Perceptions of High School Mathematics Teachers Regarding the 2005 Turkish Curriculum Reform and Its Effects on Students’ Mathematical Proficiency and Their Success on National University Entrance Examinations

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the faculty of

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of Ohio University

In partial fulfillment

of the requirements for the degree

Doctor of Philosophy

Sidika Nihan Er

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This dissertation titled

Perceptions of High School Mathematics Teachers Regarding the 2005 Turkish Curriculum Reform and Its Effects on Students’ Mathematical Proficiency and Their Success on National University Entrance Examinations

by

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has been approved for

the Department of Teacher Education

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Abstract

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Perceptions of High School Mathematics Teachers Regarding the 2005 Turkish Curriculum Reform and Its Effects on Students’ Mathematical Proficiency and Their Success on National University Entrance Examinations

Director of Dissertation: Gregory D. Foley

In Turkey, the secondary mathematics curriculum, students’ mathematical proficiency, and their preparation for the university entrance examinations are inextricably connected. The Ministry of National Education adopted a new curriculum in 2005 that was built on constructivist theory. This study explored the perceptions of high school mathematics teachers in Turkey regarding the effects of this new curriculum on students’ mathematical proficiency and students’ success on the examinations.

Specifically, this study investigated two issues:

- the perceptions of teachers regarding the reform and its impact on students’ mathematical proficiency and their success on national university entrance examinations, and
- the differences among those perceptions across types of schools and years of teaching experience.

This exploratory investigation concurrently used a survey and interviewed teachers at Anatolian, general, and science high schools. The researcher designed and tested the survey and disseminated it to 162 teachers from 59 of the 81 provinces in
Turkey. In addition, 18 teachers were interviewed: 9 from each of two provinces and 6 from each of the three types of schools. The researcher conducted three factorial analyses of variance and several follow-up tests to address the research questions, and analyzed the results using constructivist theory as a framework.

Teachers’ perceptions of the reformed curriculum and its impact on students’ mathematical proficiency were about the same regardless of school type or teaching experience. The teachers indicated that the main obstacles to implementation are lack of time, large class sizes, an unchanged university entrance examination system, and insufficient professional development. Overall, teachers’ perceptions about the impact of the curriculum reform on students’ success on university entrance examinations were slightly negative. Teachers perceived that the educational and examination systems conflict with each other and that students who attend different types of schools require different curricula. The researcher recommends that entrance examinations be changed to align with the constructivist approach, that distinct curricula be designed and implemented that are suitable for each type of school, and that targeted professional development programs be developed. There is a need for further research related to the improvement of secondary school curriculum, assessment, and their implementation.

Approved: _____________________________________________________________

Gregory D. Foley

Robert L. Morton Professor of Mathematics Education
Dedication

This dissertation is dedicated to

the ever loving memory of my father

Dr. Ayhan Ulusoy
Acknowledgments

I would like to express my warmest thanks to my advisor, Dr. Gregory D. Foley, for his support, guidance, and patience during my doctoral study. I thank him especially for calling me at home and offering me an opportunity to begin the doctoral study; I will always remember that. I would like to thank my other committee members—Dr. John Henning, Dr. George Johanson, and Dr. Timothy McKeny—for their support and help during the process of my dissertation.

Additional thanks go to Hilal Hanım and my dear friend Nilüfer for helping me in the process of developing the survey; to Harun Bey for helping me obtain the permission; and last but not least, to my dear colleagues Heba and Maha for valuable discussions, suggestions, and their continuous encouragement.

Most importantly, I would like to express my deepest gratitude to my husband, my mother, my sister, my mother-in-law, and my father-in-law for supporting and encouraging me and praying for me throughout my study; and my brother-in-law for his kind help forwarding the permission document from the ministry. And I cannot thank enough my little son, Ömer Yiğit, for being extremely patient and mature during my study.
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Chapter 1: Introduction

The purpose of this research is to investigate the perceptions of the high school mathematics teachers regarding the 2005 Turkish secondary education mathematics curriculum reform and its impact on students’ mathematical proficiency and their success on the university entrance examinations. Another aim is to explore possible differences of those perceptions across the types of schools and years of teaching experience.

The nationwide university entrance examination has an important place in the Turkish education system. Many students begin to study for this exam in the early years of their education. Student preparation accelerates during the high school years, especially the last year of high school, as is evidenced by the presence of many preparatory and tutoring institutions in Turkey (Eğitim Sen, 2010).

This critically important examination is the Öğrenci Seçme ve Yerleştirme Sınavı (ÖSYS), which means the student selection and placement examination. However, its name changed to Ölçme, Seçme ve Yerleştirme Sınavı (ÖSYS) in March 2011, which means the assessment, selection, and placement examination. Since 1985, the system of the ÖSYS has changed three times, including the content and the number of exam questions. In addition, Turkish curricula have not remained static during the same period.

Background of the Study

Milli Eğitim Bakanlığı (MEB), which means the Ministry of National Education, is the education organization at the level of Ministry. Turkey’s national education system consists in formal education and informal education, as determined by the 1973 National Education Basic Act No. 1739. “Formal education is the regular education conducted
within a school for individuals in a certain age group and at the same level, under programs developed in accordance with the purpose” (MEB, 2011, p. xi). Preprimary education, primary education, secondary education, and higher education institutions are the basic parts of formal education in Turkey. Private tutoring institutions were established as informal educational enterprises by the 1973 National Education Basic Act No. 1739 (MEB, 2009a). Informal education involves persons who have never gone to school or who quit school before graduation. One of the objectives of the informal education is for people to gain the ability to read and write and to understand scientific, technological, economic, social, and cultural developments (MEB, 2011).

This study focuses on Anatolian high schools, general high schools, and science high schools. To understand how these schools fit into the broader context of all secondary schools a brief overview is now provided. Secondary education is a part of the formal educational system of Turkey. It is defined by MEB (2011) as follows:

Secondary education includes all education institutions of a general or vocational and technical character of at least four years following primary education. The objectives of secondary education are to give students a common minimum overall knowledge, to familiarize them with problems of the individual and the society and to seek solutions, to ensure that they gain the awareness that shall contribute to the socio-economic and cultural development of the country and to prepare them for higher education, for both higher education and a profession or for life and employment, