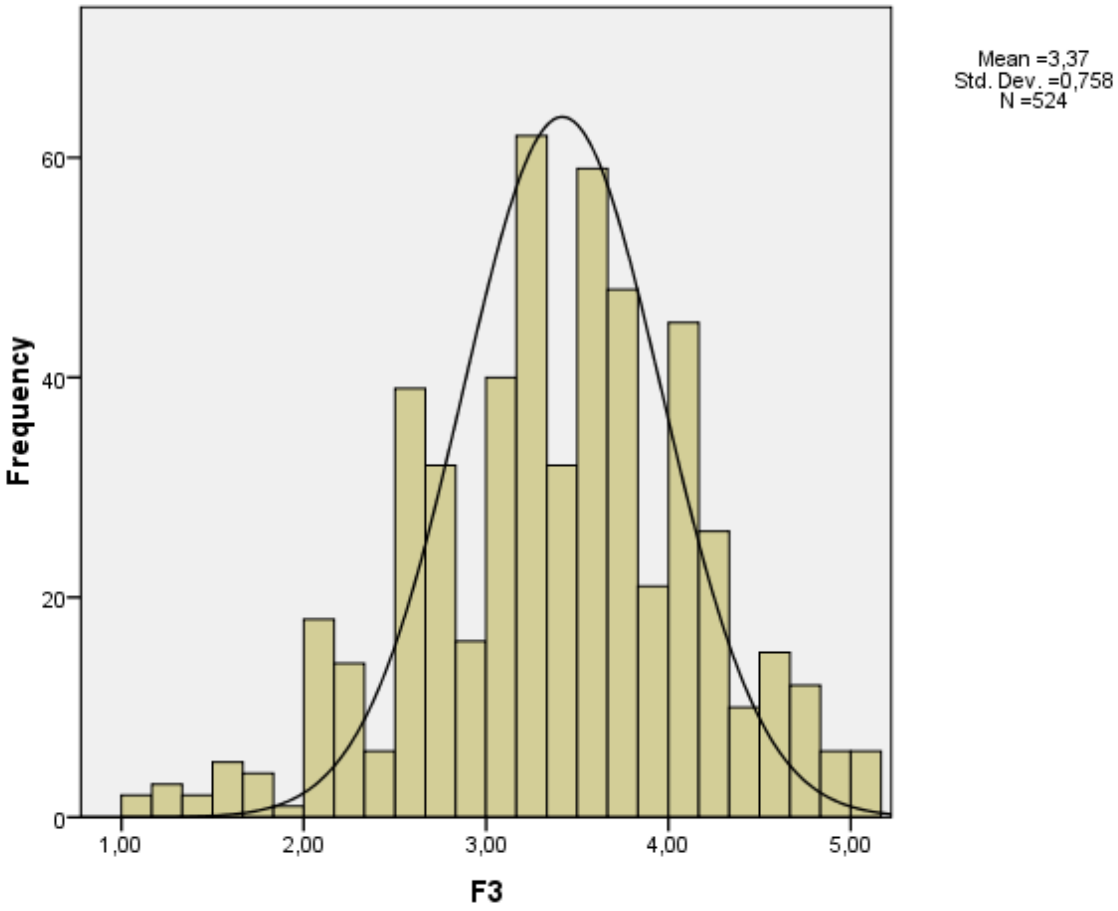

Figure 4.4 Frequency distribution of F3 (Factor 3)

For the Reading Teacher Edition Textbook dimension, means and standard deviations were computed for 10 items (see Table 4.9). For this dimension, the teachers' responses resulted in higher means on item 29 (i.e. *I refer to the teacher edition textbook for objectives*) with the mean score was 4.3 (SD = .862). A mode of 5.00 can be considered as an additional evidence for this interpretation. The mean score implied that teachers frequently used teacher edition textbook to read the curriculum objectives. The frequency distribution for this item revealed that most of the teachers (86.2%) frequently used teacher edition textbook for objectives, whereas very few teachers (5%) used it rarely or never (see Appendix G).

Table 4.9 Item descriptive summaries for the "Reading Teacher Edition Textbook" dimension, mean values sorted in descending order

Items	*M*	*SD*
29. I refer to the teacher edition textbook for objectives	4.30	.862
28. I refer to the teacher edition textbook while preparing for the class.	3.88	.945
33. I refer to the teacher edition textbook for subjects/occasions that are not clear in the student edition textbook.	3.59	1.051
34. I refer to the teacher edition textbook while performing the student edition textbook activities.	3.36	1.054
37. I learn the alternative assessment tools (i.e. portfolio, concept map, interview etc.) from teacher edition textbook	3.26	1.089
31. I refer to the teacher edition textbook to pick the performance task subjects.	3.23	.981
32. I refer to the teacher edition textbook for concepts that I forgot/don't know.	3.23	1.14
30. I refer to the teacher edition textbook to pick additional questions.	3.20	1.001
36. I refer to the teacher edition textbook about how to use the material during class.	2.88	1.175
35. I refer to the teacher edition textbook for the answers to the questions in the student edition textbook/workbook.	2.75	1.205

Note. Teachers' use of textbook scores were based on a Likert scale ranging from "1"= never to "5"= always

According to Table 4.9, the teachers' responses resulted in higher means on item 28 (i.e. *I refer to the teacher edition textbook while preparing for the class*) and item 33 (i.e. *I refer to the teacher edition textbook for subjects/occasions that are not clear in the student edition textbook*). The mean scores for these items were higher than 3.50. The frequency distribution for item 34 revealed that almost 70% of the teachers frequently used teacher edition textbook for preparing for the class, whereas about 8% of the teachers used it for this purpose rarely or never. Moreover, the frequency distribution for item 39 showed that about 60% of the teachers used teacher edition textbook for subjects/occasions that were not clear in the student edition textbook, whereas almost 16% of the teachers used it rarely or never. On the other hand, teachers' responses

resulted in lower means on item 35 (i.e. *I refer to the teacher edition textbook for the answers to the questions in the student edition textbook/workbook*) with the mean score was 2.75 (SD = 1.205). The frequency distribution for this item revealed that some of the teachers (29.6%) used teacher edition textbook for the answers to the questions in the student edition textbook and/or workbook, whereas most of the teachers (45.6%) used it rarely or never.

Briefly, these results indicated that teachers frequently used teacher edition textbook to read the curriculum objectives and to prepare for the class but they very rarely tended to look up the answers of the questions from teacher edition textbook.

4.1.1.2.4 Description of "Selecting Tasks and Questions from Auxiliary Books" Dimension (Factor 4)

Descriptive statistics results revealed that mathematics teachers commonly used auxiliary books for selecting tasks and questions as indicated by the mean scores on nine items ranging from 2.60 to 3.71 on a five-point scale. For the "selecting tasks and questions from auxiliary books dimension" (factor 4), the mean score was 3.17 (SD=.759) (see Figure 4.5). The position of mean score of this dimension represented the mean score of the five-point scale implied that teachers frequently used auxiliary books for selecting tasks and questions. A mode of 3.00 could be considered as an additional evidence for this interpretation. This dimension had a large range, from 1.00 to 5.00. Moreover, the frequency distribution of teachers' responses with means greater than 3.5 showed that while some of the teachers (34.7%) used auxiliary books for selecting tasks and questions, some of them (35.8%) used them rarely or never.

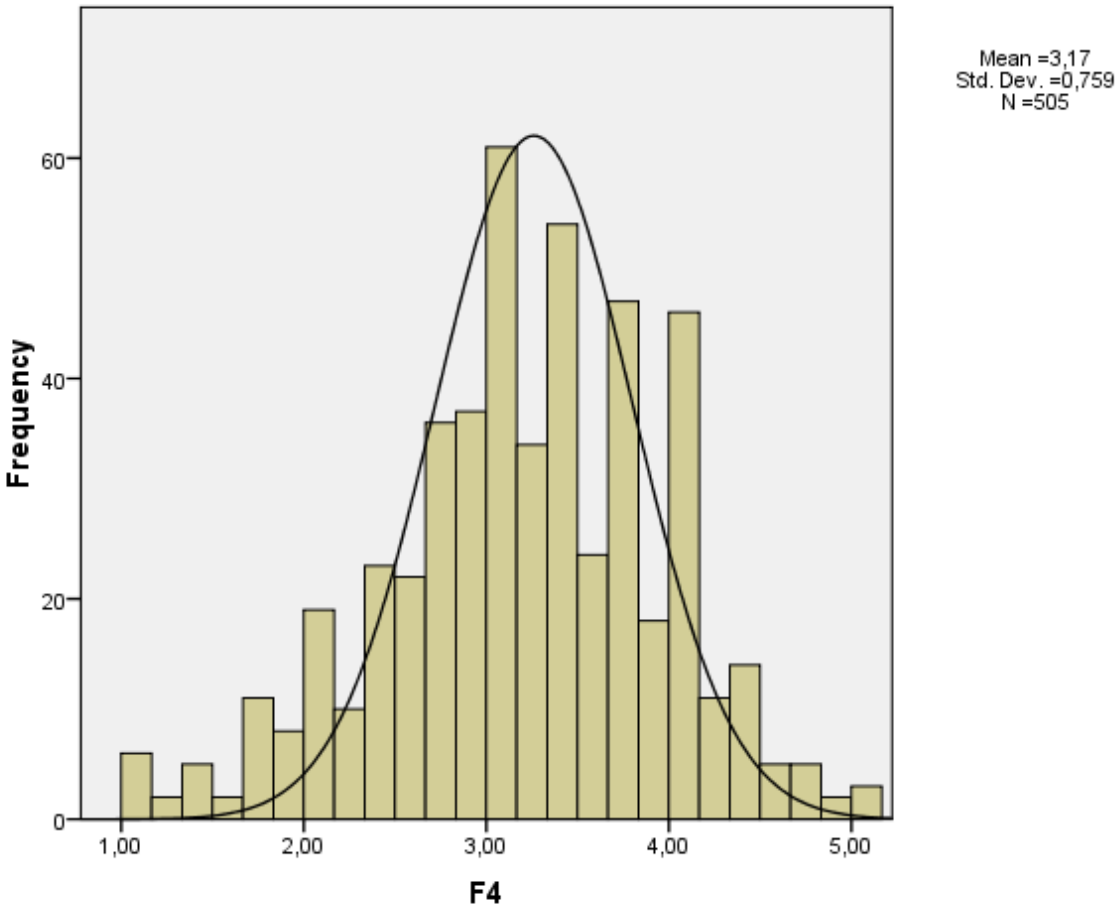

Figure 4.5 Frequency distribution of F4 (Factor 4)

For this dimension, means and standard deviations were computed for nine items (see Table 4.10). For this dimension, the teachers' responses resulted in higher means on item 43 (i.e. *I use questions similar to the ones in the common exam questions (i.e. High School Entrance Exam) that are in the auxiliary books*) with the mean score was 3.71 (SD = .885). The mean score implied that teachers most of time used questions in the auxiliary books similar to the ones in the high school entrance exam questions. A mode of 4.00 can be considered as an additional evidence for this interpretation. The frequency distribution for this item revealed that most of the teachers (66.3%) frequently used questions in the auxiliary books similar to the ones in the common exam questions, whereas very few teachers (9.6%) used them rarely or never (see Appendix H).

Table 4.10 Item descriptive summaries for the "Selecting Tasks and Questions from Auxiliary books" dimension, mean values sorted in descending order

Items	*M*	*SD*
43. I use questions similar to the ones in the common exam questions (i.e. High School Entrance Exam) that are in the auxiliary books	3.71	.885
40. I pick questions from auxiliary books that are not included in the student edition textbook.	3.67	.937
38. I pick the questions that I answer during class from auxiliary books.	3.39	.889
44. I pick the problems that I solve during class from auxiliary books.	3.29	.898
45. I pick the questions that I use in the exams from the auxiliary books.	3.08	.97
42. I refer to auxiliary books for examples that I use during class.	3.19	.982
39. I explain the subjects as in auxiliary books.	2.84	.994
41. I refer to auxiliary books for definitions I make/use during class.	2.81	1.059
46. I assess the students' success on the subject by the question from the auxiliary books.	2.6	1.065

Note. Teachers' use of textbook scores were based on a Likert scale ranging from "1"= never to "5"= always

According to Table 4.10, teachers' responses resulted in higher means on item 40 (i.e. *I pick questions from auxiliary books that are not included in the student edition textbook*). The mean scores for this item 3.67 (SD=.937). The frequency distribution for this item showed that about 65% of the teachers frequently selected questions from auxiliary books that were not included in the student edition textbook, whereas almost 11% of the teachers selected them from those books rarely or never. On the other hand, teachers' responses resulted in lower means on item 46 (i.e. *I assess the students' success on the subject by the question from the auxiliary books*) with the mean score was 2.6 (SD = 1.065). The frequency distribution for this item revealed that few teachers (21.1%) frequently assessed students' success on the subject by the question from the auxiliary books; whereas other (43%) used it rarely or never.

Briefly, teachers frequently used auxiliary books to select questions similar to the ones in the high school entrance exam questions. They also tended to used them to select questions that were not included in the student edition textbook. On the other side, they signified that they rarely assessed students' success on the subject by the question from the auxiliary books.

4.1.1.3 Description of General Characteristics of the Student Edition Textbook

General Characteristics of Student Edition Textbook Questionnaire considered teachers' evaluation of the characteristics of the textbooks. The questionnaire measured the general characteristics of the student edition textbook along 31 items. It required teachers' responses to items in a five point Likert scale ("1" = Very Poor, "2"= Poor, "3"= Fair, "4"= Good, "5"= Very Good). The mean score at the higher end of the 5-point scale implied that teachers found them good.

According to Table 4.11, the highest mean score for the general characteristics of the student edition textbook was 3.66, and the lowest mean score was 2.41 on a five-point scale. The highest mean scores implied that teachers found the physical features of the student edition textbook good. On the other hand, the lowest mean scores implied that teachers found the degrees of the instructional decisions for reading student edition textbook poor.

Table 4.11 Descriptive statistics for teachers' evaluation of the characteristics of the student edition textbook

		Items	*M*	*SD*
degree to provide physical	31	Quality of paper	3.66	.849
	30	Book size	3.51	.842
	29	Font size	3.48	.844
	27	Attractiveness of colors	3.29	.956
	28	Page format	3.13	.993
degree to provide instructional decisions for reading textbook	7	Correctness of concepts	3.47	.828
	19	Number of activities	3.33	.822
	3	Connection of real life	3.05	.881
	18	Reliability of instructions	3.04	.805
	17	Mathematical language	3.02	.877
	1	Appropriateness of program	3.01	.856
	23	Content of alternative measurement tools (product file etc.)	2.95	.819
	20	Content of activities	2.94	.919
	21	Number of projects homework	2.90	.961
	2	Connections among concepts	2.89	.867
	4	Connections of previous knowledge	2.85	.869
	8	Order of subjects	2.82	1.095
	22	Content of projects homework	2.82	.884
	10	Content of definitions	2.79	.902
	6	Explanations of concepts	2.78	.977
	5	Connections of other courses	2.78	.880
	25	Determining misconceptions	2.75	.886
	26	Demonstrating problem solving technique	2.69	.913
	24	Level of motivating students	2.64	.888
	9	Explaining subjects	2.56	.968
	11	Number of examples with solution	2.41	.939
degree to cover questions	16	Questions type (multiple choice, fill in the blanks etc.)	2.96	.955
	15	Appropriateness of question for students' level	2.84	.836
	13	Difficulty of questions	2.80	.869
	14	Similarity of questions with SBS questions	2.70	.969
	12	Number of questions	2.51	.999

Descriptive statistics results revealed that mathematics teachers found that most of the general characteristics of the student edition textbook were poor. The mean scores for the 21 items were less than 3.00 and ranged from 2.41 to 2.96 on a five point scale. The items related to the student edition textbook's physical features had the highest mean scores. The position of the mean scores of these items implied that teachers found student edition textbook good in terms of providing physical features (e.g. color, size).

The mean scores of the items related to degree to provide instructional decisions were mostly below 3.00 and ranged from 2.41 to 3.47. The position of mean scores for these items implied that teachers found student edition textbook poor in terms of making instructional decisions. In particular, teachers only found correctness of concepts, number of activities, connection of real life, reliability of instructions, mathematical language, and appropriateness of program good in terms of providing instructional decisions for reading student edition textbook.

The mean scores of the items related to degree to cover questions were below 3.00 and ranged from 2.51 to 2.96. The position of the mean scores for these items implied that teachers found student edition textbook poor in terms of covering questions. In particular, they found student edition textbook poor in terms of covering the number of questions.

4.1.2 Inferential Statistics

The purpose of this section was to provide the results of the quantitative data collected and analyzed from a survey instrument, the Use of Mathematics Textbooks Questionnaire, in order to determine the impact of mathematics teachers' decisions to use textbooks on teachers' gender, years of teaching experience, and class size. This section addressed the key research question: "Do middle school mathematics teachers' use of textbooks differ for teachers with differing demographics?" This question was elaborated with three sub-questions. To answer these research questions, inferential statistics were used. A series of one-way multivariate analysis of variances (MANOVAs) were conducted to evaluate the relationship between three demographic items (e.g. gender, level of teaching experience, and class size) and each of the

following factors: (1) reading student edition textbook, (2) selecting questions from workbook, (3) reading teacher edition textbook, and (4) selecting tasks and questions from auxiliary books. The independent variables for each MANOVA were gender, level of teaching experience, and class size; and the dependent variables were the four factors explored through PCA and then confirmed through CFA. Specifically, MANOVA was performed to determine the gender, years of teaching experience, and class size differences in using mathematics textbooks, as measured by the Use of Mathematics Textbooks Questionnaire.

Before conducting the multivariate analysis of variance (MANOVA) analyses, the following assumptions of MANOVA were checked: normality, homogeneity of variances and covariances, and independence of observations. It was concluded that all the assumptions for carrying out the intended MANOVA analyses were met.

Research Question 2: Do middle school mathematics teachers' use of textbooks differ for teachers with differing demographics?

4.1.2.1 Sub-question 1:

Is there a statistically significant difference in teachers' use of textbooks scores between male and female teachers, as measured by Use of Mathematics Textbooks Questionnaire?

The descriptive statistics results for the mathematics teachers' use of textbooks in mathematics across gender were presented in Table 4.12. According to Table 4.12, there was a clear difference in the mean scores of "selecting tasks and questions from auxiliary books" dimension (factor 4) among females and males. Females' mean score (M = 3.32, SD =.738) was higher than that of males (M = 3.04, SD=.757) implying that female teachers gave more emphasis on selecting tasks and questions from auxiliary books when compared with males. On the other hand, there was not a clear distinction between the mean scores of other dimensions among females and males.

Table 4.12 Descriptive statistics for mathematics teachers' use of textbooks dimensions across gender

Gender	Dimension	N	M	SD	Min.	Max.
Female	1	255	3.34	.610	1.69	4.75
	2	255	3.21	.638	1.10	4.80
	3	253	3.39	.745	1.20	5.00
	4	235	3.32	.738	1.00	5.00
Male	1	259	3.39	.634	1.23	4.85
	2	259	3.31	.598	1.30	4.90
	3	259	3.36	.773	1.00	5.00
	4	239	3.04	.757	1.00	5.00
Total	1	519	3.37	.621	1.23	4.85
	2	519	3.26	.619	1.10	4.90
	3	517	3.37	.758	1.00	5.00
	4	479	3.17	.759	1.00	5.00

Note. 1: reading student edition textbook, 2: selecting questions from workbook, 3: reading teacher edition textbook, and 4: selecting tasks and questions from auxiliary books

The purpose of using one-way MANOVA was to determine the difference between males and females on a number of measures of using mathematics textbooks was explored. MANOVA was run to investigate gender differences in using textbooks, as measured by Use of Mathematics Textbooks Questionnaire. Four dependent variables were used: reading student edition textbook, selecting questions from workbook, reading teacher edition textbook, and selecting tasks and questions from auxiliary books. The independent variable was gender. The alpha was set at .05.

Total N = 502 was reduced to 497 with the deletion of cases with missing values. There were no univariate or multivariate within-cell outliers at $p<.001$. Results of evaluation of assumptions of normality, homogeneity of variance-covariance matrices, linearity, and multicollinearity were satisfactory. The results of MANOVA yielded a statistically significant difference between males and females on the combined dependent variables, F (4, 494) = 4.77, $p < .001$; Wilks' Lambda=.96; partial eta squared =.04. When the results for the dependent variables were considered separately, the only difference to reach statistical significance, using a Bonferroni adjusted alpha level of

.032, was selecting tasks and questions from auxiliary books, F (1,497)=16.23, p <.001, partial eta squared =.03. Table 4.13 shows the results from the MANOVA on the four dimensions of teachers' using mathematics textbooks. An inspection of the mean scores indicated that females reported slightly higher levels of selecting tasks and questions from auxiliary books (M=3.315, SD=.738 than males (M=3.05, SD=.747). This result implied that male and female teachers only differed in their selecting tasks and questions from auxiliary books. Female teachers were more likely to use textbooks for selecting tasks and questions from auxiliary books. Despite reaching statistical significance, the η^2 of .03 indicates a small effect size.

Table 4.13 MANOVA results for teachers' using mathematics textbooks scores based on gender

	Hypothesis df	Error df	Multivariate F	Sig. (p)
F1	1	497	.611	.435
F2	1	497	1.277	.259
F3	1	497	.415	.520
F4	1	497	16.230	.000*

Note. F1: reading student edition textbook, F2: selecting questions from workbook, F3: reading teacher edition textbook, and F4: selecting tasks and questions from auxiliary books

*Statistically significant using p-value < 0.05

4.1.2.2 Sub-question 2:

Is there a statistically significant difference in teachers' use of textbooks scores between teachers in different level of teaching experience, as measured by Use of Mathematics Textbooks Questionnaire?

The descriptive statistics results for the use of textbooks across the years of teaching experience were presented in Table 4.14. According to Table 4.14, there was a decrease in the mean scores for the dimension "reading teacher edition textbook" as

years of experience increases to over 10 years. Accordingly, it was clear that experienced teacher less preferred to read the teacher edition textbook. On the other hand, there was not an apparent increase or decrease among other dimensions in the mean scores in terms of the years of teaching experience.

Table 4.14 Descriptive statistics for mathematics teachers' decisions to use textbooks dimensions across years of teaching experience

Years of experience	Dimension	N	M	SD	Min.	Max.
0-5	1	196	3.35	.617	1.23	4.75
	2	196	3.23	.616	1.30	4.80
	3	196	3.37	.689	1.80	5.00
	4	182	3.28	.702	1.00	4.67
6-10	1	121	3.31	.624	1.69	4.69
	2	121	3.18	.684	1.10	4.90
	3	119	3.37	.808	1.00	5.00
	4	113	3.31	.709	1.00	4.88
11 and over	1	109	3.36	.606	1.69	4.85
	2	109	3.27	.605	1.50	4.60
	3	109	3.28	.806	1.20	5.00
	4	95	3.09	.868	1.00	4.89

Note. 1: reading textbook, 2: selecting questions from textbooks, 3: reading teacher edition textbook, and 4: selecting tasks and questions from auxiliary books

The purpose of using one-way MANOVA was to determine the difference in teachers' using mathematics textbooks scores for teacher in different level of teaching experience, as measured by Use of Mathematics Textbooks Questionnaire. The independent variable was years of teaching experience of teachers divided into three groups (Group 1: 0-5, Group 2: 6-10, and Group 3: 11yrs and above).

Total N = 502 was reduced to 407 with the deletion of cases with missing values. There were no univariate or multivariate within-cell outliers at $p<.001$. Results of evaluation of assumptions of normality, homogeneity of variance-covariance matrices, linearity, and multicollinearity were satisfactory. There was not a statistically significant difference in teachers' using mathematics textbooks scores for teachers in different level of teaching experience, F (8, 806) = .839, p < .568; Wilks' Lambda=.98. This result

implied that years of teaching experience did not significantly influence teachers' uses of mathematics textbooks.

4.1.2.3 Sub-question 3:

Is there a statistically significant difference in teachers' use of textbooks scores between teachers who have different number of student in classroom, as measured by Use of Mathematics Textbooks Questionnaire?

The descriptive statistics results for the use of textbooks across the class size were presented in Table 4.15. According to Table 4.15, there was a decrease in the mean scores for the dimensions "reading student edition textbook" and "selecting questions from workbook" as number of student in classroom increases to over 35. Accordingly, it was clear that the teachers less preferred to read student edition textbook and selecting questions from workbook in crowed classes. Furthermore, the descriptive statistics results were tested using MANOVA in the inferential statistics section.

Table 4.15 Descriptive statistics for mathematics teachers' decisions to use textbooks dimensions across class size

Class size	Dimension	N	M	SD	Min.	Max.
16-24	1	105	3.46	.618	1.23	4.75
	2	105	3.32	.574	1.50	4.60
	3	105	3.39	.692	1.50	5.00
	4	105	3.15	.737	1.00	4.89
25-34	1	214	3.45	.579	2.00	4.85
	2	214	3.26	.565	1.10	4.50
	3	214	3.42	.774	1.00	5.00
	4	214	3.13	.770	1.00	5.00
35 and over	1	171	3.23	.629	1.31	4.67
	2	171	3.21	.676	1.30	4.90
	3	171	3.28	.758	1.00	5.00
	4	171	3.23	.728	1.11	5.00

Note. 1: reading textbook, 2: selecting questions from textbooks, 3: reading teacher edition textbook, and 4: selecting tasks and questions from auxiliary books

The purpose of using one-way MANOVA was to determine the difference in teachers' using mathematics textbooks scores for teachers who have different number of student in classroom, as measured by Use of Mathematics Textbooks Questionnaire. Four dependent variables were used. The independent variable was number of student in classroom divided into three groups (Group 1: 16-24 number of student in classroom (small class size), Group 2: 25-34 number of student in classroom (medium class size), and Group 3: 35+ number of student in classroom (large class size). The alpha was set at .05.

Total N = 502 was reduced to 490 with the deletion of cases with missing values. There were no univariate or multivariate within-cell outliers at p<.001. Results of evaluation of assumptions of normality, homogeneity of variance-covariance matrices, linearity, and multicollinearity were satisfactory.

There was a statistically significant difference between number of student in classroom on the combined dependent variables, F (8, 972) = 2.51, p < .01; Wilks' Lambda=.96; partial eta squared =.02. Table 4.16 shows the results from the MANOVA on the four dimensions of teachers' using mathematics textbooks. When the results for the dependent variables were considered separately, the only difference to reach statistical significance, using a Bonferroni adjusted alpha level of .028, was reading textbooks, F (2,489)= 8.713, p <.001, partial eta squared =.03.

Table 4.16 MANOVA results for teachers' using mathematics textbooks scores based on class size

	Hypothesis df	Error df	Multivariate F	Sig. (p)
F1	2	489	8.713	.000*
F2	2	489	2.080	.126
F3	2	489	1.469	.231
F4	2	489	.571	.565

Note. F1: reading student edition textbook, F2: selecting questions from workbook, F3: reading teacher edition textbook, and F4: selecting tasks and questions from auxiliary books

*Statistically significant using p-value < 0.05

Analysis of variance (ANOVA) on the dependent variable "reading textbook" was conducted as follow-up tests to the MANOVA. ANOVA was conducted to explore the impact of the number of students in classroom on reading textbook. There was a statistically significant difference at the $p<.05$ level in reading textbook scores for the three groups: F (2,489) = 8.713, p<.001. Despite reaching statistical significance, the η^2 of .03 indicates a small effect size. Post-hoc comparisons using the Tukey HSD test indicated the mean score for Group 1 (M=3.45, SD=.646) and Group 2 (M=3.44, SD=.594) was significantly different from Group 3 (M=3.18, SD=.675). Group 1 did not differ significantly from Group 2. These findings indicated that teachers who had 35 and above number of student in classroom were less likely to use textbooks for reading activities than the teachers who had less than 35 number of student in classroom.

4.2 Qualitative Findings

The previous quantitative data analysis on investigating dimensions of teachers' use of mathematics textbooks revealed that there were four dimensions, namely Reading Student Edition Textbook, Selecting Questions from Workbook, Reading Teacher Edition Textbook, and Selecting Tasks and Problems from Auxiliary Books. The results of the descriptive statistics of the Use of Mathematics Textbooks Questionnaire showed that teachers read student edition textbook and select tasks from workbook and supportive for different purposes. For example, teachers mostly used the student edition textbook to prepare for the lesson. On the other hand, the quantitative results were limited to explain how teachers integrated the tasks in the student edition textbook, workbook, and auxiliary book in their teaching, and implemented them in practice. Therefore, to increase the quality of the research, the qualitative data was collected to follow-up on the quantitative results and overcome the problem by enhancing and explaining the quantitative results. The dimensions of mathematics teachers' use of mathematics textbooks derived from the quantitative findings were discussed in this context as the follow-up explanations.

The purpose of the qualitative phase was to explain the quantitative results (in particular descriptive results) derived from the Use of Mathematics Textbooks

Questionnaire through the analysis of interviews, observations, and textbooks. Interviews were used as primary data collection tool in this phase. Observations were used as a method of validating the teacher responses in their interviews. The analysis of mathematics textbooks and teachers' notes were also used to provide additional information and specific examples to support the interviews and observations.

The analysis of the quantitative data formed a base for developing interview questions to use in the interviews (shown in Appendix I). Interviews were conducted to provide in-depth information about the issues identified in the Use of Mathematics Textbooks Questionnaire. In response to issues identified in the questionnaire, new questions were added to the interviews to understand how teachers used textbooks to teach the notion of ratio and proportion at the sixth and seventh grade level. Interview questions were developed to deeply examine the dimensions of the Use of Mathematics Textbooks Questionnaire (i.e. reading student edition textbook, selecting questions from textbook, reading teacher guide book, and selecting tasks and problems from auxiliary books). The interview questions were addressed: How teachers read student edition textbook, workbook, teacher edition textbook, and auxiliary books to plan and implement the ratio and proportion lesson; and how they select ratio and proportion problems and tasks from those books and implement them in practice.

Observations were used as a method of validating the teacher responses in the interviews. Particularly, classroom observations were conducted to examine teachers' integrating of tasks in the textbooks into practice. Additionally, the teacher personal records were used as additional source of information. Therefore, the primary qualitative data came from interviews and the secondary data came from classroom observations and analysis of teachers' records and textbooks.

The notion of ratio and proportion was taught at the sixth and seventh grade level. The main reason for choosing the notion of ratio and proportion was to give detailed information about teachers' integration of tasks in the textbooks. Moreover, it was taught that focusing on a specific topic might address how teachers use the textbooks to prepare and enact the lessons.

4.2.1 Examination of Teachers' Use and Integration of Tasks

Through this chapter, teachers' work with textbooks and relevant resources and the outcomes of the enactment process were examined in terms of documentational approach of didactics (Gueudet & Trouche, 2011), focusing mostly on the documentation work of the teachers outside the classroom (even if this work goes on in the classroom) (Gueudet & Trouche, 2009). Additionally, the role of mathematics textbooks as a resource for teaching mathematics in teachers' documentational works was considered. In particular, the data were analyzed in the case of teachers introducing the notion of ratio and proportion at the sixth and seventh grade level.

Considering the teachers' integrating of tasks, there are some components for explaining the process:

-*The mathematical content component*: Teachers' works were analyzed in terms of the notion of ratio and proportion at the sixth and seventh grade level. Mathematical tasks given in the textbooks and developed by teachers were also considered.

-*The material component*: The textbook set (student edition textbook, workbook, and teacher edition textbook), auxiliary books, and teachers' personal records were analyzed.

-*The contextual component*: Eight middle school mathematics teachers were interviewed and observed in their school context.

In the following subsections, the dimensions of mathematics teachers' use of mathematics textbooks derived from the quantitative findings were discussed in this context of the documentational perspective. The data were presented in quotes from individual interviews, observation notes, and examples and/or pictures from mathematics textbooks and notes from teachers' personal records.

4.2.2 Reading Textbook

"Reading" involves the teacher's attempt to understand what is written in the materials, "without imposing on it one's own convictions" (Ben-Peretz, 1990, p.66). For example, teachers read the curriculum materials to plan what kinds of activities or examples are suggested in the text (or in the curriculum) and what students are expected to learn. The decisions are related to planning activities for instruction prior to class.

In scope of this study, teachers' reading decisions were examined and investigated through the Use of Mathematics Textbooks Questionnaire which measures the frequency of the use of textbooks by mathematics teachers along four dimensions. In particular, the Reading Student Edition Textbook dimension comprised a series of decisions related to preparing for the lesson, doing the introduction just as shown in the textbook, connecting the concepts with daily life as shown in the textbook, using the textbook to relate the subject to other/different lessons, and using the textbook for definitions, problems, and examples. These decisions involved "a series of tacit decisions about what to attend to" (Remillard, 1999, p.324) but did not involve how to interpret them. For this reason, interviews and observations were conducted to understand how teachers interpret these decisions.

The interview questions were prepared to understand how teachers integrate the reading textbook decisions while teaching, in particular teaching ratio and proportion. Participants were asked several questions about using ratio and proportion tasks from resources, associating in particular the textbooks. Moreover, observations were conducted to check the findings obtained from interviews. In this sense, the Reading Student Edition Textbook dimension (particularly, Item 1, Item 2, Item 3, Item 4, Item 9, and Item 12) provided a basis for interview questions and observations considering that these items helped in framing a more comprehensive picture of teachers' reading student edition textbook and in-depth understanding about teachers' integration of tasks into the practice. According to these items, the findings of the interview and observation data were categorized under the following general headings: preparing content of ratio and proportion lesson, introducing the ratio and proportion lesson, making real-life connections in ratio and proportion lessons, making connections with other courses, making definitions in ratio and proportion lessons, promoting teacher understanding of ratio, and omitting part of the ratio and proportion lesson. The following subsections provide detailed information.

4.2.2.1 Preparing Content of Ratio and Proportion Lesson

The interview and observation data revealed that student edition textbook was not only the resource for the mathematics teachers while planning activities. The observation data indicated that all of the teachers used an additional resource such as curriculum guidebook, student workbook, teacher edition textbook, teaching notes, worksheets, auxiliary books, and internet resources while planning ratio and proportion lessons. In particular, one of the teachers (P1) who described her uses of resources while planning the instruction stated:

> [...] Initially, I'm looking to the student edition textbook, the one student is using, and then also I'm looking to the workbook. I saw that there are things are hanging on my mind then I am looking to the guide book for the points that I cannot find. [...] I also prefer to examine the original of curriculum (P1-Q1).

It seemed that P1 began reading the description of the lesson in the student edition textbook and made a sequence of the resources. She stated that she read the student edition textbook and workbook and then looked for the different resources when she needed support for planning classroom procedures. Similarly, P2 stated that she used student edition textbook regularly, and preferred to begin reading the student edition textbook and then tended to utilize other resources (e.g. teacher edition textbook, their personal notes or records, and auxiliary books) while preparing for the class. She explained the uses of her resources:

> [...] I have at least one textbook necessarily. I look at the things which entered into. I am absolutely looking to the teacher's teacher edition textbook. It says "make them read'', "make them do the activities". I determine these item by item. I am making changes on the note that I prepared from the other years. If I have additional resources I am literally planning the subject like I am going to give homework from there. I am creating questions that I can solve from the student edition textbook and workbook in my mind (P2-Q2).

In those cases, the teachers firstly looked at the student edition textbook and made an evaluation and then tended to use other resources. It seemed that this way of using resources helped them in preparing the instruction on which their perspectives

about the resources were reflected. Particularly, the observation notes revealed that most of the teachers (6 out of 8) used the student edition textbook to look for guidance about the topics' order in the ratio and proportion. They had a general overview from the student edition textbook of what they taught and paid attention to the details of the instruction. For example, two of the teachers who used the topics' order in the student edition textbook for instruction stated:

> [...] What are we doing with P7? We're looking to the plan in advance. We are looking somewhere about P7, then thinking it over a week and noted these on the book if before there is an entering or what does it want. We are finding examples that have to be given and scanning questions (P3-Q3).

> [...] I am highlighting important parts in the book. For example, I am saying that "these subjects don't need to be done" or "I will give these examples in this subject" then I'm highlighting. When I look into the book I find out those examples are the examples that I've already chosen (P4-Q4).

In those cases, the teachers focused on the outline of the tasks that involved the lesson and on the order of these tasks before the instruction. It seemed that teachers read the big ideas of a lesson to get an overview of the lesson with examining the details of the lesson, specifically prior to instruction.

In summary, the interview and observation data indicated that the teachers read the student edition textbook for the big ideas of a lesson prior to instruction, and then examine the ideas to be more focused on the details of the lesson. They read the student edition textbook as a primary resource and other resources to plan what kinds of activities or examples were suggested in the text and what students were expected to learn. Moreover, it seemed that there was an overlap between the content taught by teachers and the student edition textbook content in school mathematics. This process let teachers develop a *document* involving combined resources such as student edition textbook, workbook, teacher edition textbook, curriculum guidebook, discussion with colleagues, and lecture notes from previous years or personal notes: "designing the lesson based on the student edition textbook". It seemed that the teachers developed the

document over the years and it was an ongoing process in which student edition textbook had a particular role.

In the following sections, the specific examples about the ratio and proportion were presented in terms of preparing content of ratio and proportion lessons.

4.2.2.2 Introducing Ratio and Proportion Lesson

During the interviews, most of the teachers mentioned that they used the student edition textbook to plan the ratio and proportion lesson prior to lesson, as indicated in the previous section. Moreover, the observation data provided that teachers mostly used the student edition textbook to teach ratio and proportion lesson during the lesson. The observation notes indicated that most of the teachers gave the introductory problem in the seventh grade mathematics student edition textbook in the class and allowed student to read it word-for-word. In the observation, the teachers (3 out of 8) told the students to read the problem including proportional reasoning in the introduction of the topic of ratio and proportion in the seventh grade mathematics textbooks and explained:

> In motorways is 120 km/h speed limit known as the vision of drivers exceeding the rate decreased slightly at higher speeds and are known to be "speed blind". This angle is the angle of vision when driving at 30 kilometers, past the decreases to 330 degrees. Excessive speed is caused by loss of life and property accidents and also the vehicle's fuel consumption increases. What is the relationship between vehicle speed and viewing angle? What is the relationship between vehicle speed and fuel consumption (MoNE, 2007, p.96).

The observation data indicated that the teachers allowed the students to discuss this problem and then tried to find out new examples related to the proportions. For example, during the observation, P4 asked the students to read this problem and find out its solution. It seemed that she was concerned with the students' understanding and their participation in the class because most of the students were unable to give the correct answer to the problem. In that case, she asked how the baby's height and weight would change over her first years. She allowed students to think about the problem and to find out the solution. In the interview, she explained that this way of teaching was more effective and stated:

> [...] I am making them to read the example at the entrance of the subject and to debate about that. I offer other examples for the students who did not understand. For example, I am showing the trees outside and making them to make comment about trees' ratio or I am trying to give examples about student's family to make them understand (P4-Q5).

In this case, during the observation, she tried to pose a different case since she observed her students' inaccurate solutions to the introductory problem. It seemed that she initially tried to provide an example of direct proportions, and then to give the introductory problem involving direct and inverse proportion. After a small discussion, most of the students able to give the correct answer to the introductory problem. Similarly, during another observation, P3 used the same problem in the student edition textbook to introduce the topic in the lesson. She allowed the students to read the problem. After a while, most of the students gave the correct answer. Then, she asked students to add their own examples for developing the direct and inverse proportion. In the interview, she explained:

> [...] We're making them (the introductory examples in the student edition textbook) read. We're saying "let's read'. Then, we're saying " what have they done and what are they trying to say'. But it becomes insufficient because our kids have sufficient background knowledge. They offer better examples (P3-Q6).

In those cases, P4 and P3 did the introduction just as shown in the student edition textbook but they acted in different ways. P4 added her own question and P3 allowed students to give their own examples for developing the proportion. Both of the teachers provided additional examples with respect to students' responses to the problem. It seemed likely that the teachers' perspectives become important to interpret how problems should be enacted in the classroom. They were concerned with their students' understanding of problem and tried to provide new cases.

4.2.2.3 Making Real-Life Connections in Ratio and Proportion Lessons

The interview data revealed that the teachers (3 out of 8) who used the introductory problem in the student edition textbook claimed that such kind of problems helped them in shaping how to make real-life connections. They thought that they considered the connections between the ratio and proportion concepts and real life experience when they used this problem in the class. It seemed that the teachers introduced the topic by making real-life connections when they used the introductory problem. Additionally, the observation data revealed that the teachers (4 out of 8) preferred to use their own cases rather than to use the introductory problem in the student edition textbook to make real-life connections in the ratio and proportion lesson. During the interviews, they mentioned that their priority was simply to try to make real-life connections with the ratio and proportion concept. For example, three of them claimed:

> [...] Students' profile is important here, I am interpreting according to that but what I started as a concept is ratio and proportion in main point, updating is important, such where does it come from. I am trying to find a link with the real life (P1-Q7).

> [...] In newspapers and TV they are asking that what the utility of pool problems or worker problems in normal life is. This is logic. They are opposing without knowing. But you should use while you are learning something. Kids get it at that time yet. [...] In actual life does worker not work? Does engineer not work? Kids ought to know the logic of that (P5-Q8).

> [...] We're giving examples about direct proportion and inverse proportion. Everyone says something from real life like worker problems (P6-Q9).

During the observations, P5 and P6 tried to make real-life connections by giving cases including worker problems, as they stated in the interviews. Those cases indicated that the teachers were not inclined towards using the examples in the student edition textbook to make real-life connections in the ratio and proportion lessons. However, the analysis of the textbooks revealed that these kinds of problems were provided by the seventh grade student edition textbook.

In summary, some of the teachers used the introductory problem in the student edition textbook which had an important instrumental role in shaping the details of making connections between concepts and real life experience, and others used their own cases which were similar problems in the student edition textbook to make real-life connections. It seemed that teachers tried to make real-life connections through either the student edition textbook or teachers' own cases in ratio and proportion lessons. Moreover, it was remarkable to see the role of student edition textbook in teachers' work, particularly making real-life connections with other courses.

4.2.2.4 Making Connections with Other Courses

The interview and observation data indicated that the teachers (4 out of 8) were concerned with how the notion of ratio was related to other courses (e.g. science and social science). In particular, the sixth grade classroom observation data revealed that the teachers (3 out of 8) used a map scale in problems. For example, one of them (P7) used the map scale in a problem from an auxiliary book: "A 4-meter ladder is drawn on the scale of 1:200. What is the length of the ladder in cms in the drawing?" The teacher presented this problem and one of the students solved at the board. She did not give any explanation about using a map scale and provided another problem. It seemed that she was not concerned about making connections with social science courses. On the other side, during the interview, she expressed the importance of ratio and proportion for science courses. However, during the observation, she did not provide any examples of science that were related to ratio and proportion. She explained:

> [...] Ratio – proportion is so important issue for science courses. There are deficiencies about this issue in kids. I don't know that they are coming without knowledge from first grade or they have never seen this issue. [...] I have to give information that supports the science course (P7-Q10).

Similarly, during the sixth grade classroom observation, P1 solved a problem selected from an auxiliary book: "A distance between two settlements is measured as 5 cm in a map. What is the scale of this map if the real distance between these settlements is 10

km?" This time, during the observation, she explained that the map scale was a good example of direct proportions. Moreover, in the interview, she claimed:

> [...] I am thinking about related issues. I make allowance how the use of this issue in science or social science or how are they related just because I am interested in or I have a chance to share. So "proportion" becomes the subject of social science in "Scale" also becomes the subject of science in "Density' (P1-Q11).

In this case, P1 was concerned with how the notion of ratio was related to science (e.g. in relation to intensity) and social science (e.g. in relation to using a map scale). She provided problems and considered the nature of mathematics and its relation to other branches of knowledge. It seemed that she was convinced that mathematics was a useful tool for other scientific courses. Within this context, this was an *instrumentalization* process, her knowledge and beliefs guided her instruction.

The important point to consider was that the analysis of the student edition textbook and workbook indicated that they involved the similar problems which were used by P7 and P1. There was an example (1 out of 6) and a problem (1 out of 10) related to the map scale in the sixth grade mathematics student edition textbook; and there were not any related problems (0 out of 21) in the sixth grade workbook. Particularly, the examples and problems were very similar to the problems provided by P7 and P1. Additionally, there were three problems (3 out of 13) including six sub-problems related to the map scale, whereas there were not any related examples (0 out of 8) in the seventh grade mathematics student edition textbook; and there were not any problems (0 out of 24) related to the map scale in the seventh grade workbook.

4.2.2.5 Making Definitions in Ratio and Proportion Lessons

Teachers tried to reach a conclusion about the concept (in particular about the concept of direct and inverse proportion) after introducing the concept of ratio and proportion by using the introductory problems and examples. The observation data indicated that teachers (4 out of 8) tended to give a definition for direct and inverse proportion during the lesson. The analysis of the sixth and seventh grade mathematics

student edition textbook as well as the curriculum guidebook also showed that these resources did not comprise any mathematical definition of ratio and proportion. Instead, they included explanations about proportion concept and short summaries of the concept.

The observation data indicated that teachers mostly used these explanations about direct and inverse proportion in the seventh grade mathematics student edition textbook:

> If the one of the two multitude increases the other one also increases with same ratio or if the one of the two multitude decreases the other one also decreases with same ratio is direct proportion (MoNE, 2007, p.97).

> If the one of the two multitude increases the other one decreases with same ratio or if the one of the two multitude decreases the other one increases with same ratio is inverse ratio (MoNE, 2007, p.98).

Particularly, the observation data revealed that teachers used these explanations in two different ways. Some of the teachers (2 out of 8) allowed the students to read the explanations from the student edition textbook and some of them (3 out of 8) allowed the students to develop definitions from the examples of direct and inverse proportions. For instance, in the interviews, the teachers explained:

> [...] I am making them read for definitions then I am asking for them to write down to notebook what they understand (P4-Q12).

> [...] I am making them to find out. I am asking what is ratio for you and then they are giving definitions according to them. Then I am making them to write that definition down. I make them to write with saying we like this definition we need to write this down (P7-Q13).

> [...] We are giving examples to direct proportion and inverse proportion. Everyone says something such as worker problems, and then we are making official definition with saying if two of them increase, if two of them decrease. [...] We are making definition part to part then I make them write (P6-Q14).

Those cases indicated that the teachers did not directly use the definitions in the class. It seemed that they tried to integrate them in the lesson. However, they used different methods for integrating the definitions. In particular, teachers used the explanations from the student edition textbook or students' explanations to make a definition for direct and inverse proportion, but it seemed that teachers allowed students to develop their own definitions in an *instrumentalization* process; their knowledge and beliefs guided the making of definitions. Both interview and observation data indicated that most of the teachers' approaches were simply to try to integrate the definitions in terms of students' understanding.

4.2.2.6 Promoting Teacher Understanding of Ratio

The observations and interviews showed that teachers were confident that they had sufficient background knowledge of ratio and proportion; thus, they did not have much need to look for textbook guidance about what to learn. Further, it was interesting to note that the teachers (3 out of 8) did not make a decision on whether the units were included when ratios were written. Some of them stated that ratios were written without units; and others maintained that ratios were written with units. The teachers (2 out of 8) believed that this confusion had also arisen in the mathematics textbooks, as they explained:

> [...] It says unit of ratio does not exist in the books like meter divided second. So now are we going to say there is unit? I mean I don't know there is something. Recently unit is not mentioned in the books. It does not say " Ratio is unitless". I mean I don't comprise something nor enter. For example, the ratio of her weight to her height (P6-Q15).

> [...] Actually that (uniting the same types) stayed as a relative. There are also books which say that "it doesn't need to get proportionalize but can make proportion". In my opinion and when I scan the other books I start from this unit. "Different units should not been proportionalized" I am giving this information as an additional knowledge (P8-Q16).

These examples showed that teachers sometimes hesitated about certain aspects of the concepts. It seemed that they were confused on how to explain the definition of ratio. They claimed that when they looked for a definition of ratio in the student edition textbook, they could not find any explanation about it. Significantly, the analysis of both the sixth and seventh grade mathematics student edition textbook revealed that these books did not comprise any explanations about the difference between rate and ratio. Considering the lack of sufficient information about this difference in the student edition textbook, the teachers turned to their own understandings to decide how to teach ratio. Therefore, the constraints of the student edition textbook might influence the teachers' activity. This process was called *instrumentation*.

In contrast to these two teachers (P6 and P8), during the interview, P1 provided examples about this issue. She explained:

> [...] I show the unit situations for the ratio. For example, we are looking the rate of age to age when we proportioned the ages of the people in the class, that's why a unit is not applicable, but as in the speed problems when we say the ratio of time to road again the ratio is applicable but this time ratio has a unit (P1-Q17).

In this case, P1 presented the similar explanation represented in the curriculum guidebook. When the sixth grade mathematics curriculum book was analyzed (see Figure 6.1), it was seen that students at this grade are expected to compare quantities of the same type of objects and of different types and to learn a comparison between like quantities (e.g. inch: inch) and comparison of unlike quantities (e.g. page/minute).

6. SINIF SAYILAR ÖĞRENME ALANI

ETKİNLİK ÖRNEKLERİ
"Bir kişi 45 dakikada kitabının 30 sayfasını okuyor." ifadesinde okunan sayfa sayısının geçen süreye oranı; $\frac{30 \text{ sayfa}}{45 \text{ dakika}} = \frac{30}{45}$ sayfa / dakika olarak yazıldığından bu oran birimlidir.
Yüklü bir kamyonun 4,6 tonluk kütlesinin 3,5 tonluk darasına oranı; $\frac{4,6 \text{ ton}}{3,5 \text{ ton}} = \frac{4,6}{3,5}$ olarak yazılır ve bu oran birimsizdir.

Tasks are reproduced from Matematik 6-8 Öğretim Programı. [Mathematics 6-8 Teaching Program] (TTKB, 2007).

English Translation:

6TH GRADE LEARNING NUMBERS AREA

ACTIVITY EXAMPLES

In the expression "a person is reading 30 pages of the book in 45 minutes" the ratio of read papers to the time is 30 pages / 45 minutes = 30/45 pages / minutes written like this. This ratio is unit.

The ratio of 4.6 tons of mass of loaded truck to its 3.5 tones tare is 4.6 ton / 3.5 ton = 4.6 / 3.5 is written like this and this ratio is unitless.

Figure 5.1 Sample of rate and ratio tasks [tasks were translated from the originals published in TTKB (2007, p. 153)]

The important point to consider was that it seemed that the teachers (P6 and P8) who had confusion about the units did not look for the curriculum guidebook. They claimed that they firstly searched for the student edition textbook and auxiliary books. On the other hand, P1 mentioned that the official curriculum guidebook was an important resource for her because it provided a framework for learning, teaching, and assessment and the policies. She explained that she firstly read the official curriculum guidebook to get inside the intentions of the curriculum. She read big ideas of a lesson with examining details of the lesson from the curriculum guidebook. As a consequence, the student edition textbook, auxiliary book, and curriculum guidebook framed the teachers' choices in an *instrumentation* process.

In summary, within this context, the student edition textbook analysis indicated that student edition textbook provided little or no guidance for teaching ratio concept

and the curriculum guidebook provided a model of a ratio activity. Consequently, student edition textbook and curriculum guidebook challenged the teachers to learn (or relearn) mathematical content and to teach deeper levels of student understanding. It seemed that these textbooks framed teachers' understanding of ratio in an *instrumentation* process. It could be considered that teachers developed a *document*: "designing ratio tasks by using relevant resource." The document also entailed a scheme of utilization of resources, with (specific) *operational invariants* like: "Textbooks have a significant role in a mathematical authority and reference for teachers in teaching ratio."

4.2.2.7 Omitting Part of the Ratio and Proportion Lesson

The analysis of the observation data indicated that the teachers who used the student edition textbook to introduce the ratio and proportion continued the lesson by using tasks under the title of "Activity". The teachers (3 out of 8) used these tasks to develop the topic by asking questions in the lesson. For instance, during the observation, P4 enacted the activity related to using equilibrium on an equal-arm balance to investigate the direct proportion. She put the equal-arm balance on the table to compare objects (i.e. bonbons and beads). She asked the students to describe what happened when they placed the objects in the pails of the equal-arm balance. In the interview, she mentioned that working on the activity for the ratio and proportion topic was easy but it could be difficult for other topics. Similarly, the teachers (2 out of 8) indicated the challenges of working on the activities and stated:

> [...] Students see the activities like the game. 6th graders are enjoying more. 8th graders are mostly going to dersane and wants to solve tests about that not want to waste their time with activities (P6-Q18).

> [...] We want to give both usually. We jump the activity part and apply theoretic part. That's why I can say that I even don't read these activities. Not possible. At the public school the size of class is not less than 40. Rope, Plate etc...Already the child is not able to maintain them financially. After, suppose that all of them are solved you don't have a chance to apply this to 40 students. It's enough for them to know these learning because at the end they don't have an exam (P8-Q19).

In those cases, teachers claimed that working on the activities generally was very difficult since students did not prefer to work on activities considering that students taught that the activities could not help them prepare for national standardized exams. Moreover, teachers believed that most of the students could not support the tools for the activity. They believed that they should consider the students' interests and needs; therefore, they tended to omit the activities in the student edition textbook. It seemed that the teachers evaluated the lesson in terms of their perceptions of the students in the class in an *instrumentalization* process, their practices and beliefs guided omitting the activities. The teachers developed a *document*: "enacting (or not enacting) tasks in the student edition textbook in terms of students' interests and needs. This also involved a general *operational invariant*: "Students understand better when the lesson is enacted to meet the interests and needs of the students."

4.2.3 Selecting Questions and Tasks from Textbooks

In this part of the study, the Selecting Questions from Workbook dimension and Selecting Tasks and Problems from Auxiliary Books dimension provided a basis for interview questions and observations. These dimensions indicated teachers' selecting questions and tasks from these resources, but they did not point out how teachers interpret the questions and tasks and integrate them into practice. Therefore, interviews, observations, and textbook analysis were conducted to understand why teachers used these resources and how they integrated the questions and tasks from these resources into the practice.

In general, the analysis of the interview revealed that the teachers mostly used student edition textbook, workbook and auxiliary books to select the problems and questions in terms of giving homework, preparing exam questions, and using Level Determination Exam (SBS) questions. Their integration procedures were provided in the following subsections.

4.2.3.1 Using and Integrating Problems and Tasks

The analysis of the interview and observation data indicated that teachers considered the levels of task difficulty and students' understanding of mathematical concepts when preparing the questions, problems, and examples. In particular, the interview data indicated that they paid attention to the ordering of tasks. They claimed that they adapted the tasks to facilitate students' work with them. One of the teachers stated:

> [...] For example I'm trying to prepare 10 questions about ratio and proportion, easy to hard, what I thought questions have to include them. I'm saying easy to hard but the last two questions will be bonus. It will be much harder (P2-Q20).

During the seventh grade classroom observations, P2 provided examples from the student edition textbook and the problems from her personal records. The examples were related to solving proportions by using the rules (i.e. multiplication and division) for equivalent fractions and cross multiplication at the beginning of the lesson. Most of the students raised their hands to answer the questions. On the other hand, when she provided problems involving direct and inverse proportion problems; a few of the students raised their hands to solve the problems. In the interview, she claimed that the examples related to solving proportions by cross multiplication were easy for the students since they learned the cross product at the sixth grade level. However, she thought that the most common example of inverse proportion problems (e.g. "the more men on a job the less time taken for the job to complete") was difficult for the students. Therefore, it seemed that she paid attention to the ordering of examples and problems.

The interview data also indicated that teachers integrated the tasks not only with respect to the difficulty level of the examples and problems, but also with respect to students' understanding of mathematical concepts. They claimed that they prepared examples and problems for both low and high level students. The teacher stated:

> [...] I'm checking the examples in the book, also solving problems from other books as well. For example I have three 8th grade classes. They are all different from each other, at 8-C they are always ready for the lessons; therefore these lessons are good and pasts fast with them. At the other class there are students who know or who don't. That's why I'm preparing the questions according to their level of capacity (P4-Q21).

However, P4 was not observed in different classes; it appears clear from this quotation that the teacher prepared the lesson. It seemed that teacher made changes in problems with respect to students' understanding of mathematics. Additionally, during the interview, another teacher (P3) mentioned a similar preparation prior to the lesson. She stated: "[...] if the level (the difficulty level of the examples) is lower than I increase number of examples using (auxiliary book). I increase number of example when level of examples is lower or to make them more detailed" (P3-Q22). In this case, she firstly looked for the student edition textbook and evaluated the difficulty level of the tasks in terms of students' understanding, then added new tasks and examples from auxiliary books.

Another important finding to consider was teachers' integration of daily life into the tasks. The interview data indicated that teachers (4 out of 8) tried to connect the concept with daily life. They claimed that they considered the integration of the daily life into the tasks prior to the lesson and prepared the tasks in this way. For example, one of the teachers explained:

> [...] Definitely teacher edition textbook includes something useful for students but always I look for other resources. I investigate their better side. For instance there is an example in auxiliary book. Probability [example] which associated with popular TV show. When I associate probability with such kind of example. Student says woow! (P2-Q23).

In this case, it seemed that the teacher looked for different resources to connect the concept with daily life. She found an example from an auxiliary book which was attractive for students. However, this case was not related to the notion of ratio and proportion; it was remarkable to see teacher's general perspective about the integration

of tasks into daily life. Similarly, P1 mentioned that she paid attention to connect the concepts with daily life while preparing tasks. She explained:

> [...] Student's profile is important at this point, I assess process in this respect but the starting point from the ideas is that what the proportion and ratio is as a concept? Its actuality, where this information comes from? I try to find a connection with daily life. What proportion and ratio are related with? I am thinking some point such as what is the relation with daily life. I try to construct relations for each one of them, (I try to construct) questions that include these (subjects), and situations (P1-Q24).

In the interview, P1 claimed that she provided an activity sheet related to completing a story about ratio and proportion at the beginning of the lesson. She claimed that she used this activity sheet (which was prepared by her) for two years and the students enjoyed writing a story. The activity sheet was:

Değerli öğrencilerim, Sizden aşağıda verilen öyküyü grup olarak tamamlamanız beklenmektedir. Öyküyü tamamlarken her birinizin sırayla birer cümle yazması ve hikayenin içinde aşağıdaki kelimelerin mutlaka olması gerekmektedir. Oran orantı bölüm kat çokluk eşit Berrin, bütün Japonların çekik gözlü olduğunu sanıyordu. Bir gün .....
English Translation: Dear Students, You are expected to complete the story that is given below. While completing the story you are supposed to write a sentence in an order and the following words must be involved in story. Ratio proportion division multiple multitude equal Berrin used to suppose that all Japanese have slant-eyed. One day' .....

Figure 5.2 Activity sheet prepared by the teacher

She explained that she gave the activity sheet and allowed the students to complete the story. It seemed that she allowed students to discuss the activity sheet and created an activity in which her students could explore the mathematics and connect the concept of ratio and proportion with daily life.

Those cases indicated that the teachers were inclined towards preparing and using the daily life connections in the ratio and proportion lessons. The teachers used the student edition textbook and auxiliary books for examples and problems, but they also used their own tasks which were mostly prepared in the previous years. It seemed that they gave attention to connect the concepts with daily life in their tasks and their teaching.

The analysis of the interview and observation data also indicated that teachers (5 out of 8) were concerned about the last parts of lessons. They felt that homework assignments could serve a transition between schoolwork and homework. In particular, they claimed that the primary resources for homework assignments were student edition textbook and workbook. They explained:

> [...] I create the questions that I can solve after the class is over in my mind from the textbook or workbook. There can be sample solutions or some questions from the exercise part in textbook or workbook which I would give as homework. (Questions) Jump one by one I solve some parts and then I can give the rest as a homework just in case the kids find it pleasant. Only for them to like it (P2-Q25).

> [...] We start to solve the practice questions in the class; I bring it to a point and give the rest as a homework I usually give homework from workbook (P6-Q26).

> [...] I try to create an atmosphere as we start homework at the class but couldn't finish. I do it purposefully. Let's say we're going to solve one questions. I leave it for the last 10 seconds. If I solve one question I leave two of them as homework. Then kid has a feeling of finishing an uncompleted job. Then, they complete it on their own (P1-Q27).

During the observations, P2 and P6 gave students homework problems from the workbook that were similar to the problems solved during the lesson. Particularly, the problems included direct and inverse proportion. On the other side, P1 wrote the homework on the board. The homework was: "Investigate how gold carat and how this carat is determined by interviewing with gold store. Present your investigation in class with connecting proportion." In the interview, she mentioned that this assignment was

obtained from an auxiliary book and prepared for students to explore the concept of ratio.

In those cases, it seemed that the teachers gave homework assignments in different ways, but based on the same purpose. They tried to serve a transition between schoolwork and homework by giving problems. Moreover, they used workbook and auxiliary books for giving homework. It seemed that the teachers developed a *document:* "designing problems to serve a connection between classwork and homework".

4.2.3.2 Preparing Exam Questions

The interview data revealed that the teachers' views about using questions in the textbooks were different in terms of preparing exam questions. Some of the teachers (3 out of 8) expressed that they used the student edition textbook and workbook to develop ideas for exam questions. For instance, P1 stated:

> [...] At the first I was just changing the numbers in the questions but it was the same in general, now I am thinking what can I put more my target is their abilities. Of course it has to be same! With guide book reference. [...] That's why we need to support abilities in the class after I decide in my mind I'm trying to check the other books. [...] There are no questions that I directly use because it's not good to use without giving the source (P1-Q28).

In this case, P1 focused on what she could ask in the exam and how she could prepare the questions. She expressed that she used mostly textbooks, auxiliary books from other publishers, and web sites to develop ideas for new questions. In particular, P1 declared that her long experience in grade 6 classes has led her to develop resources comprising student edition textbook, auxiliary books, spreadsheet, and teaching records. It seemed that she had a tendency to search for different resources; therefore, she preferred to use multiple resources to have an idea for preparing the exam questions.

In contrast to P1, P6 specified that he occasionally used the questions in the student edition textbook for the exams without changing them, during the interview. He explained how he used them:

> [...] Sometimes in the exams there are questions same with the workbook. Just I wanted to show that we got them from workbook. And I'm showing them; first solve the questions in your work books then after the auxiliary book (P6-Q29).

In this case, P6 expressed that the students had to solve the questions in the workbook. It seemed that he was inclined towards using the student edition textbook and workbook and encouraged the students to solve the questions in the student edition textbook and workbook.

4.2.3.3 Using SBS questions

The interview data indicated that most of the teachers (6 out of 8) expressed the importance of SBS questions in mathematical activities. The teachers had different concerns about using SBS questions and stated:

> [...] Sometimes I put SBS questions in my preparations as well I'm saying see these were in SBS. They are also important. Whatever you say a good school is the one who has good average in SBS (P6-Q30).

> [...] If you are doing your job well, analyzing the questions in SBS every year, solving them with the kids, after the exam you can say look we did the questions before and it was in SBS also. [...] I am using all the books, first they need to solve questions easy to hard then when I say this kind of questions you will have in SBS that time they will enjoy it (P2-Q31).

> [...] We try kids not to feel SBS but they know it. They feel it very much (P7-Q32).

In those cases, the teachers claimed that the students became more motivated when the teachers selected and solved SBS questions in their teaching. It seemed that students' mathematics achievement in SBS was critical factor; therefore, the teachers used SBS questions as a motivation tool. However, during the observations, the teachers did not use any SBS questions and express the importance of SBS; it was remarkable to see teachers' concerns about SBS questions. It seemed that teachers' knowledge and belief guided the *instrumentalization* process and they developed a *document:* "setting up SBS questions in mathematical activities". This document also entailed (general)

operational invariant like: “Students perform better on SBS when they solve SBS questions in mathematical activities.”

4.2.4 Reading Teacher Edition Textbook

In using the term "teacher edition textbook", it is referred to the textbook which comprises a copy of the student edition textbook, workbook, and curriculum guidebook pages as well as a number of additional suggestions for the teacher. Participants were asked questions about using teacher edition textbook. Their responses addressed two general approaches for reading teacher edition textbook: examining the outline of the activities in the lesson and looking for guidance about how to teach. These approaches helped in framing a more comprehensive picture of teachers’ reading teacher edition textbook. These were explained and detailed in the following sections.

At this point, within the data gathered through the study, it was difficult to hypothesize that the teachers developed documents and operational invariants within this process. Further observations are necessary to confirm their documentational works with the teacher edition textbook.

4.2.4.1 Examining Outline of Activities and Looking for Guidance

The interview studies revealed that the teachers (6 out of 8) used the teacher edition textbook to examine for additional problems and activities prior to instruction. They mentioned that they used several resources for problems and activities and the teacher edition textbook was one of them. They stated:

> [...] Sometimes there are questions which don’t exist in student edition textbook, that time I’m using teacher edition textbook (P6-Q33).

> [...] If I am not satisfied with example in the student edition textbook or if it is not appropriate for materials, if I do not have activity that I produced before hand, If I am still seeking activity [...] or sometimes there are alternative activities. At that case I might look into it but it is not my bible at first (P1-Q34).

Those cases indicated that the teachers used multiple resources for what to teach and how to teach mathematics, but they considered the teacher edition textbook as an additional resource for examining the activities. Additionally, the observation studies and the analysis of the teacher edition textbook showed that some teachers (3 out of 8) underlined the problems in the teacher edition textbook which were presented during the instruction and wrote additional problems selected from the auxiliary books on the teacher notebook.

In this context, the important point to consider was that most of the teachers used the teacher edition textbook as an additional resource. This means that the teacher edition textbook was not the primary resource for the teachers. Particularly, there might be two reasons that were identified by teachers during the interviews. P8 identified one of them:

> [...] I read when the first book. I recognized that there is anything than the present (information) or because of what I remember from my previous reading. Book has been same for four years. If it new book I would definitely look it (to see) how it explains. We did when it first came. Then the process has settled down and it has been continuing like that (P8-Q35).

P8 indicated that the teacher edition textbook failed to provide new information after four years. It seemed that teachers got used to reading information from the teacher edition textbook. It might be one of the possible reasons for why teachers did not use the teacher edition textbook as a primary resource. Moreover, teachers who were over 45 years old pointed out that it was difficult to read the teacher edition textbook because it was written in small letters. Two of the teachers stated that "Font is too small in teacher edition textbook. I cannot even see with my glass." This might be the second reason.

These reasons might also have an effect on teachers' using the teacher edition textbook as a guide for pedagogical strategies. The observation and interview studies revealed that some teachers (2 out of 8) used the teacher edition textbook to look for guidance about how to teach. They claimed that they mostly used it for the pedagogical strategies described in the curriculum for setting objectives of a lesson and general descriptions about the topic. They stated:

> [...] Initially, I investigate student edition textbook, then I investigate workbook. I realized that when I am confused I look to teacher guide book. [...] Sometimes guide book has some parts previous knowledge about readiness. If it is previous subject, I look some points as an example how it examines subjects (P1-Q36).

> [...] If I need to prepare at home I'm checking everything. If I'm taking notes at home I'm doing it in a detailed manner (P6-Q37).

Those cases indicated that when the teachers asked to talk about the uses of the teacher edition textbook, they explained their uses in general and they did not give detail about the specific uses for the ratio and proportion topic. It seemed that the teachers rarely used the teacher edition textbook for looking for the pedagogical strategies and they did not have need guidance for the ratio and proportion topic.

4.2.5 Summary

In this section, the most critical findings of both quantitative and qualitative data are presented. The results of the study showed that teachers' use of mathematics textbooks were examined and investigated through the Use of Mathematics Textbooks Questionnaire, which measures the frequency of the use of textbooks by mathematics teachers along four dimensions, namely Reading Student Edition Textbook, Selecting Questions from Workbook, Reading Teacher Edition Textbook, and Selecting Tasks and Problems from Auxiliary Books. The analysis of the Reading Student Edition Textbook dimension revealed that teachers mostly used the student edition textbook prior to lessons and during the instruction. Teachers' responses to the questionnaire showed that teachers explained the subject similarly to the student edition textbook and made the introduction just as shown in the student edition textbook. Teachers' responses also revealed that teachers used the introductory activities, definitions, real life cases, examples, and connections with other courses in the student edition textbook. These findings were supported by the interviews and observations. Particularly, teachers reported that they used the student edition textbook to look for guidance about the topics and to have a general overview from the student edition textbook of what they taught

and paid attention to the details of the instruction. Moreover, the interviews and observations showed that teachers integrated them in their teaching and implemented them in practice in terms of their knowledge, beliefs, and experience; and they considered students' levels of mathematical understanding since teachers believed that students could better learn mathematics when they made necessary modifications in resources for their students.

The frequency distribution for the items for Reading Student Edition Textbook dimension revealed that teachers rarely used the student edition textbook for problems and examples considering that they tended to use workbooks and auxiliary books to select problems and questions. In particular, the results showed that most of the teachers found the student edition textbook least supportive when compared with other books and found student edition textbook poor in terms of covering questions.

Briefly, teachers used the student edition textbook during and prior to class. Their tendency was to use the student edition textbook for explaining the subject similarly to the student edition textbook. Teachers mostly used the introductory activities, real-life cases, connections with other courses, examples, and definitions in the student edition textbook. However, they rarely used it for selecting problems and examples. Teachers always considered their knowledge, beliefs, and experience and integrated the tasks in the student edition textbook according to their students' levels of mathematical understanding.

The analysis of the Selecting Questions from Workbook and Selecting Tasks and Questions from Auxiliary Books dimension revealed that teachers mostly picked the questions from the workbook and auxiliary books that were not included in the student edition textbook and selected questions from the workbook similar to the ones in the student edition textbook. These findings were supported by the interviews and observations. Teachers reported that they firstly look for questions and problems from the student edition textbook and made an evaluation with respect to the student edition textbook content; and then tended to use other books or resources to select questions and problems considering that they believed workbook and auxiliary books provided them lots of questions and problems. Teachers reported that they used workbook and auxiliary

books to select the problems and questions to give homework, prepare exam questions, and use the Level Determination Exam (SBS) questions. In particular, the observations and interviews showed that they used workbook and auxiliary books to give homework considering that they believed that those books better served a transition between schoolwork and homework. Moreover, the interview and observation data revealed that teachers used the workbook and auxiliary books to develop ideas for exam questions considering that they believed that multiple resources offered several alternatives for preparing the exam questions.

The teachers' responses to the questionnaire showed that teachers mostly selected the questions similar to the ones in the common exam questions (i.e. High School Entrance Exam) that were in the workbook and auxiliary books. This finding was supported by the interviews and observations. Particularly, the interview data indicated that most of the teachers expressed the importance of SBS questions in mathematical activities. They believed that students performed better on SBS when they solve SBS questions in mathematical activities. Additionally, teachers reported that students became more motivated when teachers selected and solved SBS questions in their teaching.

The analysis of the interview and observation data also showed that teachers considered the levels of task difficulty and students' understanding of mathematical concepts when preparing the questions, problems, and examples from workbook and auxiliary books. In particular, the interview data indicated that they paid attention to the ordering of tasks and adapted the tasks to facilitate students' work with them. Teachers were concerned about finding additional problems and students' interest. Therefore, workbook and auxiliary books had a potentiality to influence teachers' choices in selecting questions and problems.

The analysis of the Reading Teacher Edition Textbook dimension showed that teachers frequently used teacher edition textbook to read the curriculum objectives. Teachers' responses to the questionnaire revealed that they mostly used teacher edition textbook for subjects/occasions that were not clear in the student edition textbook but they very rarely tended to look up the answers of the questions from teacher edition

textbook. The interview and observation showed that teachers considered the teacher edition textbook as an additional resource for examining the activities. Particularly, the observation studies and the analysis of the teacher edition textbook revealed that teachers underlined the problems in the teacher edition textbook which were presented during the instruction and wrote additional problems selected from the auxiliary books on the teacher notebook.

CHAPTER 5

DISCUSSION, CONCLUSIONS AND IMPLICATIONS

The current study was designed to explore middle school mathematics teachers' use of mathematics textbooks and examine teachers' integration of tasks in the textbooks into practice. This study was distinctive in nature because multiple research methods were used to better understand the interaction between teacher and resources through the documentational process. In this chapter, the results from quantitative and qualitative data analysis will be summarized and discussed. The conclusions will also be presented together with discussions. The limitations, implications, and recommendations will be presented for future research.

5.1 Discussion of the Results and Conclusions

In this study, the mixed methods research provided complementary strengths and nonoverlapping weakness of both qualitative and quantitative research, as indicated by Creswell and Plano Clark (2007) and Johnson and Turner (2003). This type of research design helped to increase the quality of the study since the mixed design capitulate the strength of both qualitative and quantitative research methods. For instance, the quantitative results were limited to explain how teachers integrated the tasks from the student edition textbook, workbook, and auxilary book in their teaching, and implemented them in practice. The qualitative follow-up data was built on the initial quantitative results to overcome the problem by enhancing and explaining the quantitative results in the words or texts. It could be interpreted that the mixed methods research procedures provided a framework and logic to guide the implementation of the research methods for this study. In other words, it was more manageable for this study and best matched to the research problems.

This study involved a two-stage procedure comprising different phases. In the first phase of the study, the quantitative data were collected by means of the Use of Mathematics Textbooks Questionnaire, which allowed the researcher to explore the nature of Turkish middle school mathematics teachers' use of mathematics textbooks. In the second phase of the study, the qualitative data were collected through interviews with participants, classroom observations, and document analysis, which allowed the researcher to examine teachers' integration of tasks in the student edition textbook, workbook, and auxiliary book into practice, and to make meaningful contributions that took into account the Turkish context. The results of the current study revealed some issues of critical importance that are worth to be discussed.

5.1.1 Teachers' Use of Mathematics Textbook

The Use of Mathematics Textbooks Questionnaire was developed to identify Turkish middle school mathematics teachers' use of mathematics textbooks. The reason for developing this questionnaire was to contribute to the relevant literature about textbook use in Turkish context. Although there are some questionnaires (e.g. Christou et al., 2004; Jamieson-Proctor & Byrne, 2008) available that include identifying teachers' concerns and beliefs about textbook use, there was no questionnaire available which was dedicated to the identification of the way of teachers' using textbooks and selecting tasks from textbooks that were key interpretive activities for teachers, particularly before the instruction. Consequently, the Use of Mathematics Textbooks Questionnaire was developed and used to identify and explore middle school mathematics teachers' using mathematics textbooks, partly focusing on reading textbooks and selecting tasks from textbooks.

The Use of Mathematics Textbooks Questionnaire was aimed to provide means for eliciting the Turkish middle school mathematics teachers' use of mathematics textbooks, in particular student edition textbook, workbook, teacher edition textbook, and auxiliary book. The questionnaire was established through the review of related literature and following contextual description derived by asking a sample of middle school mathematics teachers. Therefore, the questionnaire has a unique role in

describing teachers' reading textbooks and selecting tasks from textbooks. The questionnaire might be valuable for teachers, mathematics educators, and program developers who are interested about teachers' using of mathematics textbooks.

The factor analysis results of the Use of Mathematics Textbooks Questionnaire revealed four dimensions, namely Reading Student Edition Textbook, Selecting Questions from Workbook, Reading Teacher Edition Textbook, and Selecting Tasks and Problems from Auxiliary Books. The following section gives a discussion of the results of factor analysis and findings of the interview and observation data in order to account for the discrepancy among middle school mathematics teachers in nature of mathematics textbook use.

5.1.1.1 Reading Textbook

In this current study, the Reading Student Edition Textbook dimension involved teachers' planning activities for instruction prior to class, as Remillard (1999) identified. Based on Sherin and Drake's (2004) characterization, these activities were related to reading the student edition textbook to find activities and examples from the text (or in the curriculum) and what students are expected to learn. Considering these descriptions, the data from this study described that teachers read mathematics student edition textbook to determine the structure and content of the instruction prior to lesson.

According to the teachers' responses to the items in the Reading Student Edition Textbook dimension, the mean value for this dimension was found to be 3.36 (out of 5 as the maximum score possible). It could be interpreted that the teachers read mathematics student edition textbook to determine the structure and content of the instruction prior to lesson at a "moderate" level. There might be two issues to be considered while interpreting this result. The first issue is that teachers' uses of other resources influence the reading student edition textbook score. The analyses of the observation and interview studies support this assumption considering that teachers did not only use mathematics student edition textbook, but also used their personal teaching notes, curriculum guidebook, worksheets, and web sites while planning lessons. This assumption is also confirmed by the findings of other researchers (e.g., Adler, 2000;

Cohen et al., 2003; Gueudet & Trouche, 2009) stating that teachers do not isolate resources from one to another and use them as *a set of resources* corresponding to a variety of things in teachers work. Consequently, teachers use student edition textbook and other resources as a whole for determining the structure and content of the instruction.

The second issue is that teacher's attempts to make changes in the textbooks with respect to their own knowledge and beliefs influence the reading student edition textbook score. The analyses of the qualitative data collected using classroom observations, interview with participants, and analysis of teachers' notes and textbooks support this assumption considering that teachers interpret the student edition textbook with respect to their own beliefs and experience to frame their teaching, make changes, and modify them according to the structure and the purpose of lessons, as some researchers also reported (e.g., Brown, 2002; Davis & Krajcik, 2005; Remillard, 2005). Further, the assumption is confirmed by the findings of other researchers (e.g., Brown, 2004, 2009; Remillard & Bryans, 2004; Remillard, 2009) implying that teachers attempted to make changes in the curriculum materials and interacted with them dynamically rather than using them in a straightforward way.

Based on these findings, Turkish middle school mathematics teachers interacted with student edition textbook and worked on it. It is probable that teachers brought their interpretations to what they read in the textbooks. The reason for changing and modifying the student edition textbook structure by teachers was likely caused by instructional decisions which are in turn influenced by the meanings they made from observing and interacting with their students, as reported by Ben-Peretz (1990) and Durwen and Sherman (2008). Consequently, the reading student edition textbook dimension does not only comprise an evaluation process, a finding consistent with previous studies (e.g. Remillard, 1999; Sherin & Drake, 2004), but also involve an interpretation process.

For Reading Student Edition Textbook dimension, the analysis of the frequency distributions showed that teachers most frequently used the student edition textbook to prepare for the lesson and during class and explained the topic of the lesson similarly to

the student edition textbook. It can be inferred that teachers have a general overview of what they teach with paying attention to the details of the instruction through using student edition textbook. This result supports the findings of other researchers (e.g., Remillard & Bryans, 2004; Schmidt et al., 1997) stating that textbooks do not force teachers to use the same way for instruction; rather they help shape the process of instructing mathematical topics and skills. Moreover, the findings of the observation and interview studies supported these results. Teachers' responses and activities showed that teachers read the student edition textbook for the purpose of preparing content of a lesson, introducing the lesson, making real-life connections, making connections with other courses, giving definitions, promoting the understanding of a concept, and omitting part of the lesson. This means that teachers read the textbook to plan what kinds of activities or examples are suggested in the text and what students are expected to learn, as Sherin and Drake (2004) pointed out.

Besides all these, reading textbook activities may be also worth to be considered to explain teachers' planning activities prior to lesson. Based on the teachers' responses given to the items in the Reading Teacher Edition Textbook dimension, the mean value for this dimension was found to be 3.37 which was the almost same mean value of the Reading Student Edition Textbook dimension. It could be interpreted that the teachers also read teacher edition textbook to determine the structure of instruction prior to lesson. This situation could be discussed in two ways. The first issue is that teachers use the student edition textbook as well as the teacher edition textbook to plan what kinds of activities or examples and what students are expected to learn. The analyses of the frequency distributions for Reading Teacher Edition Textbook dimension support this assumption considering that teachers most frequently used the teacher edition textbook for topics/occasions that were not clear in the student edition textbook.

The second issue is about the structure of the teacher edition textbook containing copies of the student edition textbook and workbook pages. The analyses of the observation studies and mathematics textbooks support this assumption because teachers who used teacher edition textbook planned the instruction according to the student edition textbook content prior to lesson. Consequently, teachers used teacher edition

textbook for additional suggestions and for making instructional decisions based on the student edition textbook content. In any case, teachers' use of textbook is strongly associated with their use of teacher edition textbook. Further research is needed to confirm and find possible explanations for this relationship.

5.1.1.2 Selecting Problems and Questions

There are two dimensions related to selecting tasks, problems, and questions from resources in this study. The first one is Selecting Questions from Workbook dimension comprising teachers' selecting questions and problems for classroom activities from mathematics workbooks. The second one is the Selecting Tasks and Questions from Auxiliary books dimension involving teachers' selecting tasks and questions from these books. The main difference between these dimensions is based on the nature of the resource. However, the way of teachers' uses of those books is very similar.

According to the teachers' responses given to Selecting Questions from Workbook dimension, the mean value for this dimension was found to be 3.38; whereas the mean value of the Selecting Tasks and Questions from Auxiliary books dimension was found to be 3.17. This could be interpreted that teachers used workbook and auxiliary books for selecting questions and problems at a moderate level. There might be two explanations for interpreting this result. First, teachers do not only use the workbook but also look for several books for selecting questions and problems. It could be argued that the analyses of frequency distributions for both dimensions support this assumption because these analyses showed that teachers most frequently used questions from the workbook and auxiliary book that were not included in the student edition textbook. In other words, teachers knew what the mathematics student edition textbook involved and made an evaluation with respect to the student edition textbook content; and then tended to use other books or resources. Moreover, according to the teachers' responses to the General Characteristics of Student Edition Textbook Questionnaire, the mean scores of items related to degree of covering questions were below 3.00, which showed that teachers found the degree to cover questions of student edition textbook poor. This could

be interpreted that teachers initially examine the student edition textbook for selecting questions. However, they find them poor. Therefore, they look for supplementary books, particularly workbook and auxiliary books, to select questions.

Second explanation could be that the process of selection and integration of tasks and problems from resources is intertwined. The analyses of the interview and observation studies support this assumption considering that teachers selected and integrated problems from the student edition textbook, workbook, and other books in terms of the difficulty level of the problems. Particularly, they drew attention to the problems that all students could solve at least a problem and gave opportunities to solve them, as Doerr and Chandler-Olcott (2009) pointed out. It could be interpreted that teachers are not only concerned with selecting tasks from the textbooks, but they also consider students' levels of mathematical understanding (Durwin & Sherman, 2008); therefore, teachers make necessary modifications in resources for their students (McDuffie & Mather, 2009).

5.1.2 Teachers' Integration of Mathematics Textbook

In scope of this study, teachers' reading and selection decisions were examined and investigated through the Use of Mathematics Textbooks Questionnaire which measures the frequency of the use of textbooks by mathematics teachers along four dimensions. In particular, the Reading Student Edition Textbook dimension comprised a series of decisions related to preparation for lessons, doing the introduction just as shown in the student edition textbook, connecting the concepts with daily life as shown in the textbook, using the textbook to relate the subject to other/different lessons, and using the textbook for definitions, problems, and examples. This dimension involved teachers' reading decisions about what kinds of activities or examples were suggested in the student edition textbook and what students were expected to learn, as Sherin and Drake (2004) identified. Moreover, the Selecting Questions from Workbook and Selecting Tasks and Problems from Auxiliary Books dimensions comprised a series of decisions related to selecting questions, problems, and tasks from workbook and auxiliary books. However, the quantitative data obtained from these dimensions could

not provide adequate explanations about how teachers read and interpret the textbooks, how they adapted and interpreted the questions and tasks from these resources, and why they used these resources. The qualitative follow-up data obtained from interviews and observations helped to further explain the quantitative results.

The findings of the interview and observation data indicated that teachers looked for different resources, selected tasks and questions, integrated them in their teaching, and implemented them in practice. With respect to the documentational approach of didactics (Gueudet & Trouche, 2009), this was called *teachers' documentational work*. Particularly, the interaction between teacher and textbooks, and teachers' integrating of tasks in the textbooks into practice were discussed based on documentational approach of didactics.

According to the teachers' responses to the items in the Reading Student Edition Textbook dimension, it could be interpreted that the teachers read the student edition textbook for the instructional decisions, particularly to introduce the topic, make real-life connections, make connections with other courses, and make definitions. Moreover, the analysis of interview and observation data revealed that teachers designed the lessons based on the student edition textbook content and there was an overlap between the content taught by teachers and the student edition textbook content in their lessons, as Freeman and Porter (1989) reported. In parallel with these findings, it could be argued that the student edition textbook had a crucial role for teachers who read it to make instructional decisions. There might be two explanations to be considered while interpreting this argumentation.

The first explanation concerns the impact of the Ministry of National Education in implementation of curriculum and using of textbooks (i.e. student edition textbook, workbook, and teacher edition textbook) considering that the textbooks were official resources coming from an "official institution" (i.e. Ministry of National Education) and had a significant role for mathematics teachers in determining the mathematical content and instruction. In particular, the findings of the teacher interviews suggested that they felt constrained to use the textbooks distributed by the Ministry of National Education free of charge to students and teachers because they mentioned that the inspectors

determined whether they used the textbook in their lessons. For instance, one of the teachers who had over 20 years of teaching experience talked about the inspection experience "[...] One day an inspector came and said, you never ask questions from the textbook; you always solve them (ask) from your mind. You should use textbooks during the instruction, please be a model for the beginning teachers as well" (P5-Q38). Another teacher who had about 10 years of teaching experience mentioned that

> [...] When inspectors came they looked for the exam questions, and they wanted different kinds of questions such as true-false and matching. Therefore, I try and pick questions from the student edition textbook and workbook similar to the ones in the student edition textbook and workbook. In this sense, these books are sufficient (P3-Q39).

It could be claimed that teachers were under pressure of using mathematics textbooks. Therefore, they read the student edition textbook for instructional decisions and tried to explain the subject similarly to the student edition textbook. Moreover, it seemed that the institutional factor influenced the teachers' documentational work, which was called *instrumentation*, and particularly teachers' mathematics teaching. In this sense, the inspection should be considered as an institutional factor likely to influence teachers' use of mathematics student edition textbook, as well as workbook and teacher edition textbook.

The second explanation concerns that textbooks (i.e. student edition textbook, workbook, and teacher edition textbook) which are the most available resource in Turkey might be considered to have a significant influence on teachers' documentation work. Gueudet and Trouche (2009) claimed that national character (i.e. French national character) is an influential factor on explaining the documentation approach considering that France is one of the developed countries, teachers work in classrooms equipped with technology, and that there is a free and open textbook market. Therefore, the tendency on digital resources could be expected in these developed countries. On the other hand, there is a different picture in Turkey. Particularly, most of the teachers do not have opportunity to work in classrooms equipped with technology and they have insufficient facility with using technology, and the ministry still controls the textbook

market. It seems that mathematics textbooks are the most available resource for both students and teachers and important part of learning and teaching resource in which students and teachers work in Turkey. Consequently, it could be claimed that the availability of textbooks might have played a critical role in teachers' reading student edition textbook and making instructional decisions (*instrumentation*).

According to the teachers' responses given to Selecting Tasks and Problems from Auxiliary Books dimension, it could be interpreted that teachers used questions similar to the ones in national large-scale exam questions (i.e. High School Entrance Exam) that were in the auxiliary books. Additionally, the analysis of interviews revealed that teachers believed that students became more motivated when teachers selected and solved SBS questions in their teaching. In line with these findings, it could be claimed that the auxiliary books had a potentiality to influence teachers' activity (*instrumentation*). There might be two explanations to be considered while interpreting this argumentation.

The first explanation might be teachers' concerns about selecting questions similar to the ones in the Level Determination Exam (SBS) and setting up SBS questions in mathematical activities. In particular, Turkish teachers are concerned about children's success in high school entrance exam which is a prerequisite for entrance into secondary education institutions; and parents are concerned about their children' success in the national examinations and send them to private cramming schools to get them prepared for national standardized exams (Aksit, 2007). These might be more central influence on selecting questions from the auxiliary books; owing to the fact that middle school teachers are under pressure for preparing students to the national examinations. Moreover, the analyses of interview studies indicated that teachers used SBS questions as a motivation tool since they thought that students perform better on SBS when they solve SBS questions in mathematical activities. It seemed that the existence of the national exam influence teachers' using textbook and the auxiliary books. Consequently, the findings from this study might imply that national contexts influence teachers' using mathematics textbooks, as Gueudet and Trouche (2009) pointed out.

This finding supports the findings of other Turkish researchers (e.g., Erdal, 2007): Teachers' preferences on using mostly multiple choice tests in their lesson since standardized exams are based on multiple-choice items. Consequently, teachers focus on SBS questions and the questions similar to the ones in SBS and auxiliary books had a potentiality to influence teachers' activity. It seemed that teachers developed a *document:* "setting up SBS questions and the questions similar to the ones in SBS in mathematical activities". This document also entailed (a general) *operational invariant* like: "Students perform better on SBS when they solve SBS questions in mathematical activities."

The second explanation might be teachers' concerns about looking for additional questions and problems for the lessons. Teachers' responses given to Selecting Tasks and Problems from Auxiliary Books dimension revealed that teachers frequently selected questions from auxiliary books that were not included in the student edition textbook. Moreover, the analysis of observations indicated that teachers preferred to use auxiliary books as resource for questions and problems during a class (e.g., while making connections with other courses). Another explanation might be related to teachers' choice of questions and problems. The interview data revealed that teachers looked for different resources to connect the concept with daily life and used problems from auxiliary books which were attractive for students. This finding supports the findings of other researchers (e.g., Herbel-Eisenmann, 2009): Teachers' choices when using mathematics textbooks could "undermine or support instructional goals for students' engagement with mathematics" (p.135). In line with these findings, it could be claimed that teachers' concerns about finding additional problems and considering students' interest had a crucial role in selecting resource. In this sense, auxiliary books had a potentiality to influence teachers' choices.

Another important point to consider was âbout how teachers shape and modify the resources (*instrumentalization*). In examining the process of teachers' use of mathematics textbooks, it could be argued that there were interpretive processes in teachers' engagement as they used textbooks. The analysis of interviews and observations showed that teachers *read* textbooks and *selected* tasks and questions from

those books, and they *interpreted* the mathematics textbooks by *evaluating* the tasks in planning and during instruction in terms of their perception of tasks and the students' interests, experiences, and limitations and by *integrating* the tasks into the practice.

The analysis of the qualitative data revealed that teachers read introductory problems in the student edition textbook to make connections with other courses (e.g., social science and science courses) and real life experience. It seemed teachers believed that mathematics learning occurs through knowing concepts and relationships. This finding supports the findings of other researchers (e.g., Remillard, 1999, 2005). Particularly, Remillard (1999) claimed that there are the factors which influence the approach of teachers' reading text: "thought about the contents and nature of the mathematical terrain" and "the views each held about teaching and learning" (p.326). From this point of view, it could be argued that teachers' beliefs and knowledge about the nature of mathematics and teaching mathematics make differences in reading textbook. Within this context, teachers' beliefs and knowledge were guided on the conceptual understanding in reading textbooks (*instrumentalization).* It seemed that the teachers developed a *document*: "enacting mathematical tasks comprising connections with other courses and real life", as proposed by Schmidt et al. (2002). This document also entailed an *operational invariant* like: "Students must learn connections between concepts and real life experience and have an insight into the nature of mathematics and its relation to other branches of knowledge".

The analysis of interviews and observations indicated that teachers interpreted the mathematics textbooks by *evaluating* the tasks in planning and during instruction in terms of their perception of tasks and the students' interests, experiences, and limitations. The important point to consider was that teachers read and interpret the curriculum materials based on teachers' knowledge and beliefs while evaluating the materials (Sherin & Drake, 2004). From this point of view, teachers' evaluation of materials depends on their interpretation of materials. In parallel with this finding, the analysis of interviews indicated that teachers' evaluation of textbooks depended on their interpretation of textbooks with respect to students' needs and understanding of mathematics, particularly prior to instruction. For instance, during the interviews,

teachers claimed that students did not prefer to work on activities in the student edition textbook considering that students believed that the activities could not help them prepare for national standardized exams. The analysis of observations also revealed that they did not pay attention to the activities in the student edition textbook during the lessons. It seemed that the teachers had a consideration about the students' needs. Moreover, the analysis of observations revealed that teachers did not only consider the students' needs but they also considered the students' understanding of mathematics. For instance, when students did not fully understand the case, teachers added a new case to offer them additional practice. Particularly, these considerations were central to use a textbook as a resource for students' learning of mathematics (McDuffie & Mather, 2009; Rezat, 2009). It seemed that teachers' evaluations were strictly related to students' understanding of mathematics and meeting the needs and their own understanding of teaching and learning of mathematics. It could be argued that teachers evaluated the tasks in the student edition textbook in terms of students' needs and understanding of mathematics in an *instrumentalization* process and their practices and beliefs guided omitting the activities and offering additional cases.

By means of adaptation, Sherin and Drake (2004) referred to "significant changes that teachers make in the intended curriculum such as changes in the structure of a lesson, in the activities that comprise the lesson, or in the purpose of the lesson" (p. 30). In the analysis of adaptation process, they identified three approaches: a) creating new activities, tasks, or materials; b) replacing one part of a lesson with something different; and c) omitting part of a lesson. According to this view, it was difficult to claim that teachers made significant changes in the structure of the lesson for this study. On the other hand, it could be claimed that teachers made changes in the tasks and problems in the student edition textbook and workbook. Particularly, they replaced one part of the student edition textbook or workbook (e.g., problems and tasks) with a part of an auxiliary book; and they omitted the part of the student edition textbook and workbook. The analysis of the interviews and observations revealed that a few of the teachers created new tasks and materials. In particular, only one of the teachers used her activity sheet during the lesson; others used the tasks in textbooks. Based on the findings

of the study, it could be argued that teachers were more likely to *integrate* the tasks into the classroom rather than *adapt* the tasks and materials.

The analysis of interviews and observations indicated that teachers interpreted the mathematics textbooks by *integrating* the tasks into the practice according to their evaluation of tasks in planning and during instruction in terms of their perception of tasks and the students' needs and understanding of mathematics (*instrumentalization)*. Particularly, during the observations, they tried to integrate the tasks in the textbooks (e.g. student edition textbook, workbook, and auxiliary book) into the classroom; and made changes in tasks and problems in the textbook intentions in terms of their perspectives and beliefs and students' understanding of mathematics. It could be argued that teachers considered the levels of task difficulty in terms of students' understanding of mathematical concepts when preparing the questions, problems, and examples. Therefore, they provided examples and problems for both low and high level students. It seemed that teachers developed a *document*: "enacting (or not enacting) tasks in the textbooks in terms of students' needs and students' understanding of mathematics. This also involved a general *operational invariant*: "Students understand better when the lesson is integrated the textbook tasks to meet the needs of the students and their understanding of mathematics."

The analysis of interviews and observations indicated that teachers' interactions with textbooks and relevant resources were explained through their uses and teachers' utilization schemes of resources. In particular, general schemes of utilizing a mathematics textbook were found and interpreted in different groups of middle school mathematics teachers. However, teachers mostly developed their own utilization schemes of the mathematics textbook within their individual settings (Gueudet & Trouche, 2009). It could be argued that the general utilization schemes of the mathematics textbook could be found across different teaching settings.

To sum up, the analysis of interviews and observations revealed that teachers read the several textbooks and selected tasks and questions in terms of their knowledge, beliefs, and perspectives; tried to evaluate and integrate the textbooks into the classroom; and made changes in the student edition textbook and workbook intentions

with respect to students' understanding of mathematical concepts in an intertwined process between teacher and resources distinguished as *instrumentalization* and *instrumentation.* These findings support the findings of other researchers (e.g., Brown, 2009; Remillard & Bryans, 2004): Teachers offload a degree of instructional agency onto the materials for guiding instruction. It seemed that the analysis of the process let teachers develop a *document* involving combined resources such as student edition textbook, workbook, teacher edition textbook, curriculum guidebook, discussion with colleagues, and lecture notes from previous years' or personal notes: "designing the lesson based on textbook content". These documents entailed a scheme of utilization of resources, with (general) *operational invariant* like: "Student edition textbook help to determine the structure and content of the instruction prior to lesson". It could be argued that the set of textbooks played a crucial role for teachers who used them as a primary resource for teaching mathematics.

The teachers' use and interpretation of textbooks discussed in this study were likely to illuminate teachers' documentation works and documents. The important point to consider was that teachers used the student edition textbook, workbook, and teacher edition textbook for four years, and it was remarkable to see teacher's general perspective about using and interpreting these textbooks. It could be claimed that the findings of the study would help predict teachers' documentational works and interactions with resources in other topics. However, the teachers' documentational works were analyzed in terms of a specific concept (i.e. ratio and proportion) in this study.

Gueudet and Trouche (2009) stated that different kinds of resources bring out a new resource and document is as an output of the interaction between those resources and the teacher. This kind of process cannot be isolated from teachers' professional activity and professional development because a document is developed by teachers' use of the set of resources and specifically shaped by teacher' activity and experience through the classroom context (Gueudet & Trouche, 2009). Therefore, the documents which comprised particularly student edition textbook, workbook, teacher edition textbook, and supportive would lead to a new resource for the next year. It seemed that

the teachers developed the document over the years and it was an ongoing process in which textbooks had a particular role. However, further research is certainly needed to render the development of these documents.

5.1.3 Effects of Gender, Teaching Experience and Class Size on Teachers' Use of Mathematics Textbooks

In this section, the results from the inferential statistics analysis will be summarized and discussed under three topics; gender, years of teaching experience, and class size. The conclusions will also be presented together with discussions.

5.1.3.1 Gender

The findings of this study showed that there was a significant effect of "gender" on teachers' decisions to use mathematics textbooks. It was implied that female teachers were more likely to use textbooks for selecting tasks and questions from auxiliary books. This finding was not consistent with the previous research. The literature suggested that teacher gender do not influence the classroom practice (e.g., Nisbet & Warren, 2000) and do not significantly influence teachers' decisions to use textbooks in mathematics (e.g., Jamieson-Proctor & Byrne, 2008). However, there are some nuances appeared between female and male teachers' instructional decisions. For example, Li (1999) reported that female teachers were likely to be more student-centered, indirect and supportive of students than male teachers. So, it might be concluded that Turkish female teachers tend to find more supportive methods such as using auxiliary books to the instructional decisions for students to teach mathematics compared to male teachers.

Although the results of the current study on gender indicated a gender difference in selecting questions and problems from auxiliary books, the role of gender in teachers' using mathematics textbooks is not very clear. Female teachers' scores on selecting questions from supportive resources were higher than male teachers' scores, but it is difficult to claim that this had an impact on using textbooks. Particularly, the findings of the qualitative data of this current study also showed that female teachers draw much attention to evaluate the problems in terms of students' levels of mathematical

understanding than did male teachers, but there was not a clear difference between female and male teachers in terms of using textbooks in mathematics. Interpreting this finding is somewhat difficult, but it will be of great importance to consider the Turkish cultural and educational values while discussing the use of supportive resources in mathematics. Further research is needed to further look into and find possible explanations for this seemingly conflict like the effect of selecting tasks and questions from auxiliary books on teacher gender.

5.1.3.2 Years of Teaching Experience

The results of this study also indicated that years of teaching experience had no significant effect on teachers' decisions to use textbooks in mathematics. Years of teaching experience did not significantly influence teachers' decisions to use textbooks in mathematics. This finding is consistent with some of the studies (e.g., Jamieson-Proctor & Byrne, 2008). On the other hand, most of the studies on exploring the use of curriculum material and textbooks have suggested that experienced and beginning teachers used mathematics textbooks and curriculum materials differently (e.g. Christou et al., 2004; Moulton, 1994; Remillard & Bryans, 2004). For example, Christou et al. (2004) suggested that beginning teachers had less worries about the implementation of the curriculum and using the new textbooks and were more concerned about their preparation of their daily work and the collaboration with other colleagues. In contrast, experienced teachers were largely interested in the consequences of the innovation for their students and had less interest about the adoption of the innovation. Particularly, these differences mentioned in the literature are based on teachers' experiences in relation with the implementation of a new mathematics curriculum and new mathematics textbooks and their responses to educational change (Hargreaves, 2005). The important point to consider is that Turkish mathematics teachers who participated in the current study confronted with educational change 5 years ago and they were using the same mathematics textbooks throughout those years; therefore, such a difference could not have been found in this study.

Although the results of the quantitative data analysis on years of teaching experience did not show a difference in teachers' decisions to use textbooks in mathematics, the qualitative data analysis revealed that the experienced teachers used mathematics textbooks differently from the beginning teachers. As Remillard (1999) reported, the difference may be due to teachers' approaches to task selection: *appropriation* and *invention.* The analysis of observations, interviews, and teaching notes suggested that most of the experienced teachers invented mathematical tasks in terms of their experience and students' level of understanding mathematics. On the other hand, beginning teachers appropriated introductory task and basic exercises in the textbook directly from textbooks and show them to students. Consequently, there was not a statistically significant difference in teachers' decisions to use textbooks scores between teachers in different level of teaching experience, as measured by Use of Mathematics Textbooks Questionnaire, but there might be a practical difference in teachers' reading textbook and selecting tasks from resources in different level of teaching experience.

5.1.3.3 Class Size

Findings of the study showed that teachers teaching in classes with more than 35 students were less likely to use textbooks for reading activities than the teachers teaching in classes with less than 35 students. This result could be explained in two ways. Firstly, teachers in large classes could not find enough time to read activities and examples which are suggested in the textbook because they have less teaching time and have difficulty to complete content coverage, as Blatchford, Moriarty, Edmonds, and Martin (2002) reported. Secondly, teachers in large classes could not also provide different learning opportunities from other resources because they could not spend more time on a new material and nor do they finish the assigned textbook, similar to what Betts and Shklonik (1999) pointed out. Consequently, the results which are consistent with the literature suggested that mathematics teachers in large classes have difficulty to read activities and examples from the textbook or to use different resources.

5.1.4 Limitations and Suggestions for Future Research

There are several limitations of the study that should be considered in the interpretation and generalization of the findings. It is suggested that recognizing the weaknesses of the study will avoid any interpretation beyond the data or scope of this investigation.

The first limitation about the use of the Use of Mathematics Textbooks Questionnaire is related to the measurement of the constructs within the study. Relying on self-reported questionnaire data from teachers is one of the weaknesses in this study. Since the baseline data were constructed on teachers' description of their textbook use, the construct as indicated by the teachers might limit the study.

Another limitation of a research like this is the difficulty of measuring the construct like teachers' using textbook strategies. Most of the participants did not signify their textbook grade level in the questionnaire; however, there was a choice offered to select the textbooks grade level in the questionnaire. Therefore, the interpretation of the textbook use factor structure was indicated a general explanation which covered the use of sixth, seventh, and eight grade mathematics textbooks. Future research may focus on a specific grade level.

A third limitation of the study is related to the Turkish cultural educational characteristic. Since the Use of Mathematics Textbooks Questionnaire was designed and developed for Turkish middle school teachers' use of textbooks, the use of the questionnaire in different cultural context might be problematic. The Turkish cultural educational characteristics should be considered when it is used in different cultural contexts.

A fourth limitation of the study is related to the results of the quantitative data analysis. Some of the results of inferential statistics could not be examined through the qualitative data analysis. For instance, there was a gender difference on selecting tasks and questions from auxiliary books. It was implied that female teachers were more likely to use textbooks for selecting tasks and questions from auxiliary books. Moreover, the teachers teaching in larger classes reported less likelihood to read textbooks. Further

research may confirm possible explanations for these results. In-depth interview studies may be used to complement these differences in terms of using textbooks.

Another limitation concerns the role of researcher. The researcher tried to control bias during the interview and observation process and made a concerted effort to look objectively at the collection and analysis of the qualitative data. However, there is always the possibility of unintentional bias. For further research, a second observer or interviewer might be incorporated into the study.

The sixth limitation is related to the quantitative data collection procedure. One part of the quantitative data was collected by EARGED. Particularly, in this procedure, EARGED distributed the questionnaires to the selected schools and collected them. Therefore, the teachers might feel uncomfortable giving out the real information about their decisions on using mathematics textbooks and might have completed it carelessly.

Another limitation is related to the selection of the notion of ratio and proportion. In particular, ratios and proportions are the concepts that are often used in real life. Therefore, teachers' use and selection of real life tasks and problems from textbooks might limit the interpretation of the teachers' integration of tasks. Another mathematical topic would need to be selected to better understand the teachers' integration of tasks from textbooks.

The eighth limitation concerns the analyzing teachers' use of mathematics textbooks only at the middle school grade levels. In particular, Altun, Arslan and Yazgan (2004) found that most of the high school math teachers did not use mathematics textbooks which were distributed free of charge to students and teachers by the Turkish Ministry of National Education. Therefore, it is difficult to discuss the teachers' use of textbooks for the high school grade levels in Turkey. Further research may confirm possible explanations for this result.

There is another limitation related to data collection procedure. The quantitative data were collected simultaneously; this means that this study was a cross-sectional study. A longitudinal study would need to be performed to better understand the factor structure of the teachers' textbook use. For instance, does the level of teachers' reading textbooks and selecting tasks from textbooks lead to a change after one year? Moreover,

documentational process was “an ongoing process” (p.206), as Gueudet and Trouche (2009) indicated. In this study, the documents developed from the interviews and observations might represent a small part of teachers’ documentational process. Long-term observations are needed. Further studies might consider long-term observations.

5.1.5 Implications

The findings of the current study can have some important implications for mathematics instruction and might be helpful for educational leaders and policy-makers to increase the prospects of success for implementation of educational resources. The following suggestions can be offered based on the findings of the study.

The findings of the study will be of importance for mathematics teachers in terms of interpreting resources into the mathematics classroom. It might help mathematics teachers in finding solutions for the problems they face when they are in trouble in interpreting and selecting tasks and questions from textbooks. The findings of the study showed that mathematics teachers mostly preferred the student edition textbook for deciding what students could learn from the textbook. Teachers planned and executed the instruction according to the content of the student edition textbook. Particularly, when teachers used the real life connections, introductory activities, and connections with other courses from the student edition textbook, students were more likely to understand the purpose of the lesson and realize the importance of the subject in the real life and other courses. It seemed that teachers kept students engaged in learning mathematics when they selected the introductory activities, real-life cases, and connections with other courses. It could be claimed that these kinds of tasks in the textbooks are valuable for both teachers and students since students can follow the tasks and see what would happen next and teachers easily manage the instruction. On the other hand, there should be more alternatives that help teachers integrate and adapt the tasks into the instruction. Therefore, the teacher edition textbook should include several tasks that support teachers to introduce the lesson and make connections with real life and other courses.

The findings of the study showed that teachers found the student edition textbook poor in terms of covering questions. Therefore, teachers tended to use workbook and auxiliary books to select questions and problems after introducing the lesson. However, at the beginning of the lesson, teachers used the real-life cases and connections with other courses from the student edition textbook and found them supportive for mathematics teaching. It seemed that teachers needed enrichment questions, problems, and examples especially to keep students focused while learning mathematics. Therefore, resources (e.g., technologies, mathematical objects, everyday objects) or teacher edition textbooks which offer good questions, problems, and examples should be considered and supported. Moreover, these suggestions would provide valuable in developing the curriculum materials and (digital) resources and improving the mathematics curriculum.

According to qualitative findings of the study, two considerations transpired in Turkish national context that influence the teacher-resource interaction: (a) impact of the Ministry of National Education in use of textbooks and (b) existence of national examinations. Therefore, educators, researchers, curriculum developers should be aware of these issues in developing new teaching and learning resources. For instance, SBS questions have a particular meaning for teachers and students. Therefore, SBS questions or questions similar to the ones in the common exam questions should be considered in textbooks or other teaching resources.

The findings of the current study point to the importance of teachers' experiences and concerns with respect to the student edition textbook, workbook, teacher edition textbook, and auxiliary books. As Cohen et al. (2003) indicated, teacher who is knowledgeable about a subject and know how to present it to learners will be more likely to make good use of a mathematics text than teachers who don't know the subject or know it but not know how to present it to learners. Moreover, teachers' use of resources should be understood as a design and enactment process, as Gueudet and Trouche (2009) indicated. This allows teachers to more skilled than other teachers in designing instruction. Therefore, teachers should be aware of the ways in which teachers effectively use the resources in the classroom. For instance, seminars/workshops based

on the uses and integration of textbooks and other resources might be designed to give information to teachers on how to use resources for effective mathematics teaching. At this point, experienced teachers' experiences, beliefs, and concerns about the uses of textbooks might be valuable in designing seminars. By this way, particularly, the beginning teachers might be supported in terms of using a teaching resource.

Although textbook writers and publishers are not a primary audience, the research findings have also important implications for the design of textbooks and curriculum materials for teachers. For instance, textbook writers and publishers should be aware of the teachers' interpreting and selecting tasks from textbooks. Particularly, the interviews and observations showed that teachers integrated the tasks not only with respect to the difficulty level of the examples and problems from the student edition textbook, workbook, and other books, but also with respect to students' understanding of mathematical concepts. Therefore, textbook writers and publishers should consider the difficulty level of the examples and problems and level of mathematical skill or understanding of students when preparing the questions, problems, and examples. They might prepare examples and problems for both low and high level students. Moreover, they might consider tasks and assignments that could serve a transition between schoolwork and homework since teachers need more resources for giving homework.

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APPENDICES

APPENDIX A

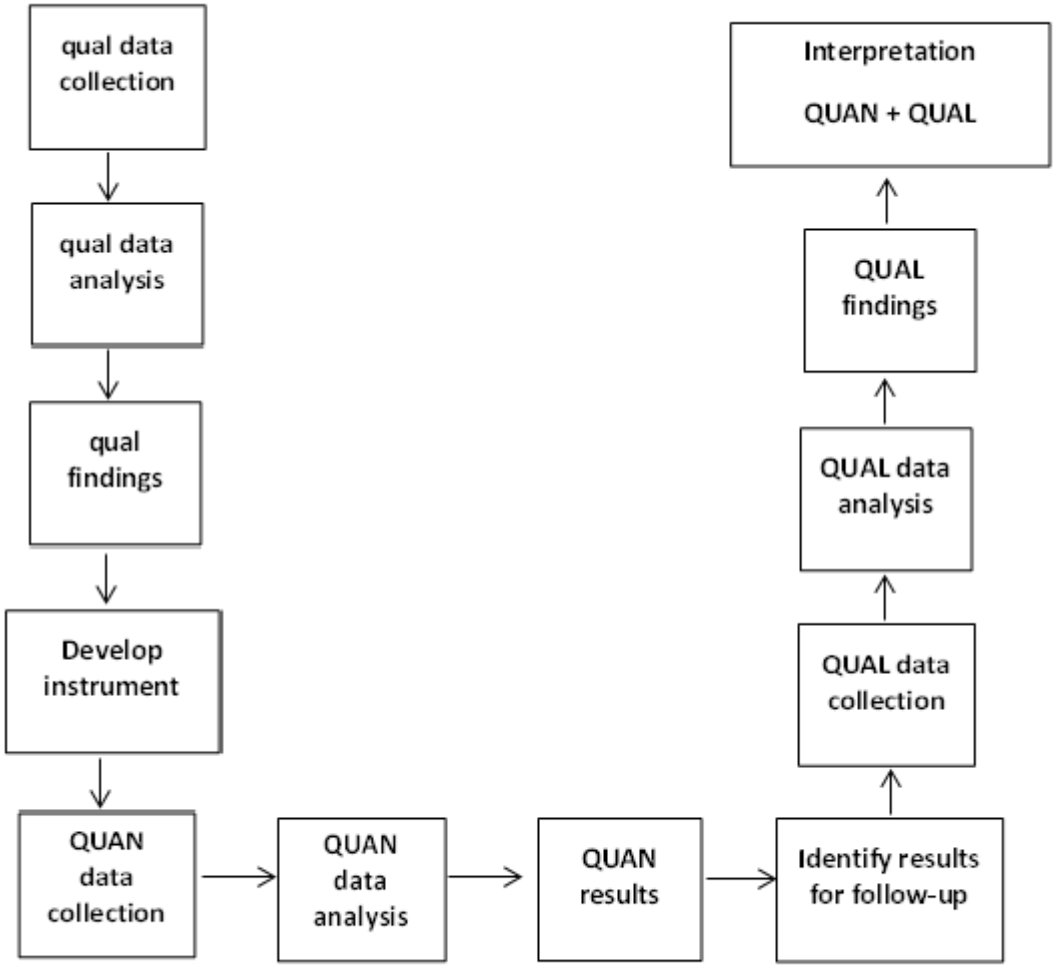

Figure A. Detailed design procedure of the study

APPENDIX B

Genel Bilgiler:

1. Ne kadar zamandır öğretmenlik yapıyorsunuz?
2. Hangi sınıflarda öğretmenlik yaptınız?
3. Hangi üniversiteyi bitirdiniz?
4. Üniversitede ya da lisede hatırladığınız kadarıyla matematik dersinde öğretmenin ve öğrencinin rolüneydi? Kullandığınız kaynaklar nelerdi ve nasıl kullanıyordunuz?

SORULAR:

Kaynak Kullanımı:

5. Öğretmenliğe başladığınızdan beri hangi kaynakları (kitap, kişisel notlar, web sitesi vs.) kullandınız? Bunlardan hangisi sizin için en önemli? Hangi amaçla nasıl yararlandınız ve yararlanmaya devam ediyorsunuz? (10 yıl öncesi-şimdi)
6. Sınıfta kullanmaya yönelik oluşturduğunuz doküman ya da materyal var mı?

   A) (Öğretmenin kendi ürettiği bir doküman yoksa)

   - Bu kaynaklara nasıl ulaştınız? Bunları nasıl seçtiniz? Neden?
   - Hangi amaçla kullanıyorsunuz ve özellikleri nelerdir? Bunları nasıl oluşturdunuz?
   - Örneğin yeni bir konuya başlayacaksınız, konuyu anlatmaya başlamadan önce içerik hakkında hangi kaynaklara ve ne için bakıyorsunuz? (Yöntem, gösterim,örnek, soru,ödev için durum nasıl?)
   - Matematiksel olarak bunlardan yararlanıyor musunuz? Hangi konularda? Neden?
   - En beğendiğiniz konu hangisidir? En beğenmediğiniz konu hangisidir? Neden?
   - Yararlandığınız kaynakları iyi yapan özellikler nelerdir?

   B) (Öğretmenin kendi ürettiği bir doküman varsa)

- Sözünü ettiğiniz kaynakları hazırlama nedeniniz nedir? Bunları hazırlarken hangi kaynaklardan yararlanıyorsunuz? Bunları nasıl kullanıyorsunuz?
- Bu kaynakların içeriğini nasıl düzenliyorsunuz?

7. Sınıf içinde bu kaynakları kullanıyor musunuz? (Kullanıyorsanız nasıl kullanıyorsunuz? Kullanmıyorsanız neden kullanmıyorsunuz?)
8. Sizi materyal kullanmaya iten özel durumlar oluyor mu? Bunlar neler?
    - Sınıf düzenini sağlamak için ya da kontrolden çıkan öğrenciler için kullandığınız herhangi bir kaynak var mı? Yoksa bunları tamamen deneyimlerinizle mi hallediliyorsunuz?
9. Ne tür öğrenci özellikleri -örneğin öğrencinin becerileri, yaşı, tutumu, davranışları ya da önceki öğrenmeleri- kaynak kullanımınızda etkilidir?
10. Meslektaşlarınızla birlikte ortak kullandığınız veya oluşturduğunuz bir kaynak var mı? Varsa nasıl yararlanıyorsunuz? Bunların etkililiği hakkında ne söyleyebilirsiniz?

Kitap Kullanımı:

11. Şu an hangi kitabı kullanıyorsunuz? Nasıl kullanıyorsunuz?
12. Okullarda kullanılan ders kitaplarını nasıl değerlendiriyorsunuz?
13. Özellikle matematik konularının içeriğini, sunumunu ve yeterliliğini nasıl buluyorsunuz?
14. Bu kitapların öğretmen ve öğrenci açısından kullanımlarını değerlendirebilir misiniz?
15. Okuldaki uygulamaların-buna yöneticiler, diğer öğretmenler de dahil olmak üzere- sizin kitap kullanımınızda etkili midir? Nasıl?
16. Öğretmen kitabını kullanıyor musunuz?
17. Yardımcı kitap kullanıyor musunuz? Nasıl?
18. Farklı yayınevlerinin kitaplarını incelediniz mi? Eski kitaplar mı daha iyi yoksa şimdiki kitaplar mı daha iyi? Nedeni nedir?
19. Sizce ideal bir kitap nasıl olmalı?

APPENDIX C

Table 3.3 Group of cities based on socio-economic development levels

Group of cities				
1	2	3	4	5
İstanbul	Eskişehir	Konya	Osmaniye	Bayburt
Ankara	Tekirdağ	Karabük	K.Maraş	Kars
İzmir	Adana	Isparta	Niğde	Şanlıurfa
Kocaeli	Yalova	Hatay	Giresun	Iğdır
Bursa	Antalya	Uşak	Kastamonu	Batman
	Kırklareli	Burdur	Tunceli	Gümüşhane
	Denizli	Samsun	Sivas	Mardin
	Muğla	Kırıkkale	Kilis	Siirt
	Bolu	Nevşehir	Bartın	Ardahan
	Balıkesir	Karaman	Aksaray	Van
	Edirne	Elazığ	Sinop	Bingöl
	Mersin	Rize	Erzincan	Hakkâri
	Bilecik	Trabzon	Çankırı	Şırnak
	Kayseri	Amasya	Erzurum	Bitlis
	Gaziantep	Kütahya	Tokat	Ağrı
	Zonguldak	Malatya	Ordu	Muş
	Aydın	Kırşehir	Diyarbakır	
	Sakarya	Artvin	Yozgat	
	Çanakkale	Afyon	Adıyaman	
	Manisa	Düzce		
		Çorum		

Table 3.9 Model fit criteria and accepted fit interpretation

Model fit criterion	Acceptable level	Interpretation
Chi-square	Tabled χ^2 value	Compares obtained value with tabled χ^2 value for given df
Comparative Fit Index (CFI)	CFI ≥ .95	Values more than .95 indicate an acceptable fit and in the range of .90-.95 to indicate good model (e.g., Bentler, 1990; Hu & Bentler, 1999)
Tucker-Lewis index (TLI; Tucker & Lewis, 1973) often referred to as the nonnormed fit index (NNFI)	TLI or NNFI≥ .95	Values more than .95 indicate an acceptable fit and in the range of .90-.95 to indicate good model (e.g., Bentler, 1990; Hu & Bentler, 1999)
Standardized-root-meansquare Residual (S-RMR)	SRMR ≤ .08	Values close to .08 or below reflect a good fit (e.g., Brown, 2006; Hu & Bentler, 1999)
Root-mean-square error of approximation (RMSEA)	RMSEA< .06	Value less than .06 indicates a good model fit, values less than .08 indicate adequate model fit, and values over .1 indicate poor model fit (e.g., Brown, 2006; Browne & Cudeck 1993)

APPENDIX D

DERS KİTAPLARININ KULLANIMINA İLİŞKİN GÖRÜŞLER

Bu bölümde, matematik ders kitaplarının, çalışma kitaplarının, öğretmen kılavuz kitaplarının ve yardımcı kitapların kullanımları ile ilgili bazı ifadelere yer verilmiştir. (Not: Sözü geçen ders kitapları, şu an okulunuzda kullanmakta olduğunuz matematik ders kitaplarıdır.)

B1. Ders kitaplarının kullanımına ilişkin görüşler

1. Derse hazırlık yaparken ders kitabı kullanırım.
2. Konu girişini ders kitabındaki gibi yaparım.
3. Kavramların günlük yaşamla olan ilişkilerini ders kitabındaki gibi yaparım.
4. Konunun diğer derslerle ilişkilendirilmesinde ders kitabı kullanırım.
5. Konunun işleniş sırası için ders kitabının konu sırasını takip ederim.
6. Konu anlatımımı, ders kitabının konu anlatımına benzetirim.
7. Konu sınırlarını ders kitabı ile belirlerim.
8. Öğrencilerin konuya ders kitabından hazırlanmalarını isterim.
9. Bilmediğim/unuttuğum kavramlar için ders kitabından yararlanırım.
10. Ders işlenişi sırasında ders kitabı kullanırım.
11. Öğrencilerden ders kitaplarını derste yanlarında bulundurmalarını isterim.
12. Derste kullandığım tanımları ders kitabından yaparım.
13. Derste kullandığım örnekleri ders kitabından seçerim.
14. Derste kullandığım problemleri ders kitabından seçerim.
15. Matematiksel temsil biçimlerini (grafik, tablo, vb. gösterimleri) ders kitabından seçerim.
16. Ders kitabındaki etkinliklerin hepsini derste yaptırırım.
17. Ders kitabındaki etkinlikleri yaptırtmak yerine okuttururum.
18. Ders kitabındaki etkinlikleri ödev olarak veririm.
19. Ödevleri ders kitabından veririm.
20. Performans ödevlerini ders kitabından seçerim.

B2. Öğrenci çalışma kitaplarının kullanımına ilişkin görüşler

21. Derste çözdüğüm soruları çalışma kitabından seçerim.

22. Çalışma kitabındaki soruları derste çözerim.

23. Çalışma kitabında bulunan merkezi sınav (örn. SBS) sorularına benzer soruları kullanırım.

24. Çalışma kitabından ders kitabındaki sorulara benzer soruları seçerim.

25. Çalışma kitabından ders kitabında olmayan soruları seçerim.

26. Çalışma kitabındaki soruları ödev olarak veririm.

27. Çalışma kitabındaki sorularla öğrencileri değerlendiririm.

B3. Öğretmen kılavuz kitaplarının kullanımına ilişkin görüşler

28. Derse hazırlık yaparken öğretmen kılavuzuna başvururum.

29. Kazanımlara öğretmen kılavuzundan bakarım.

30. İlave soruları öğretmen kılavuzundan seçerim.

31. Performans ödevlerini öğretmen kılavuzundan seçerim.

32. Bilmediğim/unuttuğum kavramlar için öğretmen kılavuzuna başvururum.

33. Ders kitabında açık olmayan durumları öğretmen kılavuzu ile netleştiririm.

34. Etkinlikleri yaparken öğretmen kılavuzuna başvururum.

35. Soruların doğru cevapları için öğretmen kılavuzuna başvururum.

36. Ders araç-gereçlerinin kullanımını öğretmen kılavuzundan öğrenirim.

37. Alternatif ölçme araçlarının (örn. ürün dosyası, kavram haritası, görüşme, vb.) kullanımını öğretmen

B4. Yardımcı kitapların kullanımına ilişkin görüşler

(MEB'nin okullara ücretsiz dağıttığı ders kitaplarının dışındaki kitaplarla ilgili görüşleri içermektedir.)

38. Derste çözdüğüm soruları yardımcı kitaplardan seçerim.

39. Konu anlatımımı, yardımcı kitapların konu anlatımına benzetirim.

40. Ders kitabında olmayan soruları yardımcı kitaplardan seçerim.

41. Derste kullandığım tanımları yardımcı kitaplardan yaparım.

42. Derste kullandığım örnekleri yardımcı kitaplardan seçerim.

43. Yardımcı kitaplarda bulunan merkezi sınav (örn. SBS) sorularına benzer soruları kullanırım.

44. Derste kullandığım problemleri yardımcı kitaplardan seçerim.

45. Sınavlarda sorduğum soruları yardımcı kitaplardan seçerim.

46. Öğrencileri yardımcı kitaplardaki sorularla değerlendiririm.

ŞU AN KULLANILAN DERS KİTAPLARININ GENEL ÖZELLİKLERİ

Bu bölümde, şu an kullanılan matematik ders kitaplarının genel özellikleri verilmiştir.

1. Programa uygunluğu
2. Kavramların birbiriyle bağlantısı
3. Gerçek hayatla bağlantısı
4. Önceki öğrenmelerle bağlantısı
5. Diğer derslerle bağlantısı
6. Kavramların açıklamaları
7. Kavramların doğruluğu
8. Konuların sırası
9. Konu anlatımları
10. Tanımların içeriği
11. Çözümlü örnek sayısı
12. Soru sayısı
13. Soruların zorluğu
14. Soruların SBS' de çıkan sorulara benzerliği
15. Soruların öğrenci seviyesine uygunluğu
16. Soru tipleri (çoktan seçmeli, boşluk doldurma, vs.)
17. Matematiksel dili
18. Yönlendirmelerin güvenirliği
19. Etkinlik sayısı
20. Etkinliklerin içeriği
21. Proje ödevlerinin sayısı
22. Proje ödevlerinin içeriği

23. Alternatif ölçme araçlarının içeriği (ürün dosyası vb.)
24. Öğrenciyi motive etme düzeyi
25. Kavram yanılgılarını belirtme
26. Problem çözme tekniklerinin gösterimi
27. Renklerin ilgi çekiciliği
28. Sayfa düzeni
29. Yazıların büyüklüğü
30. Kitabın boyutları
31. Kağıt kalitesi

Frequency distribution of teachers' reading student edition textbook

	Item 10 n(%)	Item 1 n(%)	Item 6 n(%)	Item 2 n(%)	Item 12 n(%)	Item 15 n(%)	Item 3 n(%)	Item 4 n(%)	Item 13 n(%)	Item 14 n(%)
Never	9 (1.7%)	4 (0.8%)	14 (2.7%)	14 (2.7%)	24 (4.7%)	11 (2.1%)	10 (1.9%)	24 (4.6%)	29 (5.6%)	30 (5.8%)
Rarely	62 (11.9%)	52 (10.1%)	73 (14%)	78 (15%)	73 (14.2%)	69 (13.3%)	68 (13.2%)	90 (17.3%)	100 (19.3%)	102 (19.7%)
Some-times	111 (21.3%)	133 (25.7%)	152 (29.2%)	184 (35.3%)	163 (31.7%)	195 (37.7%)	223 (43.2%)	192 (37%)	226 (43.5%)	231 (44.7%)
Usually	203 (39%)	208 (40.2%)	228 (43.8%)	193 (37%)	199 (38.6%)	200 (38.7%)	185 (35.9%)	178 (34.3%)	150 (28.9%)	139 (26.9%)
Always	136 (26.1%)	120 (23.2%)	53 (10.2%)	52 (10%)	56 (10.9%)	42 (8.1%)	30 (5.8%)	35 (6.7%)	14 (2.7%)	15 (2.9%)
Total	521 (100%)	517 (100%)	520 (100%)	521 (100%)	515 (100%)	517 (100%)	516 (100%)	519 (100%)	519 (100%)	517 (100%)

Frequency distribution of teachers' selecting questions from workbook

	Item 23 n(%)	Item 25 n(%)	Item 27 n(%)	Item 22 n(%)	Item 24 n(%)	Item 21 n(%)
Never	8 (1.5%)	17 (3.3%)	23 (4.4%)	19 (3.7%)	30 (5.9%)	34 (6.6%)
Rarely	34 (6.6%)	57 (11.1%)	55 (10.6%)	78 (15%)	82 (16.2)	103 (19.9%)
Some-times	127 (24.5%)	158 (30.7%)	178 (34.4%)	193 (37.1%)	158 (31.3%)	218 (42.2%)
Usually	260 (50.2%)	220 (42.7%)	201 (38.8%)	183 (35.2%)	199 (39.4%)	146 (28.2%)
Always	89 (17.2%)	63 (12.2%)	61 (11.8%)	47 (9%)	36 (7.1%)	16 (3.1%)
Total	518 (100%)	515 (100%)	518 (100%)	520 (100%)	505 (100%)	517 (100%)

Frequency distribution of teachers' reading teacher edition textbook

	Item 29 n(%)	Item 28 n(%)	Item 33 n(%)	Item 34 n(%)	Item 37 n(%)	Item 31 n(%)	Item 32 n(%)	Item 30 n(%)	Item 36 n(%)	Item 35 n(%)
Never	5 (1%)	8 (1.5%)	20 (3.8%)	26 (5%)	29 (5.6%)	29 (5.6%)	41 (7.9%)	29 (5.6%)	70 (13.6%)	89 (17.3%)
Rarely	21 (4%)	38 (7.3%)	63 (12.1%)	80 (15.5%)	112 (21.7%)	74 (14.2%)	100 (19.3%)	88 (16.9%)	133 (25.9%)	145 (28.3%)
Some-times	46 (8.8%)	106 (20.3%)	131 (25.1%)	160 (30.9%)	127 (24.6%)	205 (39.4%)	143 (27.7%)	199 (38.2%)	144 (28%)	127 (24.8%)
Usually	191 (36.5%)	227 (43.5%)	206 (39.5%)	182 (35.2%)	192 (37.1%)	170 (32.7%)	166 (32.1%)	161 (30.9%)	122 (23.7%)	111 (21.6%)
Always	260 (49.7%)	143 (27.4%)	101 (19.4%)	69 (13.3%)	57 (11%)	42 (8.1%)	67 (13%)	44 (8.4%)	45 (8.8%)	41 (8%)
Total	523 (100%)	522 (100%)	521 (100%)	517 (100%)	517 (100%)	520 (100%)	517 (100%)	521 (100%)	514 (100%)	513 (100%)

Frequency distribution of teachers' selecting tasks and questions from auxiliary books

	Item 43 n(%)	Item 40 n(%)	Item 38 n(%)	Item 44 n(%)	Item 45 n(%)	Item 42 n(%)	Item 39 n(%)	Item 41 n(%)	Item 46 n(%)
Never	8 (1.6%)	13 (2.6%)	17 (3.4%)	16 (3.2%)	34 (6.8%)	29 (5.8%)	52 (10.4%)	66 (13.2%)	99 (19.9%)
Rarely	40 (8%)	43 (8.6%)	50 (10%)	67 (13.4%)	90 (18.1%)	82 (16.5%)	123 (24.6%)	119 (23.8%)	115 (23.1%)
Some-times	121 (24.1%)	122 (24.4%)	191 (38%)	208 (41.5%)	201 (40.4%)	187 (37.6%)	190 (37.9%)	180 (35.9%)	179 (35.9%)
Usually	252 (50.2%)	240 (48%)	207 (41.2%)	175 (34.9%)	148 (29.8%)	167 (33.5%)	123 (24.6%)	116 (23.2%)	96 (19.3%)
Always	81 (16.1%)	82 (16.4%)	37 (7.4%)	35 (7%)	24 (4.8%)	33 (6.6%)	13 (2.6%)	20 (4%)	9 (1.8%)
Total	502 (100%)	500 (100%)	502 (100%)	501 (100%)	497 (100%)	498 (100%)	501 (100%)	501 (100%)	498 (100%)

APPENDIX I

GÖRÜŞME SORULARI

İlk Görüşme Soruları

Öğretmenin Girdiği Sınıflar:_____

Tarih: _____

Bu görüşme, matematik öğretimi hakkındaki genel görüşleriniz ve kaynak kullanımlarınız hakkındadır. Görüşmedeki soruların her biri matematik dersi kapsamında sizin değerlendirmelerinize ve görüşlerinize yöneliktir. Sorulara vereceğiniz cevaplar doktora tezim kapsamında sizin isminizi, kişiliğinizi ve çalıştığınız kurumu ortaya çıkarmayacak bir biçimde ele alınacaktır.

Genel bakış: Öğretmenin matematik öğretimi hakkındaki görüşleri

1. Öğretim yönteminiz hakkında neler söyleyebilirsiniz?
2. Matematik öğretiminiz hakkında kısaca bilgi verebilir misiniz?
3. Öğrencilerin matematiği nasıl öğrendiğini ya da nasıl öğrenebileceğini düşünüyorsunuz?
    a. Öğrencilerin bu kapsamda ne tür ihtiyaçları var?
4. Derste ne tür öğretim yöntem ve teknikleri kullanıyorsunuz?
    a. Bu tekniklerin sizce ne kadarı ders kitabında yer alıyor?
    b. Ders kitabının önerdiği yöntemleri kullanıyor musunuz?
5. Derste sizi zorlayan bir durumla (matematiksel olarak) karşılaştığınızda neler yapıyorsunuz?
6. Planlanan ya da programın amaçları genelde sizin öğretim amaçlarınıza uyuyor mu?

Kullanılan Kaynaklar: Öğretmenin kullanılan kaynaklar hakkındaki görüşleri

7. Matematik dersi için kullandığınız kaynakların matematiksel içerik düzeyini nasıl buluyorsunuz?
8. Bu kaynaklar öğrencilerin matematiği öğrenmelerinde ne kadar yarar sağlıyor?
9. Bir kaynak, matematiksel anlamda nasıl öğretici olmalı?

10. Bir kaynağın nasıl daha iyi kullanılacağı ile ilgili düşünceliriniz neler?
11. Öğretmenin kaynak kullanımında bilinçli olması öğretimini nasıl etkiler?
12. Öğretim yönteminizi belirlerken kitaplar nasıl belirleyici bir rol oynuyor? Örneğin kaynakların dersi planlama, derste uygulama ve değerlendirme süreçlerindeki kullanımları ile ilgili bir yüzde verebilir misiniz?
13. Farklı kaynakların ne tür özellikleri sizin için önemli?
14. Ders sonunda ya da dönem sonunda kaynaklar ya da konunu öğretimi ile ilgili not ettiğiniz değişiklikler var mı?
15. Kitaplar, öğrencilerin ne tür öğrenci ihtiyaçlarını karşılıyor?
16. Kaynakların veya kitapların matematiksel içeriği öğrencilerin başarısını kestirmeye yardımcı olabilir mi?
17. Dönem veya sene boyunca kitaplarda değiştirilmesi gereken bir yer, örneğin konun anlatımı, veriliş sırası, örnekleri vs. var mı?
18. Derste, ders kitabı kullanmak öğretiminizi nasıl etkiliyor? (destekliyor mu yoksa size bir engel mi oluşturuyor?)

İkinci Görüşme Soruları

Ders kitabı, öğrenci çalışma kitabı, öğretmen kılavuz kitabı ve yardımcı kaynak kullanımları:

1. Ders kitapları, öğrenci çalışma kitabı, öğretmen kılavuzu, internetteki öğretmen portalları, matematik dersi öğretim programı ve geçmiş yıllara ait ders kitaplarının matematik öğretiminize sağladığı katkıyı açıklayabilir misiniz?
    a. Derse hazırlıkta, derse başlangıçta ve değerlendirme sürecinde nasıl kullanıyorsunuz?
2. Ders öncesinde dersi planlarken hangi kitapları kullanıyorsunuz? Nasıl?
3. Ders sırasında kullandığınız kitap var mı? Varsa bunları ne için ve nasıl kullanıyorsunuz?
4. Ders kitabında yer alan soruları, problemleri, etkinlikleri, örnekleri vb. nasıl kullanıyorsunuz?
    a. Ders kitabındaki örnekleri nasıl buluyorsunuz? Dersin hangi aşamasında nasıl kullanıyorsunuz?

b. Problemleri nasıl buluyorsunuz? Dersin hangi aşamasında nasıl kullanıyorsunuz?
c. Etkinlikleri nasıl buluyorsunuz? Dersin hangi aşamasında nasıl kullanıyorsunuz?
d. Konu anlatımlarını nasıl buluyorsunuz? Dersin hangi aşamasında nasıl kullanıyorsunuz?
e. Değerlendirme sorularını nasıl buluyorsunuz? Dersin hangi aşamasında nasıl kullanıyorsunuz?

5. Ders kitabındaki tüm bu soruların, örneklerin, etkinliklerin öğrencileri SBS'ye hazırlanmada nasıl yardımcı olduğunu düşünüyorsunuz?
6. Öğrenci çalışma kitaplarındaki soruları hangi amaçla kullanıyorsunuz?
   a. Bu soruları dersin hangi aşamasında nasıl kullanıyorsunuz?
   b. Ders kitaplarındaki sorulardan farkı nedir?
7. Öğretmen kılavuz kitabını hangi amaçla kullanıyorsunuz?
   a. Öğretmen kılavuzu ders kitabını ve öğrenci çalışma kitabını destekler nitelikte mi?
   b. Öğretmen kılavuzunun içeriği ve konu anlatımını nasıl buluyorsunuz?
8. Ders kitapları dışında kullandığınız kaynaklar var mı? Varsa nelerdir?
   a. Bu kaynakları tercih nedeniniz nedir?
   b. Bunları hangi amaçla nasıl kullanıyorsunuz?
   c. Bu kaynakların ders kitaplarından farkı nedir?

Üçüncü Görüşme Soruları

Sınıf :_____

Dersin Konusu: _____

Tarih: _____

1. Derse nasıl giriş yaptınız?
   a. Bu girişi yaparken neleri göz önünde bulundurdunuz?
   b. Kullandığınız kaynak, yaptığınız girişe bu anlamda yardımcı oldu mu?
2. Dersin işlenişi için nasıl bir sıra izlediniz?

a. İzlediğiniz bu sıra kaynaklarda belirtildiği gibi mi? (Cevap evetse, hangi kaynakları bu anlamda kullanıyorsunuz? Cevap hayırsa, bu sıra nasıl oluşuyor?)

3. Derste verdiğiniz örnekleri nasıl seçtiniz?
   a. Bunları hangi kaynaklardan seçtiniz?
   b. Bu örnekleri seçerken hangi kriterleri göz önünde bulundurdunuz?
   c. Bunları ders içinde nasıl kullandınız?
   d. Örnekleri sunarken kaynaktaki haliyle mi sundunuz? (Cevap hayırsa, neden değişiklik yapma ihtiyacı duydunuz? Neleri göz önünde bulundurdunuz?)
4. Derste kullandığınız soru ve problemleri nasıl seçtiniz?
   a. Bunları hangi kaynaklardan seçtiniz?
   b. Bu problemleri seçerken hangi kriterleri göz önünde bulundurdunuz?
   c. Bunları ders içinde nasıl kullandınız?
   d. Problemleri sorarken kaynaktan aldığınız haliyle mi sordunuz? (Cevap hayırsa, neden değişiklik yapma ihtiyacı duydunuz? Neleri göz önünde bulundurdunuz?)

Dördüncü Görüşme Soruları

Öğrencilerin kaynak kullanımlarının değerlendirilmesi:

1. Öğrencilerin en çok kullandıkları kaynaklar nelerdir? Bunları hangi amaçlar için kullanıyorlar?
2. Derste öğrencilerle kullandığınız kaynaklar nelerdir? Bunları hangi amaçlar için kullanıyorsunuz?
3. Öğrencilerin ders kitaplarından matematiği öğrenebilme düzeyleri nedir?
4. Öğrencilerin kaynak kullanımlarında
   a. matematik başarı düzeyleri
   b. velilerin eğitim düzeyleri
   c. sosyo-ekonomik düzeyleri

ne düzeyde etkilidir?

Beşinci Görüşme Soruları

Konu Kapsamında Kaynak ve Kitap Kullanımı

(ders öncesi sorulması planlanan sorular)

1. Oran-orantı konusunda öğrencilerin öğrenmesi gereken kazanımlar nelerdir? (Öğretim programının belirttiği kazanımlardan başka öğrencilerin öğrenmesini düşündüğünüz kazanımlar var mı?
2. Oran-orantı konusunda hangi kavramları ele alacaksınız? Bunları ele alırken ne tür kaynaklar kullanacaksınız? (Eğer varsa bu kaynakların hangi özellikleri sizin için belirleyici oldu?)
3. Oran-orantı konusunda ne tür sorular (problemler) soracaksınız? Bu sorular için ne tür kaynaklar kullanacaksınız? (Eğer varsa bu kaynakların hangi özellikleri sizin için belirleyici oldu?)
    a. Bunları sınıfa adapte ederken neleri göz önünde bulunduracaksınız?
    b. Ders kitabında konuyla ilgili verilen hangi soruların ve problemlerin ne kadarını kullanmayı düşünüyorsunuz?
4. Oran-orantı konusunda ne tür örnekler ve gösterimlerden yararlanacaksınız? Bu sorular için ne tür kaynaklar kullanacaksınız? (Eğer varsa bu kaynakların hangi özellikleri sizin için belirleyici oldu?)
    a. Bunları sınıfa adapte ederken neleri göz önünde bulunduracaksınız?
    b. Ders kitabında konuyla ilgili verilen hangi örneklerin ve gösterimlerin ne kadarını kullanmayı düşünüyorsunuz?
5. Bu bağlamda kullandığınız kaynakların içeriği, öğretim yönteminizi nasıl etkiliyor?
6. Ders öncesinde öğrencilerin oran-orantı konusu için bir hazırlık yapması gerekiyor mu? (Öğrencilerin yapması gerekenler varsa nedir? Bunun için belirli bir kaynak kullanmaları gerekiyor mu?)

NOT: Ders öncesinde oran-orantı konusu için üzerinde durmadığımız başka hazırlıklar var mı?

(ders sonrası sorulması planlanan sorular)

7. Ders işlenişi sırasında belirlediğiniz örnek, soru veya problemlerin ne kadarını uygulayabildiniz?
    a. Kaynaktaki bu bilgiler nasıl bir değişime uğradı?
    b. Yapılan değişikliklerin nedeni neydi?
8. Ders işlenişi sırasında hangi kaynakları, nasıl kullandınız?
9. Kullandığınız kaynak öğrencilerin oran-orantı konusunu öğrenmelerinde yeterli olabildi mi?
10. Derste kullandığınız kaynağın sorularını, örneklerini, gösterimlerini sınıfta kullanırken nelere dikkat ettiniz?
11. Kullandığınız kaynaklar sizin bilginize bir şey kattı mı?
12. Oran-orantı konusunu bilmeyen biri (öğrenci, öğretmen, veli) bu kaynakları kullanırsa bunlardan konuyu tek başına öğrenebilir mi?
13. Ders öncesinde plandıklarınızın ne kadarını gerçekleştirebildiniz? Bu süreçte neler etkili oldu?
14. Konuyla ilgili ödev verdiniz mi?
    a. Verdiyseniz ne tür sorular seçtiniz? Kaynağı nedir?
15. Oran-orantı konusunda öğrencilerin öğrenmesi gereken başka bilgiler var mı?
16. Oran-orantı konusu, ilerleyen hangi konularla bağlantılı olacak?

NOT: Ders işlenişi sırasında ve sonrasında oran-orantı konusu için üzerinde durmadığımız başka bir durumlar söz konusu mu?

APPENDIX J

CURRICULUM VITAE

PERSONAL INFORMATION

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FOREIGN LANGUAGES

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PUBLICATIONS

1. Fadlelmula, K.F. & Özgeldi,M. (2010). How a learner self-regulates reading comprehension: A case study for graduate level reading. *Journal of US-China Education Review, 7(10).*
2. Ubuz, B., Erbaş, A.K., Çetinkaya, B., & Özgeldi, M. (2010). Exploring the quality of the mathematical tasks in the new Turkish elementary school mathematics curriculum guidebook: the case of algebra. *ZDM – The International Journal on Mathematics Education*, 42(5), 483-491.

APPENDIX K

TURKISH QUOTATIONS

[...] Başlangıçta ders kitabına bakıyorum. Öğrencinin kullandığı kitaba, sonra çalışma kitabına da bakıyorum. Baktım ki aklıma takılanlar var, çıkaramadığım noktalarda öğretmen kılavuzuna bakıyorum.[...]Ayrıca programın orjinalini incelemeyi tercih ediyorum. Çünkü ders kitabında farklı farklı öneriler var, programda da aynı şekilde ama temelini görmek istiyorum ve ne düşünülmüş diye bakıyorum (P1-Q1).

[...] Mutlaka bir ders kitabım oluyor. Hangi seylerle girmis ona bakıyorum. Öğretmen kılavuzuna bakıyorum mutlaka. Genel çizgileri neler, hangi kriterlere dikkat etmis onlara bakıyorum. Okut diyo, etkinliği yap diyor, bunları madde madde belirliyorum. Kendi hazırladığım daha önceki yıllardan notlarım varsa gerekirse onlar üzerinde değişiklik yapıyorum. Kullandığımız ek kaynak varsa oradan da ödev verecek şekilde konuyu tam olarak planlamış oluyorum. Ders kitabından ve çalışma kitabından ders bittikten sonra çözebileceğim soruları kafamda tasarlıyorum (P2-Q2).

[...] Biz P7 ile napıyoruz? Önceden plana bakıyoruz. Önce şurda başlangıcı var ya da, ne istiyor ona göre bir hafta üzerinde düşünüp sonra P7 ile ilgili yerlere bakıyoruz, buralara (kitabın üzerine) yazıyoruz. Verilmesi gereken örnekleri çıkartıyoruz, soruları tarıyoruz (P3-Q3).

[...] Kitapta önemli olan yerlerin altını çiziyorum. Mesela şu konuda bu işlenmeyecek ya da şu konuda şu örnek çözülecek diyip önemli bulduysam onların altını çiziyorum. Zaten kitaptaki sorulara ve örneklere baktığımda bunlar benim düşündüğüm sorular oluyor (P4-Q4).

Otoyollarda 120kilometre/saat olarak bilinen hız sınırını aşan sürücülerin görme oranının düştüğü ve daha yüksek hızlarda da "hız körü" oldukları bilinmektedir. Araç kullanırken görme açısını 30 kilometreyi geçince bu açı 330 dereceye kadar düşmektedir. Aşırı hız kazalara, can ve mal kaybına sebep olduğu gibi, aracın yakıt tüketimini de artırmaktadır. Aracın hızı ile görme açısı arasında nasıl bir ilişki vardır? Aracın hızı ile yakıt tüketimi arasında nasıl bir ilişki vardır? (MEB, 2007, p.96).

[...] Konu girişindeki örneği sınıfta okutturuyorum ve ne anladıkları konusunda tartışmalarını sağlıyorum. Anlamayan öğrenciler için başka örnekler sunuyorum. Mesela o anda dışarıdaki ağaçları göstererek ağaçların oranları hakkında yorum yapmalarını istiyorum. Ya da öğrencinin çevresi, ailesi ile ilgili örnekler vermeye çalışıyorum. Bunlar öğrencilerin daha iyi anlamasını sağlayan örnekler (P4-Q5).

[...] Onları okutuyoruz. Okuyalım diyoruz. Sonra burada ne yapmış, ne anlatılmak istenmiş diyoruz. Ama bizim çocuklarımız daha bilgili geldiği için yetersiz kalıyor. Daha iyi örnekler sunuyorlar (P3-Q6).

[...] Öğrenci profili bunda önemli, işlenişi o açıdan değerlendiriyorum ama ana noktada başladığım şey kavram olarak oran orantı nedir, güncelliği önemli, nereden geliyor bu bilgi gibi. Günlük yaşamla ilgisini bulmaya çalışıyorum biraz da (P1-Q7).

[...] Gazetelerde, televizyonlarda havuz problemleri, işçi problemleri bizim ne işimize yarayacak diyorlar, bu bir mantıktır. Onlar bilmeden karşı çıkıyorlar. Ama bir şeyin mantığını anlatmakta kullanmalısın. Çocuk anca o zaman anlayabilir. [...] Günlük hayatta işçi çalışmıyor mu? Mühendis çalışmıyor mu? Onun mantığını çocuğun bilmesi gerekiyor (P5-Q8).

[...] Doğru orantıya, ters orantıya örnek veriyoruz. Herkes bir şey söylüyor, günlük hayattan akıllarına geleni söylüyorlar, işçi problemleri gibi (P6-Q9).

[...] Fen bilgisi dersi için oran-orantı çok önemli bir konu. Bu konuda çocukların eksikleri de var. Birinci kademeden eksik mi geliyorlar yoksa hiç mi görülmüyor bilemiyorum. [...]Fen dersine yatırım olması amacıyla bir takım bilgiler vermek zorunda kalıyorum (P7-Q10).

[...] İlişkili olduğu konuları düşünüyorum. Hatta birazcık ilgili olduğum için belki de paylaşma imkanımız olduğu için bu konunun fende sosyalda kullanımı nasıl, onlarla ilişkisi nasıl, onları da göz önünde bulunduruyorum. Bu şekilde oran konusu sosyalda ölçekle ilgili bir konu olabiliyor. Bir de fende yoğunluk kavramıyla ilgili olabiliyor (P1-Q11).

"İki çokluktan biri artarken diğeri de aynı oranda artıyor ya da biri azalırken diğeri de aynı oranda azalıyorsa bu çokluklar doğru orantılıdır." (MEB, 2007, p.97)

"İki çokluktan biri artarken diğeri de aynı oranda azalıyorsa ya da biri azalırken diğeri de aynı oranda artıyorsa bu çokluklar ters orantılıdır." (MEB, 2007, p.98)

[...] Tanımlar için de kitaptaki örneği okutuyorum, sonra kendi anladıklarını defterlerini yazmalarını istiyorum (P4-Q12).

[...] Ben kendilerine çıkarttırıyorum. Sizce oran nedir, diye soruyorum, onlar da kendilerine göre bir tanım yapıyorlar. Daha sonra bu tanımı kendilerine yazdırıyorum. Bunu beğendik doğru ifade ettik diyerek çocuğun ifadesini deftere geçirtiriyorum (P7-Q13).

[...] Doğru orantıya, ters orantıya örnek veriyoruz. Herkes bir şey söylüyor, günlük hayattan akıllarına geleni söylüyorlar, işçi problemleri gibi. Ondan sonra ikisi artıyorsa,

ikisi azalıyorsa diyip resmi tanımımızı yapıyoruz. [...] Tanımı parça parça yapıyoruz sonra ben yazdırıyorum (P6-Q14).

[...] Kitaplarda oranın birimi yoktur diyor. Vallaha metre bölü saniye gibi. O zaman birim var mı diyeceğiz? Bilmiyorum yani orada bir şey var. Son zamanlarda kitaplarda birimden bahsetmiyor. Oran birimsizdir demiyor. Yani orda bir sey oluşturmuyorum, girmiyorum oraya hiç. Kilosunun yaşına oranı mesela (P6-Q15).

[...] Aslında o (aynı cinsten olanların birimlenmesi) da bir görece olarak kaldı. Biz bence oranlanmaması gerekir ama oranlanabilir diyen kitaplar da var. Kendimce doğru olan, ve diğer kitapları da taradığımda böyle birimlerden yola çıkıyorum. Farklı birimlerin oranlanmaması gerektiğini ama bunu da ek bir bilgi olarak veriyorum (P8-Q16).

[...] Oran için birimsiz ve birimli olma durumlarını da gösteriyorum. Örneğin, sınıftakilerin yaşlarının oranladığımızda diyorum ki yaşın yaşa oranına bakıyoruz, bu nedenle bir birim soz konusu değildir; fakat hız problemlerinde olduğu gibi yolun zamana oranı dediğimizde yine bir oran söz konusudur fakat bu sefer oranın bir birimi vardır (P1-Q17).

[...] Öğrenciler, etkinlikleri oyun gibi goruyor. 6.sınıf daha cok zevk alıyor. 8ler daha cok dersaneye gidiyor ve onunla ilgili test cozmek istiyor. Etkinlikle vakit kaybetmek istemiyor (P6-Q18).

[...] Biz her ikisini de vermeye çalışıyoruz ama çoğunlukla etkinlik kısmını atlayıp teorik kısmını uyguluyorum. O nedenle açıkçası bu etkinlikleri okumuyorum bile diyebilirim. Mümkün değil. Devlet okullarında sınıf mevcudu 40 tan aşağı değil. İp, tabak vs. Maddi açıdan bunları sağlayamıyor zaten çocuk. [...] Ondan sonra tutun ki bunlar halloldu, 40 kisiye bunları uygulama şansı yok. Çocuklar bunun sonunda bir sınava girmeyecekleri için şu bilgileri bilmeleri yeterli oluyor (P8-Q19).

[...] Örneğin oran orantı konusu ile alakalı 10 soru hazırlamaya çalışıyorum. Kolaydan zora doğru, verdiğim özellikler nelerse, o özellikleri içeren birer soru olmalı. Kolaydan zora diyorum ama mutlaka son iki soruyu bonus soru olarak düşünüyorum. Daha bir zor olacak şekilde (P2-Q20).

[...] Kitaptaki örneklere bakıyorum, farklı kaynaklardan da sorular çözüyorum. Bu soruları kolaydan zora doğru sıralıyorum. Mesela 3 tane 8.sınıfım var. Üçü de birbirinden farklı, 8C de öğrenciler derse hazırlıklı geliyor, o nedenle ders çok rahat ve hızlı geçiyor. Diğer sınıfta ise hem bilen hem de bilemeyenler var. Dolayısıyla soruları öğrencinin seviyesine ve anlama kapasitesine göre hazırlıyorum (P4-Q21).

[...] Eğer seviyesi hafif geliyorsa (kitaptaki) örnekleri (yardımcı kitaplarla) çoğaltıyorum, örneğin seviyesi düşük geldiği için veya biraz daha ayrıntı olsun diye soruları çoğaltıyorum (P3-Q22).

[...] Mutlaka öğretmen kılavuzundan öğrencinin öğreneceği şeyler var ama mutlaka değişik kaynaklara başvururum. Onların güzel yönlerine bakarım. Mesela yardımcı kitapta guncel bir olay var, Acunun "Var Mısın Yok Musun", guncel bir olayla birleştirmiş olasılığı. Böyle bir örnekle olasılığı ilişkilendirdiğimde öğrenciler "aaa" diyor (P2-Q23).

[...] Öğrenci profili bunda önemli, işlenişi o açıdan değerlendiriyorum ama ana noktada başladığım şey kavram olarak oran orantı nedir, güncelliği önemli, nereden geliyor bu bilgi gibi. Günlük yaşamla ilgisini bulmaya çalışıyorum biraz da... Oran orantı neylerle ilişkili dersin içinde neyle ilişkili, günlük hayatla neyle ilişkili gibi düşündüğüm noktalar var. Her birinin ilişkli olduğu şeylerin bunları içeren sorular, durumlar oluşturmaya çalışıyorum (P1-Q24).

[...] Ders kitabından ve çalışma kitabından ders bittikten sonra çözebileceğim soruları kafamda tasarlıyorum. Örnek çözümler olabiliyor ya da ders kitabından çalışma kitabından ödev vereceğim alıştırma kısmından bir kaç tanesi olabiliyor. [Soruları] Birer atlayıp çocuklara sevimli gelsin diye bir kısmını çözüp geri kalan kısmı ödev olarak verebiliyorum. Onların hoşuna gitsin diye (P2-Q25).

[...] Uygulama sorularını da sınıfta çözmeye başlıyoruz, bir noktaya getiriyorum ve geri kalanını ödev olarak veriyorum. Genelde çalışma kitabından ödev veriyorum (P6-Q26).

[...] Ödeve derste başlamışız da bitirememişiz gibi bir hava yaratmaya çalışıyorum. Halbuki bilinçli bir şey bu. Mesela üç soru çözeceğiz diyelim. Dersin son 10 dakikasına bırakıyorum. Bir soruyu çözüyorsam diğer ikisini ödev bırakıyorum. O zaman çocukta yarım kalmış bir işi bitirme gibi bir his oluyor. Kendi tamamlıyor (P1-Q27).

[...] İlk başlarda tamamen sorulardaki sayıların değiştiği ama kalıbın aynı olduğu şeyler kullanırken şimdi daha ne katabilirim diye düşünüyorum ve becerileri de hedeflemeyi çalışıyorum. Tabi bu işleyişle paralel olmak zorunda. Bu yüzden becerileri de sınıfta desteklemek gerekiyor. [...] Yine kafamda bir şey belirledikten sonra kaynaklara bakmaya çalışıyorum. [...] Direk alıp kullandığım soru olmuyor çünkü orijnal o tür soruyu alıp kaynak göstermeden kullanmak biraz şey oluyor, bütünlüğü bozuyor (P1-Q28).

[...] Bazen yazılılarda çalışma kitabındaki sorunun birebir aynısını sorduğum oluyor. Esinlenerek sorduğum oluyor, bir de birebir aldığım sorular oluyor. Sırf seyi vurgulamak icin bakın çalışma kitabından aldık diye. Sunu da vurguluyorum önce çalışma kitabındaki sorularınızı çözün sonra kaynak kitabınızdan soru çözebilirsiniz (P6-Q29).

[...] Bazen yaptığım hazırlıklarda SBS sorusu da koyuyorum. Bakın diyorum bu SBS de çıkmış diyorum. O da onemli yani. Siz ne derseniz diyin, iyi okul SBS de ortalaması yuksek olan okuldur (P6-Q30).

[...] İşinizi gerçekten iyi yapıyorsanız, her sene SBS sorularını inceliyorsanız, çocuklara bununla ilgili çözüm yaptırıyorsanız, sınavdan sonra da bakın biz bu sorunun benzerini çözdük. Bakın SBS de şu tarz sorular çıktı diyip ilişkilendirebiliyorsunuz. [...] Ben bütün kitapları kullanıyorum, öncelikle çocukların konuyu hazmetmesi sonra da kolaydan zora doğru soru çözmesi gerekir ki arkasından böyle bir soru SBS de şu tarz bir soru vardır dediğimde daha keyifli olacaktır (P2-Q31).

[...] Çocuğa SBS yi hissettirmesek de çocuk zaten mecbur bunu biliyor. Onu o kadar yoğun yaşıyor ki (P7-Q32).

[...] Bazen ders kitabında verilmeyen sorular oluyor, o zaman kılavuz kitabın o kısımlarından yararlandığım oluyor (P6-Q33).

[...] Kitaptaki etkinlik içime sinmiyorsa ya da malzeme açısından olmuyorsa, benim elimde daha önceden ürettiğim etkinlik yoksa hala bir etkinlik arayışı içindeysem [...] ya da bazen alternatif etkinlikler oluyor. O zaman bakabiliyorum ama ilk etapta benim kutsal kaynağım şeklinde değil (P1-Q34).

[...] İlk kitap geldiğinde okudum. Mevcut bilgilerin ötesinde bir şey olmadığını gördüğüm için ya da okuduk aklımda kalanlardan dolayı. aynı kitap 4 yıldır aynı. Yeni bir kitap olasaydı mutlaka bakardım nasıl anlatılıyor diye. İlk geldiğinde yaptık ve ondan sonra işleniş vs yerine oturdu ve oradan devam ediyo (P8-Q35).

[...] Başlangıçta ders kitabına bakıyorum, sonra çalışma kitabına bakıyorum. Baktım ki aklıma takılan, çıkaramadığım noktalarda öğretmen kılavuzuna bakıyorum.[...]Bazen de kılavuzun hazır bulunuşlukla ilgili ön bilgileri var, ben önceden gelen bir konuysa nasıl konuları yokluyor diye örnek olarak baktığım noktalar var (P1-Q36).

[...] Evde oturup ciddi hazırlık yapacaksam (kılavuz kitaptaki işleniş kısımları ile ilgili) hepsine bakıyorum. Evde not hazırlayacaksam bunları ayrıntılı inceliyorum (P6-Q37).

[...] Bir gün müfettiş geldi, sen hiç kitaptan soru sormuyorsun, hepsini kafandan çözüyorsun, dedi. Derste kitap kullanmalısınız, lütfen bu konuda yeni gelen öğretmenlere de model olun dedi (P5-Q38).

[...] MEB müfettişleri geldiğinde yazılı sorularımıza da bakıyor ve 10 soru istemiyorlar, çeşitli tarzda soru istiyorlar. Onun için kitaplardakine benzer sorular soruyorum. Bu anlamda kitaplar yeterli oluyor (P3-Q39).

APPENDIX L

TURKISH SUMMARY

BÖLÜM 1

GİRİŞ

Matematik ders kitabı, matematik öğretiminde ve öğreniminde en çok güvenilen materyaller arasında yer almaktadır (Beaton ve diğerleri, 1996). Öğretmenler genellikle ders kitaplarından neyi öğretecekleri ve nasıl öğretecekleri konusunda yararlanırken (Robitaille & Travers, 1992); öğrenciler sıklıkla sınıf içi alıştırmaları ve ödevlerini yapmak için ders kitaplarını kullanır (Fan ve diğerleri, 2004). Bu nedenle matematik ders kitaplarının matematik öğretiminde ve öğreniminde önemli bir yere sahip olduğu söylenebilir.

Ders kitapları öğretim programlarının yorumlanmasında önemli bir yere sahiptir. Kitaplar, öğretim programlarının hedefleri ve öğretmenler tarafından gerçekleştirilen eğitsel aktiviteler arasında bağ kurmaya yardımcı olmaktadır (Törnroos, 2005). Bu bağlamda, ders kitapları öğretim programlarının yorumlanmasında önemli bir materyal olarak ele alınmaktadır.

Son yıllarda yapılan çalışmalar, ders kitapları ve materyallerinin matematik eğitiminde ve öğretiminde öğretmen tarafından nasıl kullanıldığını araştırmakta ve bu çalışmalara olan ilgi günden güne artmaktadır (Lloyd, Herbel-Eisenmann, & Remillard, 2009). Araştırmacılar, öğretmenin öğretim materyali veya ders kitaplarıyla nasıl etkileşime girdiğini farklı açılardan incelemekte ve araştırmaktadır (örneğin, Brown, 2009; Haggarty & Pepin, 2002; Remillard, 1996, 1999, 2005; Sherin & Dake, 2004).

Özellikle belirtmek gerekir ki, araştırmacılar öğretmenlerin öğretim materyallerine olan tutumlarını (Brown, 2002), deneyimlerini (Frykholm, 2004, Nicol & Crespo, 2006), kişilik özelliklerini (Spillane, 2000), kaygılarını (Christou, Menon, & Philippou, 2004), pedagojik alan bilgisini (Van Zoest & Bohl, 2002) araştırmışlardır. Bunların öğretmen ve öğretim materyali arasındaki etkileşimi incelemede önemli faktörler olduklarını belirtmişler, öğretmenleri de bu etkileşimin merkezine yerleştirmişlerdir. Bu nedenle, öğretmenlerin materyal kullanımlarının araştırılması, öğretmen ve materyal kullanımı arasındaki etkileşimi yorumlama bakımından önemli bir unsurdur; çünkü öğretim materyalinin değeri nasıl kullanıldığına bağlıdır (Cohen, Raudenbush, & Ball, 2003).

Öğretmenlerin öğretim materyallerini nasıl kullandıklarını inceleyen araştırmalar, öğretmen-materyal etkileşiminin yorumlanması için önemli bir paya sahiptir. Gelişen bu alanla birlikte öğretmen-kaynak etkileşiminin araştırılması da günden güne önem kazanmaya başlamıştır. Bu bağlamda, *dokümantasyonal yaklaşım* (Gueudet & Trouche, 2009) öğretmenlerin kaynakları nasıl kullandıkları ile ilgili önemli bilgiler sunmaktadır. Özellikle, *dokümantasyonal yaklaşım* öğretmen-materyal etkileşimini inceleyen çalışmalara çok benzer bir yaklaşım ortaya koymakta; fakat bu çalışmalardan farklı olarak öğretmenin bir kaynağı nasıl araştırdığı, bu kaynaklardan matematiksel görevleri nasıl seçtiği ve dizayn ettiği, bunları nasıl planladığı ve öğretime nasıl entegre ve adapte ettiği, bunları meslektaşlarıyla nasıl paylaştığı ve kaynakları nasıl yönettiği diğer çalışmalara göre bir adım öne çıkmaktadır. Gueudet ve Trouche (2009) bu çalışmaların tümüne öğretmenlerin dokumantasyon süreçleri adını vermektedir. Bu kapsamda, öğretmenlerin dokumantasyon süreçleri, öğretmenin görevleri seçme, bunları entegre ve adapte etme süreçleri, öğretmenin kaynakları nasıl kullandıklarını anlama bakımından önemli bilgiler sağlamaktadır. Bu çalışmanın kapsamında da *dokümantasyonal yaklaşım,* matematik ders kitaplarından görevlerin (örnekler, problemler, alıştırmalar, tanımlar vs.) seçilmesi, bunların öğretime adapte edilmesi ve uygulanması için bir çerçeve oluşturmaktadır.

Gueudet ve Trouche (2009) yalnızca sadece öğretim materyallerine odaklanmamakta aynı zamanda öğretmen için önemli olan herşeyi bir kaynak olarak ele almaktadır. Örneğin, ders kitabı, bilgisayar yazılımları, öğrenci kağıtları, bir meslektaş

veya öğrenci arasındaki konuşma birer kaynak olarak ele alınmaktadır. Özellikle belirtmek gerekir ki, Gueudet ve Trouche (2009) bu kaynakları birbirinden ayırmadan ele almakta, bunları kaynakların oluşturduğu bir takım (set of resources) olarak düşünmektedir. Bu özelliği ile aslında bir çok çalışmada ele alınmayan bir noktayı, kaynakların bir takım olarak ele alınmasını, öne çıkartmaktadır. Bu nedenle, bu çalışma kapsamında, dokümantasyonal yaklaşım öğretmenlerin sadece matematik ders kitaplarını nasıl kullandıklarını değil, aynı zamanda öğretmene ait notları, öğretmenin öğrencilerle olan konuşması ve yardımcı kaynakları nasıl kullandıkları ile ilgili kapsamlı bir çerçeve sunmaktadır.

Dokümantasyonal yaklaşım (Gueudet & Trouche, 2009) yeni bir çalışma alanı olması ile birlikte öğretmenlerin kaynak kullanımları hakkındaki çalışmalara olan ilgi günden güne artmaktadır (örneğin, Kieran, Tanguay, & Solares, 2011; Maschietto & Trouche, 2010; Rezat, 2011; Sabra & Trouche, 2011). Bu kapsamda, bir kaynak olarak ders kitabı kullanımı farklı bir bağlamda incelendiği için çalışmadan elde edilecek öğretmenlerin ders kitaplarının kullanımları ile ilgili bilgiler bu alanın gelişmesinde önemli bir rol oynayacaktır.

Bu çalışmada, matematik ders kitapları, öğretim programının hedeflerini yansıttığı ve öğretimle doğrudan bağlantılı olduğu için öğretim materyali olarak ele alınmıştır. Bununla birlikte, matematik ders kitabı matematik öğretimi ve eğitimi için kaynak sayılabilabilir. Ayrıca bu çalışma kapsamında ders kitapları birden fazla kitabı içerdiği için (örneğin, ders kitabı, çalışma kitabı, öğretmen kılavuzu gibi) bu kitapların bir bütün içinde kullanımlarının incelenmesi açısından da önemli bir yere sahiptir

1.1 Çalışmanın Amacı

Bu çalışmanın amacı, ilköğretim matematik öğretmenlerinin matematik ders kitaplarının kullanımlarını araştırmak ve kitaplardaki örnek, problem ve tanımların uygulamada nasıl kullanıldığını incelemektedir. Bu çalışma kapsamında, öğretmenlerin ders kitabı kullanımlarını belirlemek amacıyla ölçek geliştirilmiş, ardından öğretmenlerin bu ölçeğe verdiği yanıtları daha iyi açıklayabilmek ve öğretmenlerin kitaplardaki örnek, problem ve tanımların uygulamada nasıl kullanıldığını incelemek için nitel veri toplanmıştır.

1.2 Araştırma Soruları

Bu çalışma esas olarak şu soruya cevap aramaktadır: "İlköğretim matematik öğretmenleri matematik ders kitaplarını nasıl kullanmakta ve öğretmenler kitaplardaki örnek, problem ve tanımları uygulamada nasıl kullanmaktadır?" Bu soru karma araştırma yöntemi kullanılarak araştırılmıştır. Çalışmanın soruları şöyle belirtilmiştir:

1. Öğretmenlerin matematik ders kitabı kullanmalarını etkileyen faktörler nelerdir?

2. Farklı demografik özelliklere sahip öğretmenlerin ders kitabı kullanımları farklılık gösterir mi?

2.1. Kadın ve erkek öğretmenlerin ders kitabı kullanımları arasında istatistiksel anlamda bir fark var mıdır?

2.2. Farklı öğretim deneyimlerine sahip öğretmenlerin ders kitabı kullanımları arasında istatistiksel anlamda bir fark var mıdır?

2.3. Farklı sınıf mevcutlarına sahip öğretmenlerin ders kitabı kullanımları arasında istatistiksel anlamda bir fark var mıdır?

3. Öğretmenler, kitaplardaki örnek, problem ve tanımları uygulamada nasıl kullanmaktadır?

1.3 Çalışmanın Önemi

Öğretmen ve öğretim kaynakları arasındaki ilişkiyi anlamak matematiğin eğitimi ve öğretimi için önemlidir. Son zamanlarda öğretmenlerin materyal kullanımları üzerine yapılan çalışmalar (örneğin, Remillard, 2005; Remillard & Bryans, 2004; Sherin & Drake, 2004) ve ders kitapları üzerine yapılan çalışmalar (örneğin, Brown, 2009; Haggarty & Pepin, 2002; Johansson, 2007) göstermektedir ki öğretmen ve kaynaklar arasında karşılıklı bir ilişki olduğundan dolayı bu ilişki dikkatli bir şekilde incelenmelidir. Bu noktada belirtilmelidir ki, matematik öğretmenlerinin ders kitabı kullanımları ve öğretmen-ders kitabı arasındaki ilişki matematik öğretiminin nasıl gerçekleştiği hakkında önemli bilgiler sunar.

Araştırmacılar öğretmenlerin öğretim materyallerini ve ders kitaplarını nasıl yorumladıklarını incelerken, materyal ya da ders kitabı ve öğretmen arasındaki ilişkide öğretmeni merkeze almıştır; fakat yapılan çalışmalarda, öğretim materyallerinin hangi özellikleri bu karşılıklı ilişkide etkin rol oynamaktadır, henüz netlik kazanmamıştır.

Remillard'a (2005) göre öğretim programları ve materyallerinin özellikleri bu karşıllıklı ilişkide ele alınmalı ve öğretmenin dersi planlarken ve uygularken bu materyalleri nasıl kullandığı incelenmelidir. Bu nedenle, ders kitaplarının özellikleri öğretmen ve ders kitabı arasındaki karşılıklı ilişkide belirlenmesi gereklidir. Bu kapsamda, dokümantasyonal yaklaşım öğretmenlerin ders kitaplarında yer alan örnek, problem, alıştırma gibi görevleri öğretime entgre etmesi ve ders kitapları ile etkileşime girmesi bakımından kapsamlı bir çerçeve sunmaktadır. Bu eksiklikler göz önüne alındığında bu çalışma alan yazınında önemli bir boşluğu doldurabilecektir.

Yapılan çalışmalarda, öğretmenlerin takım halinde sunulan ders kitaplarını (örn, ders kitabı, çalışma kitabı, öğretmen kılavuzu ve yardımcı kitaplar) nasıl kullandıkları ve öğretmen ve kitaplar arasındaki ilişkinin nasıl şekillendiği hala netlik kazanmamıştır. Bu kapsamda, dokümantasyonal yaklaşım ve öğretim materyallerinin kullanımları ile ilgili süreçler (Remillard, 1999; Sherin & Drake, 2004) öğretmen ve ders kitapları arasındaki ilişkiyi açıklama bakımından kapsamlı bir çerçeve sunmaktadır. Bu çerçeve ile matematik öğretmenlerinin ders kitabı kullanımları ile ilgili çalışmalar değerlendirilebilecektir. Bu çalışmadan, program geliştiricilerin, ders kitabı yayıncılarının, eğitimcilerin ve öğretmenlerin yararlanabileceği düşünülmektedir.

BÖLÜM 2

ALANYAZIN ÇALIŞMALARININ İNCELENMESİ

Bu bölümde, matematik öğretmenlerinin kitap kullanımlarını inceleyen ve kitaplardaki örnek, alıştırma, problem gibi görevleri öğretime entegre eden çalışmalar ele alınmıştır. Bu kapsamda, Gueudet ve Trouche (2009) tarafından geliştirilen dokümantasyonal yaklaşım ve öğretmenlerin öğretim materyallerini inceleyen çalışmalar teorik çerçeveyi belirlemektedir.

2.1 Dokümantasyonal Yaklaşım

Matematik öğretiminde kaynaklar her zaman matematiğin öğretilmesi ve öğrenilmesinde çok önemli bir rol oynamıştır. Öğretmenlerin bir kaynağı öğretime entegre etmeleri, ne tür kaynaklar kullandıkları farklı yaklaşımlar tarafından ele alınmıştır. Bu yaklaşımlardan, *dokümantasyonal yaklaşım* (Gueudet & Trouche, 2009) matematik öğretmenleri ve kaynaklar arasındaki etkileşimi inceleme ve öğretmenlerin bir kaynağı öğretime entegre etme süreçlerini belirleme açısından bir adım ön plana çıkmaktadır. Özellikle, bu yaklaşım öğretim materyallerinin kullanımlarını inceleyen çalışmalarla (örneğin, Arbaugh & Brown 2005; Ball & Cohen, 1996; Christou ve diğerleri, 2004) karşılaştırıldığında teorik bir çerçeve oluşturması açısından önemli bir yere sahiptir.

Dokümantasyonal yaklaşımda, öğretmen ve kaynaklar arasındaki etkileşimi iki yönlü olarak incelenmekte ve bu karşılıklı etkileşim enstürmantasyon *(instrumentation)* (öğretmenin aktivitelerini destekleyen kaynaklar) ve enstrümantalleştirme (*instrumentalization)* (öğretmenin kaynaklar üzerinde çalışması) olarak tanımlanmaktadır. Bu karşılıklı etkileşim öğretmenlerin kaynakları nasıl kullandığını açıklarken, kaynakların ne tür zayıf ve güçlü yönlerinin olduğunu da açıklamaktadır. Kaynaklar ve öğretmen arasındaki bu karşılıklı etkileşim dokümantasyonun doğasını ortaya koymaktadır.

Dokümantasyon süreci öğretmen ve kaynaklar arasındaki etkileşimi göstermektedir. Bu şekilde belirtilen enstrümantalleştirme boyutu öğretmenlerin kaynakları nasıl şekillendirdiklerini gösterirken, enstürmantasyon boyutu kaynakların öğretmenin kaynak kullanımlarına etkisini göstermektedir resources (Gueudet & Trouche, 2009). Bununla birlikte öğretmeninn dokümantasyon sürecini etkileyen birden fazla faktörden söz edilebilir. Bunlar öğretmenin inançları, deneyimleri, bilgisi olabilir. Bu süreç eşitlikle şöyle gösterilebilir:

Doküman = Kaynaklar + Kullanım Şemaları

Bu eşitlikte doküman, öğretmenin aktivitelerini destekleyen herşey olabilmektedir (Gueudet & Trouche, 2009). Bu doküman, öğretmen tarafından geliştirilir ve süreç sonunda elde edilir. Süreç sonunda elde edilen doküman farklı kaynakların biraraya gelerek yeni bir doküman oluşturması ile sonuçlanır. Bu yeni elde edilen doküman öğretmeninin deneyimlerinden ayrı tutulamaz ve mesleki aktivitelerinin bir parçası olarak ele alınır. Bununla birlikte, bu eşitilik statik gibi görünse de kaynaklar ve doküman arasındaki dinamik ilişkiyi işaret eder (Gueudet, Pepin, & Trouche, 2011). Bu dinamik ilişki diğer dokümanların da ele alındığı bir süreci belirtir.

2.2 Öğretim Materyallerinin Kullanımı ile İlgili Çalışmalar

Öğretmenlerin öğretim materyallerinin kullanımı ile ilgili son dönemlerde yapılan çalışmalar (örneğin, Remillard, 2005; Remillard & Bryans, 2004; Sherin & Drake, 2004) ve öğretmenlerin kitap kullanımları ile ilgili çalışmalar (örneğin, Brown, 2009; Haggarty & Pepin, 2002; Johansson, 2007) dokümantasyonal yaklaşım için önemli birer kaynak niteliğindedir. Bu çalışmalar, dokümantasyonal yaklaşımın temel kavramlarının açıklanması için de önemli bir yere sahiptir. Bu nedenle, bu çalışmalar öğretmen ve kaynaklar arasındaki etkileşimin açıklanmasına yardımcı olacak çerçeveyi belirlemede yardımcı çalışmalardır.

Öğretmenlerin materyal kullanımlarını etkileyen, öğretmenin deneyimi (Van Zoest & Bohl, 2002) ve kaygıları (Christou ve diğerleri, 2004, 2009) gibi önemli etkenler vardır. Christou ve diğerleri (2004) yeni materyallerin kullanımında

öğretmenliğe yeni başlayan öğretmenlerin kaygılarının deneyimli öğretmenlerin kaygılarından farklı olduğunu belirtmektedir. Bulgular göstermektedir ki, öğretmenliğe yeni başlayan öğretmenlerin yeni programı uygulama ve yeni ders kitabını kullanma bakımından deneyimli öğretmenlere göre daha az endişe duyduğu belirlenmiştir. Deneyimli öğretmenlerin de yapılan yeniliklerin öğrenciler için ne tür sonuçlar doğuracağı konusunda endişeleri olmakta ve yeni programın adaptasyonu ile kaygıları öğretmenliğe yeni başlayan öğretmenlere göre daha az olmaktadır.

2.2.2 Öğretmenlerin Öğretim Materyali ve Ders Kitabı Kullanımı ile İlgili Görüşleri

Son zamanlarda, öğretmenlerin matematik öğretim materyal kullanımları oldukça ilgi çeken konular arasında yer almaktadır (örn. Christou ve diğerleri, 2004; Brown, 2002, 2009; Haggarty & Pepin, 2002; Remillard, 1996, 1999, 2005; Sherin & Dake, 2004). Araştırmacılar, öğretmenlerin materyallerle olan etkileşimi farklı açılardan incelemekte ve araştırmaktadır. Bazı araştırmacılar, öğretim materyallerinin geliştirildiği gibi kullanılmaları gerektiğini savunurken öğretim ve program ya da materyaller arasında bir uygunluk ve paralelliğin olması gerektiğini düşünmektedir. Buna karşın, diğer araştırmacılar öğretim ve program arasında bir uygunluğun mümkün olamayacağını savunmaktadır. Bu noktada, Lloyd, Herbel-Eisenmann ve Remillard (2005), öğretim materyallerini şekillendiren öğretmenin öğretimi ve programda belirtilenlerin birbirinden farklı olacağını; bu bakımdan, öğretim ve program arasında birebir bir uygunluktan söz edilemeyeceğini belirtmektedir. Bu nedenle, bu araştırmacılar öğretmenin programı ve program kaynaklarını nasıl yorumladığını ve bu kaynakları öğretime nasıl adapte ettiğini incelemektedir. İlerleyen bölümlerde bu iki yaklaşım, öğretmenin aktiviteleri kapsamında incelenecektir.

2.2.2.1 Öğretim Materyallerinin Takip Edilmesi

Bu yaklaşımda, öğretim programlarının öğretmen tarafından plandığı gibi uygulanıp uygulanmadığı araştırılmaktadır. Öğretmenler, ders kitabının birincil uygulayıcıları ve kitaplar da öğrencilerin öğrenmesi için en önemli kaynaktır. Freeman ve Porter (1989) dört ilköğretim matematik öğretmeninin ders kitabı kullanımlarını incelemiş; öğretmenin öğretimi ve ders kitabının içeriğini karşılaştırmıştır. Sonuç olarak,

öğretmenlerin ders kitabını hangi konuları nasıl öğreteceği, her konu için ne kadar zaman ayıracağı ve hangi sıra ile sunacağı konusunda farklı yöntemler geliştirdikleri bulunmuştur. Araştırmacılar, öğretmenin öğretimi ile ders kitabı içeriğinin birbirine örtüştüğü konusunda da hem fikir olmuşlardır.

Ders kitabı kullanımının ele alındığı diğer çalışmalarda, ders kitabının konuları belirleme, ders içeriğini oluşturma ve öğretimi dizayn etme bakımından birincil kaynak olarak kullanıldığı belirtilmiştir (Chval, Chávez, Reys, & Tarr, 2009). Chval ve diğerleri (2009) çalışmalarında, öğretmenlerin ders kitabının büyük bir kısmını (yaklaşık olarak %58) öğretim için kullandıklarını ortaya koymakta ve kitapların ders sırasında sıklıkla (yaklaşık % 87) kullandığını belirmektedir. Bu sonuçlar göstermektedir ki, ders kitabının kullanımı ve derse entegrasyonu öğrencinin başarısını yorumlama bakımından oldukça önemli bir yere sahiptir.

Bu alanda yapılan araştırmalar, öğretmenlerin ders kitabı kullanımlarını program hedeflerinin öğretimle olan ilişkisi kapsamında ele almaktadır. Bu nedenle program hedeflerinin derste yerine getirilme derecesi dolaylı olarak öğrencilerin matematik başarılarını yorumlama açısından da önem kazanmaktadır. Bu yaklaşım, öğretmen-ders kitabı arasındaki ilişkiyi açıklamaya yardımcı olurken bu ilişkinin doğası hakkında da çok fazla bilgi vermemektedir. Bu nedenle, öğretmen-ders kitabı arasındaki ilişkiyi incelerken bu ilişkiyi etkileyebilecek etkenler göz önünde bulundurulmalıdır.

2.2.2.2 Öğretim Materyallerinin Yorumlanması ve Adaptasyonu

30 yılı aşkın bir süredir çalışmalarda, öğretmenlerin öğretim materyalleri kullanımları ve bu materyallerin öğretimdeki görevleri araştırılmaktadır. Bu çalışmalar göstermektedir ki, öğretmenler öğretim materyalleri ile etkileşime geçtiğinde bunları programda belirtildiği gibi aynen kullanmak yerine kendi matematik anlayışlarına ve öğrencilerin durumlarına göre değiştirerek kullanmayı tercih etmektedir (Brown, 2002, 2009; Remillard & Bryans, 2004; Remillard, 1999, 2005, 2009).

Bu yaklaşım doğrultusunda araştırmacılar öğretmenlerin öğretim materyallerini ne zaman ve nasıl kullandıklarını anlayamaya çalışmaktadır. Bu yaklaşımın temelinde şu yatmaktadır: Öğretmenler porgram hedeflerinin uygulanması, matematiksel görevlerin yerine getirilmesi ve ders planlarının hayata geçirilmesi sürecinde en önemli kişilerdir

(Lloyd ve diğerleri, 2009). Bu nedenle, öğretim programının kullanılması öğretmenlerin öğretim materyaleri ile ne yaptıklarına, bunları neden seçtiklerine birebir bağlıdır (Remillard, 2009).

Remillard'ın (2005) çalışmasında, öğretmen-program ilişkisi öğretim kaynaklarının kullanımı ile ilgili çalışmalarla şekillenmiştir. Bu çalışmada, öğretmen ve program arasında karşılıklı etkileşime dayanan karmaşık bir sürecin öğretmen-program ilişkisini nasıl etkilediğinden söz edilmiştir. Remillard'a (2005) göre bu ilişkiyi açıklamak için öğretmenlerin öğretim materyallerini nasıl kullandıklarını araştırmak gerekmektedir. Remillard (2005) öğretmen ve program arasındaki bu ilişkiyi katılımcı ilişki (participatory relationship) olarak adlandırmaktadır.

Remillard'ın (2005) tanımladığı bu katılımcı ilişkiyi şekillendiren etkenler vardır. Öğretmen ve programın özellikleri bu ilişkiyi etkileyen iki önemli faktördür. Öğretmenin karakter özelliklerinden örneğin bilgisi, inançları, amaçları, deneyimleri, kapasitesi ve algıları öğretmen boyutunda önemli etkenler olarak ele alınabilirken, programın yapısını yansıtan kavramların gösterimi, görüntüsü ve materyalleri program boyutunda ele alınabilir. Bu nedenle, öğretmenin ve programın özellikleri bu ilişkiyi şekillendirir (Remillard, 2005).

2.2.3 Öğretmenlerin Öğretim Materyalleri ile Etkileşiminde Tanımlanan Temel Süreçler

Araştırmalarda, öğretmenin programı kendi inanaçlarına ve deneyimlerine göre şekillendirdiği, dersin yapısına ve amacına göre programı değiştirdiği belirtilmektedir (Brown, 2002; Davis & Krajcik, 2005; Remillard, 2005). Bu nedenle, öğretmenin öğretim materyalleri ile etkileşimini anlamak için öğretmenin materyal kullanımını sınıf ortamında incelemek gerekir. Örneğin, Brown (2009) öğretmen ve materyaller arasındaki etkileşimi şu basamaklarla tanımlamıştır: Öğretmen ilk olarak materyali *seçer*; fakat bu seçim çoğu zaman öğretmenin seçilen materyali kullanması ile gerçekleşir. İkinci adımda, öğretmen bu materyalleri derse hazırlıkta ve ders sürecinde kendi algılarına göre *yorumlar*. Üçüncü basamakta, öğretmen kendi algısını dersin planına ve ortamın özelliklerine *uydurur*. Dördüncü basamakta, öğrencilerin ilgilerini, deneyimlerini ve özelliklerini derse *uyum sağlayacak* hale getirir. Son olarak, ortamı

kendi kararlarına ve öğrencinin kapasitesine göre değiştirir. Özetle, Brown tarafından önerilen bu basamaklar, öğretmen ve materyaller arasındaki dinamik ve yapıcı etkileşimi tanımlamaya yardımcı olmaktadır.

Öğretmenlerin materyallerle olan etkileşimini tanımlamada, Sherin ve Drake (2004) daha kapsamlı bir süreç tanımı sunmaktadır. Sherin ve Drake (2004) "öğretim materyallerini yorumlama (reading), değerlendirme (evaluating) ve adapte etme (adapting)" süreçlerini ders öncesinde, ders esnasında ve ders sonrası olmak üzere üç ayrı süreçte incelemektedir. Bu araştırmacıların bulguları göstermektedir ki, öğretmenler materyallerin kullanımı için kendi yaklaşımlarını tercih etseler de her birinin ortak yönleri bu süreçleri tanımlamaya yardımcı olabilmektedir. Bu noktada özellikle şunu belirtmek gerekir ki, öğretmenlerin materyal kullanımları şöyle tanımlanabilir:

Görevlerin Seçimi:

Görevlerin (bir materyalde yer alan öğretim ile ilgili olabilecek her şey; örneğin alıştırma, problem, soru) seçimi, öğretmenlerin içerik ve pedagojik kararları ile şekillenmektedir; çünkü bunlar öğretmenlerin matematik öğretimi ve eğitimi ile ilgili en etkili faktörlerdir. Bu kapsamda iki önemli yaklaşım vardır: benimseme (appropriation) ve yaratıcılık (invention) (Remillard, 1999). Öğretmenler kitaptaki görevleri benimsediklerinde kitapta yer alan görevleri doğrudan öğrencilere gösterir ve bunlar üzerinden dersi işler. Genellikle, öğretmenlerin benimsedikler görevler, kitaplarda yer alan günün problemi ya da basit alıştırmalar olmaktadır. Buna karşın, öğretmen kitaptan bu tür görevler seçmek istemediğinde kitapları bir kaynak olarak görmektedir. Bu nedenle öğretmen kendi tanımlamalarını ve görevlerini oluşturmakta ve derse adapte etmektedir. Öğretmenin kendi oluşturduğu bu görevler de genellikle kendi inançlarını yansıtmaktadır.

Materyallerin Yorumlanması:

Remillard (1999), görev seçiminin farklı olması öğretim materyallerinin farklı yorumlanmasından kaynaklandığını belirtmektedir. Yorumlama, "metinde yazılanlardan bir anlam çıkarmadır" (Remillard, 1999). Bu bakımdan yorumlama, metinde nelerin yazıldığını anlama yönünde varılan kararları içerir. Öğretmen çoğunlukla metinde

yazılanlara kendi yorumunu ekler. Bu nedenledir ki, metnin yorumlanması neyi, nasıl anlatacağı konusunda öğretmenin kararlarını içerir (Remillard, 1999).

Materyallerin yorumlanması ve kullanılması, öğretmenin program hedefleri hakkında bilgi sahibi olma açısından oldukça değerlidir (Sherin & Drake, 2004). Öğretmenler, materyalleri derste yapacağı etkinlikler ve öğrencinin öğrenecekleri ile ilgili kararlarda kullanırlar. Bu kararların büyük çoğunluğu da dersi planlama sürecinde yer alan kararlardır. Bu nedenle, yorumlama daha çok dersin planlanma sürecinde gözlenen bir süreçtir.

Materyallerin değerlendirilmesi:

Remillard (1999), öğretmenlerin materyalleri yorumlama sürecinde "matematiğin doğasını ve içeriği hakkında düşüncelerin" ve öğretim ve eğitim hakkındaki görüşlerin" iki önemli faktör olduğundan söz etmiştir. Öğretmen, matematiğin kavramları ve ilişkileri araştırılarak öğrenileceğini düşünüyorsa o zaman metinde yazılanları keşfetme yoluna gider. Bu bakımdan, öğretmenin matematiğin doğası ve matematik öğretimi hakkında sahip olduğu bilgi ve inançları metinde yazılanları yorumlama sürecinde farklılık yaratacaktır. Bu noktada, değerlendirme süreci, öğretmenin kendi bilgi ve inançlarına göre materyali yorumlamasını içerir (Sherin & Drake, 2004). Bu değerlendirme sürecinde de öğrencinin matematiği algılayışı, matematiğe olan ilgisi değerlendirme süreci ile yakından ilgilidir.

Materyallerin Adapte Edilmesi:

Remillard (1999) öğretmenlerin kitaplarda ve diğer kaynaklarda yer alan görevleri öğrencilerin bunlarla çalışması için adapte ettiğinden söz etmektedir. Öğretmen bir görevi adapte ederken sadece öğrencilerinin verdiği yanıtlara göre değil kendi inançları ve bakış açılarıyla da değerlendirmektedir. Örneğin, öğretmen öğrencinin verdiği yanlış cevaba yönelik yeni bir soru sorar ve var olan durumu öğrenciye göre adapte eder. Bu örnekte olduğu gibi öğretmenin inançları ve görüşleri durumların ve görevlerin derste nasıl uygulanacağını ve derse nasıl adapte edileceğini belirler.

Sherin ve Drake (2004) adaptasyon sürecini şöyle tanımlamaktadır: Öğretmenin program hedeflerinde, dersin işlenişinde ve amacında önemli değişiklik yapmasıdır. Bu araştırmacılar üç yaklaşımın bu noktada önemli olduğunu vurgulamaktadır: a) yeni bir

aktivite, görev veya materyal oluşturma, b) dersin bir parçasını başka bir şey ile yer değiştirme, c) dersin bir kısmını atlama. Bu üç yaklaşım sadece ders esnasında gerçekleşebilir.

2.3 Özet

Çalışmalar göstermektedir ki, araştırmacılar öğretmen-materyal ilişkisinde öğretmeni merkeze koymakta, öğretmenlerin materyalleri ve kitapları nasıl yorumladıkları incelenmektedir. Bu alanda yapılan çalışmaların sayısı artsa da materyallerin hangi özellikleri öğretmenlerin materyallerle ve kitaplarla olan ilişkisini nasıl etkilediği henüz cevaplanabilmiş değildir (Remillard, 2009).

Çalışmalar aynı zamanda öğretim materyallerinin ve ders kitaplarının matematik eğitiminde ve öğretiminde önemli bir rolünün olduğunu, öğretmenler ve öğrenciler için birer kaynak olabileceğini göstermektedir. Araştırmacılar, öğretmen ve materyaller arasındaki ilişkisi için farklı açılımlar sunmakta ve bu alanın anlaşılması için araştırmalar yapmaktadır. Yine de öğretmenlerin matematik ders kitabı kullanımları bu kapsamda çok belirgin değildir. Öğretmen ve kitaplar arasındaki ilişkiyi inceleyen çalışmalara gereksinim duyulmaktadır.

Dokümantasyonal yaklaşım (Gueudet & Trouche, 2009), öğretmen ve matematiksel kaynaklar arasındaki etkileşimi, öğretmenlerin kaynakları derse entegre etme süreçlerini inceleyen yeni bir alan olarak görülmektedir. Bu yaklaşım, öğretmenlerin kaynakları derse entegre etme süreçleri hakkında bilgi sunarken kaynakların hangi özelliklerinin öğretmen aktivitelerini nasıl etkilediği hakkında da bilgiler sunmaktadır. Ders kitaplarının hangi özellikleri öğretmenlerin ders kitabı kullanımlarını nasıl etkiler henüz araştırılmış değildir. Alanda yapılabilecek çalışmalar ders kitaplarının nasıl ele alındığını, öğretmen-ders kitabı ilişkisini hangi yönlerden etkilenebileceğini inceleyebilir.

Bu çalışmada, alanda yapılan çalışmalar göz önüne alınmış, ilköğretim matematik öğretmenlerinin ders kitabı kullanımları incelenmiştir. Bu çalışmadan elde edilecek sonuçların öğretmenlerin matematik öğretimi için önemli bir kaynak olarak gördükleri ders kitaplarını nasıl kullandıkları ile ilgili önemli bilgiler sunabileceği düşünülmektedir.

BÖLÜM 3

ÇALIŞMANIN YÖNTEMİ

Bu bölümde, karma araştırma yöntemi ve bu yöntemin seçiliş nedeni, katılımcıların özellikleri, çalışmada kullanılan ölçeğin yapısı, veri toplama ve analiz süreci anlatılmaktadır.

3.1 Çalışmanın Dizaynı: Karma Araştırma Yöntemi

Son yıllarda, karma araştırma yöntemi üçüncü bir yaklaşım olarak bir çok çalışmada kullanılmaktadır. Bu yöntemde, nitel ve nicel çalışma yöntemleri çalışmanın her aşamasında (problem cümlelerinde, veri toplama ve analiz sürecinde, tartışma kısmında) içiçe geçmektedir. Bu nedenle, karma araştırma yöntemi üçüncü bir yöntem olarak ortaya çıkmaktadır.

Bu çalışmada, karma araştırma yöntemi veri toplama ve analizi için bir çerçeve sunmaktadır. Diğer bir deyişle, bu yöntemin bu çalışma için çok kullanışlı olduğunu ve çalışmanın sorularına en uygun yöntemin olduğu söylenebilir. Bu bakımdan, Creswell ve Plano Clark (2007) tarafından geliştirilen yöntemsel süreç bu çalışmada kullanılacaktır.

3.1.1 Karma Araştırma Yönteminin Sınıflandırılması

Karma araştırma yöntemi için birden fazla sınıflandırma önerilmektedir (örneğin, Creswell, 2003; Creswell & Plano Clark, 2007; Tashakkori & Teddlie, 2003). Bu sınıflandırmalar farklı isim ve özellikte olmasına rağmen benzer özellikler göstermektedir. Özellikle, Creswell ve Plano Clark (2007) tarafından geliştirilen sınıflandırma diğerlerine göre daha ayrıntılı bir çerçeve sunmaktadır. Bu sınıflandırmada, dört tip sınıflandırma bulunmaktadır: üçgenleme, gömülü, açıklayıcı ve araştırmacı.

Bu çalışmada, açıklayıcı ve araştırmacı araştırma dizayn süreçleri kullanılmıştır. Açıklayıcı tasarım süreçleri nicel veri toplama ölçeğinin geliştirilmesi için kullanılırken

araştırmacı dizayn süreçleri çalışma problemlerine cevap vermek ve istatiksel sonuçları açıklamak için kullanılmıştır. Özellikle, açıklayıcı dizayn süreci, ilköğretim matematik öğretmenlerinin ders kitabı ve materyal kullanımları görüşmelerle belirlenmeye çalışılmıştır. Görüşmelerden elde edilen bulgular ve literatürden ele edilen sonuçlarla ölçeğin geliştirilmesi sürecinde kullanılmıştır. Araştırmacı dizayn süreci ile nicel ölçekle toplanan verilerin istatiksel analizleri yapılmıştır. Ardından, görüşme, gözlem ve ders kitabı analizleri ile nicel verilerin yorumlanması sağlanmıştır.

3.2 Veri Toplama Süreci

Veri toplama sürecinin iki önemli amacı vardır: a) ölçek geliştirmek ve b) araştırma problemlerine genel bir bakış açısı sağlamak. Bu nedenle, veri toplama süreci dört farklı zaman aralığında farklı yöntemlerle gerçekleştirilmiştir (nicel ve nitel araştırma yöntemleri). Genel süreç Tablo 3.1'de özetlenmiştir.

Table 3.1 Genel veri toplama ve analiz süreci

Aşamalar	Veri Toplama	Veri Toplama Zaman Çizelgesi	Veri Toplama Araçları	Veri Toplama Amaçları	Katılımcılar	Analiz
(I)	Nitel Veri Toplama	Ekim - Kasım 2009	Yarı yapılandırılmış görüşmeler	Ölçeğin sınırlarını ve ölçeğin maddelerini belirlemek	13 ilköğretim matematik öğretmeni	Tema analizi
(II)	Nicel Veri Toplama	Nisan - Mayıs 2010	Ölçek	Ölçeğin faktör yapısını keşfetmek	189 ilköğretim matematik öğretmeni	Açıklayıcı faktör analizi
(III)	Nicel Veri Toplama	Aralık 2010 - Ocak 2011	Ölçek	Ölçeğin faktör sayısını belirlemek ve doğrulamak Faktörlerin öğretmen cinsiyetine, deneyimlerine ve sınıf mevcuduna göre fark olup olmadığını belirlemek	531 ilköğretim matematik öğretmeni 8 ilköğretim matematik öğretmeni	Açıklayıcı ve doğrulayıcı faktör analizi MANOVA, etc.
(IV)	Nitel Veri Toplama	Şubat - Nisan 2011	Yarı yapılandırılmış görüşmeler, gözlemler, doküman analizleri	Nicel sonuçları nitel sonuçlarla açıklamak		Tema analizi

3.2.1 Veri Toplama Süreci Aşama I

Veri toplama süreci, ölçek geliştirmek için nitel veri toplama süreci ile başlamıştır. Nitel veri toplama, ölçeğin maddelerini oluşturmak için toplanmıştır. Bu süreçte, 13 ilköğretim matematik öğretmeni ile yarı yapılandırılmış görüşmeler düzenlemiştir. Bu görüşmelerin amacı, öğretmenlerin matematik ders kitaplarını nasıl kullandıklarını anlamaktır. Görüşmeler, yaklaşık 40-60 sürmüştür. Bu görüşmelerde sorulan sorular Ekler B kısmında verilmiştir.

3.2.2 Veri Toplama Süreci Aşama II

Nitel veri toplama süreci sonunda elde edilen maddeler, Matematik Öğretmenlerinin Ders Kitabı Kullanım Ölçeğini oluşturmak için kullanılmıştır. Oluşturulan bu yeni ölçeğin pilot testine Ankara'nın Çankaya ve Keçiören ilçelerinden rastlantısal olarak seçilmiş 15 farklı okuldan 189 ilköğretim matematik öğretmeni katılmıştır.

3.2.3 Veri Toplama Süreci Aşama III

Ölçeğin pilot testi yapıldıktan sonra elde edilen faktör yapısını belirlemek ve doğrulamak için nicel veri toplanmıştır. Açıklayıcı faktör analizi (AFA) ve doğrulayıcı faktör analizi (DFA) yapılmıştır. Nitel veri, Eğitimi Araştırma ve Geliştirme Dairesi Başkanlığı (EARGED) tarafından Aralık 2010- Ocak 2011 tarihlerinde 15 farklı ilden toplanmıştır. 515 ilköğretim okulundan 531 ilköğretim matematik öğretmeni bu çalışmaya katılmıştır.

3.2.4 Veri Toplama Süreci Aşama IV

Araştırma problemlerini anlayabilmek için ölçekten elde edilen sonuçlar doğrultusunda nitel veri toplanmıştır. Bu sürecin amacı, nicel sonuçların daha iyi anlaşılması içindir. Nitel veri toplama sürecine 8 ilköğretim matematik öğretmeni katılmıştır. Süreçte gözlemler, görüşmeler ve ders kitabı analizleri yapılmıştır. Görüşmeler ses kayıt cihazı ile kayıt altına alınmıştır. Her görüşme yaklaşık bir saat sürmüştür. Bu görüşmelerin amacı, öğretmenlerin dersi nasıl planladıkları, bu süreçte ne tür kaynaklar kullandığı ve bunları nasıl kullandıklarını oran-orantı konusunda incelemektir.

Görüşmelerle birlikte, öğretmenlerin oran-orantı konusunu anlattıkları dersler de gözlenmiştir. Her öğretmen iki kere sınıf ortamlarında incelenmiştir. Bu

gözlemlerin amacı, öğretmenlerin görüşmeler sırasında verdikleri cevapları görüşemelerle doğrulamaktır. Ayrıca, öğretmenlerin ders esnasında kullandıkları çalışma kâğıtları ve kendi ders notları süreç içinde analiz edilmiştir.

3.3 Katılımcılar

Süreçte farklı katılımcılardan veri toplanmıştır. Tablo 3.1 katılımcılar hakkında genel bilgi vermektedir. Ayrıntılı bilgi alt bölümlerde yer almaktadır.

3.3.1 Katılımcılar Aşama I

Ölçeğin geliştirilmesi kısmında, 13 ilköğretim matematik öğretmeni (4 Erkek, 9 Kadın) ile görüşmeler düzenlenmiştir. Katılımcılar, deneyimlerine ve çalışmaya katılım isteklerine göre seçilmiştir. Yedi öğretmen 10 yılın üzerinde bir öğretmenlik deneyimine sahipken iki öğretmen 25 yıldır öğretmenlik yapmaktadır. Öğretmenler aynı zamanda, aynı yayınevinin matematik ders kitaplarını kullanmaktadır.

3.3.2 Katılımcılar Aşama II

Görüşmelerden sonra geliştirilen ölçeğin pilot çalışmaları için Ankara'nın Çankaya ve Keçiören ilçelerinden rastgele seçilmiş toplamda 30 okuldan 189 öğretmen çalışmaya katılmıştır. Katılımcılar hakkında detaylı bilgi Tablo 3.2'de verilmiştir.

Tablo 3.2 Matematik öğretmenlerinin frekans dağılımı

	Frekans (*f*)	Yüzde (%)
Cinsiyet		
Erkek	66	35
Kadın	123	65
Toplam	189	100
Öğretmenlik Deneyimi		
0-5	5	2.6
6-10	18	9.5
11-15	49	26
16-20	30	15.9
21- 21 üstü	87	46
Toplam	189	100

3.3.3 Katılımcılar Aşama III

Ölçeğin pilot çalışmaları tamamlandıktan sonra, ortaya çıkan faktör yapısını doğrulamak üzere tabakalandırılmış rasgele örneklem yöntemi ile katılımcılara ulaşılmıştır. Hedef kitle, devlet okullarında altıncı, yedinci ve sekinci sınıflarda

öğretmenlik yapan matematik öğretmenlerdir. Hedef kitlenin hepsine ulaşmak mümkün olmadığı için Dinçer, Özaslan ve Kavasoğlu (2003) tarafından Türkiye'nin 81 ilinde yapılan illerin ve bölgelerin sosyo-ekonomik gelişmişlik sıralamasına göre çalışmaya dahil edilecek iller belirlenmiştir. Toplamda 15 farklı ilden 515 ilköğretim okulunda çalışan 531 matematik öğretmeni çalışmaya katılımıştır (Bakınız Tablo 3.4).

Tablo 3.4 Sosyo-ekonomik gelişmişlik sıralamasına göre çalışmaya katılan okulların sayısı

İl Grupları	Rasgele Seçilen İller	2009-2010 Yıllarında İlköğretim Okulu Sayısı	Seçilen İlköğretim Okulu Sayısı
1	İstanbul	1621	108
	İzmir	980	65
	Kocaeli	369	25
2	Eskişehir	234	16
	Muğla	393	26
	Mersin	558	37
3	Samsun	901	60
	Karaman	173	12
	Afyon	454	30
4	Kastamonu	290	19
	Aksaray	270	18
	Tokat	484	32
5	Batman	403	27
	Iğdır	169	11
	Bitlis	441	29

3.3.4 Katılımcılar Aşama IV

Ölçekten elde edilen sonuçlar doğrultusunda öğretmenlerle görüşmeler ve gözlemler yapılmıştır. Çalışmaya sekiz katılımcı (3 Erkek, 5 Kadın) katılmıştır. İki öğretmen 10 yıl, iki öğretmen 15 yıl ve dört öğretmen 25 yıl öğretmenlik deneyimine sahiptir.

3.3 Nicel Veri Toplama Ölçeği

Görüşmelerden ve literatürden elde edilen verilerle ölçek oluşturulmuş, faktör yapısının belirlenmesi için pilot çalışma yapılmıştır. Pilot çalışma sonucunda ortaya çıkan ölçeğin, Matematik Öğretmenlerinin Ders Kitabı Kullanım Ölçeğinin, üç farklı

kısmı vardır. İlk kısım, demografik bilgilerin yer aldığı kısımdır. Bu kısımda öğretmenlerin cinsiyeti, yıl olarak öğretmenlik deneyimleri, sınıflarındaki öğrenci sayısı ve matematik öğretimi için kullandıkları bazı kaynakların değerlendirmesine yer verilmiştir. İkinci kısımda, ders kitaplarının, çalışma kitaplarının, öğretmen kılavuzunun ve yardımcı kitapların kullanımını içeren maddeler yer almaktadır. 5-li Likert ölçek (1:Hiçbir zaman - 5:Herzaman) kullanılmıştır. Üçüncü kısımda, öğretmenlerin ders kitabı değerlendirmelerini içeren bölüm yer almaktadır. 5-li Likert ölçek (1:çok zayıf - 5:çok iyi) kullanılmıştır.

BÖLÜM 4

SONUÇLAR

Bu bölümde, Matematik Öğretmenlerinin Ders Kitabı Kullanım Ölçeğinden elde edilen sonuçlar ve bu sonuçlar doğrultusunda yapılan görüşme ve gözlem sonuçları sunulacaktır.

4.1.2 Ölçeğin Faktör Yapısı

Matematik Öğretmenlerinin Ders Kitabı Kullanım Ölçeğinin ikinci kısmında yer alan öğretmenlerin ders kitabı kullanımlarına yönelik maddeler dört faktörlü bir yapıya sahiptir. Temel bileşenler tekniği ile oblik döndürme faktör çözümlemesi sonuçları dört faktörlü bir yapının olduğunu göstermektedir. Dört faktörlü yapının toplam varyansı açıklama oranı %55.61 olarak hesaplanmıştır. Faktör analizinde üçüncü, dördüncü, birinci ve ikinci faktörlerin özdeğerleri sırasıyla 10.137, 5.280, 2.241, ve 1.810 dir. Birinci faktör, ders kitabını yorumlama, ikinci faktör çalışma kitabından soru seçme, üçüncü faktör öğretmen kılavuzunu yorumlama, dördüncü faktör yardımcı kitaplardan soru ve problem seçme olarak isimlendirilmiştir. Faktörlerin güvenirlik katsayıları ve madde sayıları Tablo 3.8'de verilmiştir.

Table 3.8 Ders kitabı kullanımı ölçeğinin faktör sayısı, güvernirlik katsayısı ve maddeleri

Faktörler	Maddeler	Cronbach Alfa	n
Ders Kitabını Yorumlama	1-4, 6, 10, 12-15	.88	10
Çalışma Kitabından Soru Seçme	21-25, 27	.79	6
Öğretmen Kılavuzunu Yorumlama	28-37	.91	10
Yardımcı Kitaplardan Soru ve Problem Seçme	38-46	.92	9

Dört faktörlü yapı için daha sonra DFA yapılmıştır. DFA sonucunda elde edilen uyum indeksleri Tablo 3.10 da gösterilmiştir. Uyum indeksleri sonuçlarına göre ölçeğin dört faktörlü yapıya sahip olduğu görülmüştür.

Tablo 3.10 Doğrulayıcı faktör analizi sonuçları

	χ^2	*df*	*RMSEA*	*(90% CI)*	*SRMR*	*CFI*	*NNFI*
(n=262)							
Dört faktörlü yapı	2321.11*	554	.075	(.069-.081)	.081	.95	.94

*90% CI, 90% RMSEA için güvernirlik aralığı, *p< .001*

4.1.2.1 Betimsel İstatistik Sonuçları: Ders Kitabının Yorumlanması (Faktör 1)

Betimsel istatistik sonuçları göstermektedir ki, matematik öğretmenleri ders kitabını genellikle kitapta yer alan görevleri yorumlamak için kullanmaktadır. 10 maddeden oluşan birinci faktörün ortalaması 3.36 (Ss=.644) olarak bulunmuştur. Bu faktör için maddelerin ortalamalarına bakıldığında, öğretmenlerin ders kitaplarını derse hazırlık yapmak için kullandıkları aynı zamanda kitaptaki konu girişlerini ve günlük hayat ilişkilerini kurmak için kullandıkları söylenebilir (Bakınız Tablo 4.7). Bu faktörün modu 3.40 olarak bulunmuştur.

Table 4.7 Ders kitabının yorumlanması faktöründeki maddelerin ortalamaları

Maddeler	$\bar{X}$	*Ss*
10. Ders işlenişi sırasında ders kitabı kullanırım.	3.76	1.024
1. Derse hazırlık yaparken ders kitabı kullanırım.	3.75	.949
6. Konu anlatımımı, ders kitabının konu anlatımına benzetirim.	3.45	.946
2. Konu girişini ders kitabındaki gibi yaparım.	3.37	.946
12. Derste kullandığım tanımları ders kitabından yaparım.	3.37	1.008
15. Matematiksel temsil biçimlerini (grafik, tablo, vb. gösterimleri) ders kitabından seçerim.	3.37	.890
3. Kavramların günlük yaşamla olan ilişkilerini ders kitabındaki gibi yaparım.	3.30	.842
4. Konunun diğer derslerle ilişkilendirilmesinde ders kitabı kullanırım.	3.21	.963
13. Derste kullandığım örnekleri ders kitabından seçerim.	3.04	.902
14. Derste kullandığım problemleri ders kitabından seçerim.	3.01	.903

4.1.2.2 Betimsel İstatistik Sonuçları: Çalışma Kitabından Soru Seçme (Faktör 2)

Betimsel istatistik sonuçları göstermektedir ki, matematik öğretmenleri çalışma kitaplarını soru ve problem seçmek için kullanmaktadır. 6 maddeden oluşan ikinci faktörün ortalaması 3.38 (Ss=.659) olarak bulunmuştur. Bu faktör için maddelerin ortalamalarına bakıldığında, öğretmenlerin çalışma kitaplarını merkezi sınav (örn. SBS) sorularına benzer soruları kullandıkları ve çalışma kitabından ders kitabında olmayan soruları seçtikleri söylenebilir (Bakınız Tablo 4.8). Bu faktörün modu 3.67 olarak bulunmuştur.

Tablo 4.8 Çalışma kitabından soru seçme faktöründeki maddelerin ortalamaları

Maddeler	$\bar{X}$	*Ss*
23. Çalışma kitabında bulunan merkezi sınav (örn. SBS) sorularına benzer soruları kullanırım.	3.75	.870
25. Çalışma kitabından ders kitabında olmayan soruları seçerim.	3.50	.957
27. Çalışma kitabındaki sorularla öğrencileri değerlendiririm.	3.43	.980
22. Çalışma kitabındaki soruları derste çözerim.	3.31	.957
24. Çalışma kitabından ders kitabındaki sorulara benzer soruları seçerim.	3.26	1.008
21. Derste çözdüğüm soruları çalışma kitabından seçerim.	3.01	.933

4.1.2.3 Betimsel İstatistik Sonuçları: Öğretmen Kılavuzunu Yorumlama (Faktör 3)

Betimsel istatistik sonuçları göstermektedir ki, matematik öğretmenleri öğretmen kılavuzunu kazanımlara bakmak ve derse hazırlık yapmak için kullanmaktadır. 10 maddeden oluşan üçüncü faktörün ortalaması 3.37 (Ss=.758) olarak bulunmuştur. Bu faktör için maddelerin ortalamalarına bakıldığında, öğretmenlerin öğretmen kılavuzunu derse hazırlık aşamasında kullandıkları ve ders kitabında açık olmayan durumları öğretmen kılavuzu netleştirdikleri söylenebilir (Bakınız Tablo 4.9). Bu faktörün modu 3.60 olarak bulunmuştur.

Tablo 4.9 Öğretmen kılavuzunu yorumlama faktöründeki maddelerin ortalamaları

Maddeler	$\bar{X}$	*Ss*
29. Kazanımlara öğretmen kılavuzundan bakarım	4.30	.862
28. Derse hazırlık yaparken öğretmen kılavuzuna başvururum.	3.88	.945
33. Ders kitabında açık olmayan durumları öğretmen kılavuzu ile netleştiririm.	3.59	1.051
34. Etkinlikleri yaparken öğretmen kılavuzuna başvururum.	3.36	1.054
37. Alternatif ölçme araçlarının (örn. ürün dosyası, kavram haritası, görüşme, vb.) kullanımını öğretmen	3.26	1.089
31. Performans ödevlerini öğretmen kılavuzundan seçerim.	3.23	.981
32. Bilmediğim/unuttuğum kavramlar için öğretmen kılavuzuna başvururum.	3.23	1.14
30. İlave soruları öğretmen kılavuzundan seçerim.	3.20	1.001
36. Ders araç-gereçlerinin kullanımını öğretmen kılavuzundan öğrenirim.	2.88	1.175
35. Soruların doğru cevapları için öğretmen kılavuzuna başvururum.	2.75	1.205

4.1.2.4 Betimsel İstatistik Sonuçları: Yardımcı Kitaplardan Soru ve Problem Seçme (Faktör 4)

Betimsel istatistik sonuçları göstermektedir ki, matematik öğretmenleri yardımcı kitapları soru ve problem seçmek için kullanmaktadır. 9 maddeden oluşan dördüncü faktörün ortalaması 3.37 (Ss=.758) olarak bulunmuştur. Bu faktör için maddelerin ortalamalarına bakıldığında, öğretmenlerin yardımcı kitapları merkezi sınav (örn. SBS) sorularına benzer soruları kullandıkları ve ders kitabında olmayan soruları yardımcı kitaplardan seçtikleri söylenebilir (Bakınız Tablo 4.10). Bu faktörün modu 3.00 olarak bulunmuştur.

Tablo 4.10 Yardımcı kitaplardan soru ve problem seçme faktöründeki maddelerin ortalamaları

Maddeler	$\bar{X}$	*Ss*
43. Yardımcı kitaplarda bulunan merkezi sınav (örn. SBS) sorularına benzer soruları kullanırım.	3.71	.885
40. Ders kitabında olmayan soruları yardımcı kitaplardan seçerim.	3.67	.937
38. Derste çözdüğüm soruları yardımcı kitaplardan seçerim.	3.39	.889
44. Derste kullandığım problemleri yardımcı kitaplardan seçerim.	3.29	.898
45. Sınavlarda sorduğum soruları yardımcı kitaplardan seçerim.	3.08	.97
42. Derste kullandığım örnekleri yardımcı kitaplardan seçerim.	3.19	.982
39. Konu anlatımımı, yardımcı kitapların konu anlatımına benzetirim.	2.84	.994
41. Derste kullandığım tanımları yardımcı kitaplardan yaparım.	2.81	1.059
46. Öğrencileri yardımcı kitaplardaki sorularla değerlendiririm.	2.6	1.065

Sonuçlar göstermektedir ki, Matematik Öğretmenlerinin Ders Kitabı Kullanım Ölçeği dört boyuttan meydana gelmektedir: ders kitabını yorumlama, çalışma kitabından soru seçme, öğretmen kılavuzunu yorumlama ve yardımcı kitaplardan soru ve problem seçmedir. Bu boyutların her biri ilköğretim matematik öğretmenlerin kitap kullanımları hakkında önemli bilgiler sunmaktadır. Örneğin, öğretmenler ders kitabını çoğunlukla ders öncesinde derse hazırlık yaparken kullanmaktadır. Öğretmenler özellikle konunun günlük hayatla ilişkilendirilmesi, diğer derslerle bağlantı kurulması, konu sırasının takibi için ders kitabından faydalanmaktadır. Ayrıca ders kitabında yer alan konu girişleri, tanımlar, alıştırmalar ve aktiviteler dersin planlanmasında ve dersin işlenmesinde önemli matematiksel kaynaklardır. Görüşmelerde öğretmenler ayrıca, ders kitaplarını derste neyi öğretecekleri konusunda önemli bir rehber olarak gördüklerini belirtmektedirler. Bu noktada, öğretmenlerin soru kaynağı olarak farklı kaynaklara yöneldikleri görülmektedir. Öğretmenler soru ve problem kaynağı olarak çalışma kitabına ve yardımcı kitaplara yönelmektedir. Özellikle, çalışma kitapları öğretmenler için hem derste soruların çözülmesi, hem de ders sonrasında öğrencilere ödev verme konusunda oldukça yardımcı olmaktadır. Öğretmenler çalışma kitabından, ders

kitabında olmayan ve SBS'ye hazırlık sürecinde sıklıkla kullanılan soru tiplerini seçmektedir.

Sonuçlar göstermektedir ki, öğretmenler ders kitabındaki soruları matematiksel yönden çok iyi bulmamakta; bu nedenle soru bulmak için farklı kaynaklara başvurmaktadır. Yardımcı kitaplar bu konuda öğretmenler için oldukça zengin bir soru kaynağı olarak görülmektedir. Ayrıca, öğretmenlerin yardımcı kaynaklara yönelmelerinin nedenlerinden biri öğretmenlerin öğrencileri SBS gibi sınavlara hazırlama endişeleridir. Bu kitaplar, sınavlara hazırlık anlamında öğretmenlere ve öğrencilere farklı türlerden sorular sunmaktadır. Bu nedenle, öğretmenlerin ders sırasında çözdüğü soruların kaynakları ders kitabı değil de yardımcı kaynaklar olmaktadır.

Öğretmenler, kılavuz kitapları sıklıkla derse hazırlık sürecinde kullanmaktadır. Görüşmelerde öğretmenlerin belirttiği gibi öğretmenler kılavuz kitapları ders kitaplarının yanında ikincil bir kaynak olarak görmektedir. Dolayısıyla, öğretmenler ilk olarak ders kitaplarına bakmakta, orada netleştiremedikleri noktalar olduğunda kılavuz kitabı kullanmaktadır. Öğretmenler bu kitapları özellikle dersin kazanımlarına bakmak, dersin sınırlarını belirlemek amacıyla kullanmaktadır. Bu noktada, kılavuz kitapların öğretmenler için neyi, nasıl öğretecekleri konusunda çok az yardımcı oldukları söylenebilir.

BÖLÜM 5

YORUM VE TARTIŞMA

Bu çalışmada, ilköğretim matematik öğretmenlerinin kitap kullanımları araştırılmış ve öğretmenlerin ders kitabında yer alan görevleri derse nasıl entegre ettikleri incelenmiştir. Bu alanda yapılan çalışmalara bakıldığında ders kitabının kullanımına yönelik ölçeğin olmadığı; bu nedenle Matematik Öğretmenlerinin Ders Kitabı Kullanım Ölçeğinin geliştirilmesinin bu alanda yararlı olabileceği düşünülmüştür. Bu ölçek temelde öğretmenlerin ders kitabı, çalışma kitabı, öğretmen kılavuz kitabı ve yardımcı kitapları nasıl yorumladıkları ve bu kitaplardan soruları ve problemleri nasıl seçtikleri ele alınmıştır.

Ders kitabını yorumlama boyutu incelendiğinde, öğretmenlerin ders kitabı kullanım sıklığının orta derecede olduğu söylenebilir. Bu sonucun iki önemli nedeni vardır. Bunlardan ilki, öğretmenlerin ders kitabı dışında diğer kitapları kullanım sıklıklarıdır. Diğer kitapların kullanımı ders kitabının kullanım sıklığını bir derece düşürmüş olabilir. Bu varsayım diğer çalışmalar tarafından da desteklenmektedir. Yapılan çalışmalarda (örneğin, Adler, 2000; Cohen ve diğerleri 2003; Gueudet & Trouche, 2009) öğretmenlerin kaynakları bir bütün olarak ele aldığı, kaynakları birbirinden ayırt etmekte zorlandığı belirtilmektedir. İkinci olarak, öğretmenlerin ders kitabını kullanırken kendi inançlarına ve bilgilerine göre değişiklik yapma isteğinden kaynaklanmaktadır. Öğretmenler, ders kitaplarında yer alan görevleri yorumlarken bunlarda değişiklik yapmakta ve derse göre adapte etmektedirler.

Ders kitabının yorumlanması boyutunda, öğretmenler ders kitabını derse hazırlanmak, diğer dersle ve günlük yaşamla bağlantısını bağlantı kurmak ve tanım yapmak amacıyla kullanmaktadır. Sherin ve Drake'in (2004) çalışmasında belirtildiği üzere, öğretmenler ders kitabını derste hangi aktivitelerin yapılacağı ve hangi örneklerin verileceği konusunda, kısaca öğrencilerin ne öğrenmesi konusunda, ders kitaplarından yararlanmaktadır.

Öğretmenlerin ders kitabındaki aktiviteleri yorumlaması bir yandan öğretmenlerin kılavuz kitabı nasıl yorumladığı ile de ilgilidir. Öğretmenler, derse hazırlık aşamasında ders kitabınının yanı sıra öğretmen kılavuzundan da yararlanmaktadır. Öğretmen kılavuzunun yorumlanması boyutu incelendiğinde, bu boyutun ortalamasının ders kitabının yorumlaması boyutu ile hemen hemen aynı ortalamaya sahip olduğu görülmektedir. Bu sonuç iki türlü tartışılabilir. İlki, öğretmenler ders kitabını da öğretmen kılavuzunu da derse hazırlık için kullanmaktadır. Sonuçlar göstermektedir ki, öğretmenler ders kitabında netleştiremedikleri noktalar için kılavuz kitaba yönelmektedir. Bu sonuç, her iki boyutun ortalamalarının neden bu kadar birbirine yakın çıktığını destekler niteliktedir. İkinci olarak, kılavuz kitap hem ders kitabının hem de çalışma kitabının sayfalarını içermektedir. Gözlemler ve görüşmeler göstermektedir ki, kılavuz kitabı kullanan öğretmenler dersin planını ders kitabının içeriğine göre gerçekleştirmektedir. Bu nedenle, öğretmenlerin ders kitabı kullanımları kılavuzun kitap kullanımı ile yakından ilişkilidir. Bu varsayımın doğrulanması için başka çalışmaların yapılması gerekmektedir.

Ders kitabını yorumlama boyutu incelendiğinde, öğretmenlerin ders kitabı kullanım sıklığının orta dereceli olduğu söylenebilir. Bu sonucun iki açıklaması olabilir. Bunlardan ilki, öğretmenlerin soru ve problem seçmek için sadece çalışma kitabı ya da yardımcı kitabı kullanmaması olabilir. Öğretmenlerin ölçekteki maddelere verdiği cevaplar göz önünde bulundurulduğunda, öğretmenlerin önce ders kitabına baktığı fakat ders kitabındaki soruları matematiksel yönden zayıf bulduklarından çalışma ve yardımcı kitaplara yöneldiği görülmektedir. İkinci açıklama, öğretmenlerin kitaplardan soruları ve problemleri seçerken öğrencilerin seviyelerini göz önünde bulundurarak değişiklik yapma yoluna gitmeleridir. Doerr ve Chandler-Olcott'un (2009) sözünü ettiği gibi öğretmenler problemleri ve soruları seçerken ve düzenlerken her öğrencinin bir soru çözebileceğini düşünür. Bu nedenle, öğretmenler kitap kullanımında öğrencilerin seviyelerine göre gerekli modifikasyonları yapma eğilimindedir. Bu ise öğretmenlerin kitap kullanımlarını yakından ilgilendiren faktör olarak değerlendirilebilir.

TEZ FOTOKOPİSİ İZİN FORMU

ENSTİTÜ

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YAZARIN

Soyadı : ÖZGELDİ
Adı : MERİÇ
Bölümü : ELE

TEZİN ADI (İngilizce) : MIDDLE SCHOOL MATHEMATICS TEACHERS' USE OF TEXTBOOKS AND INTEGRATION OF TEXTBOOK TASKS INTO PRACTICE: A MIXED METHODS STUDY

TEZİN TÜRÜ : Yüksek Lisans [ ] Doktora [X]

1. Tezimin tamamından kaynak gösterilmek şartıyla fotokopi alınabilir. [ ]
2. Tezimin içindekiler sayfası, özet, indeks sayfalarından ve/veya bir bölümünden kaynak gösterilmek şartıyla fotokopi alınabilir. [ ]
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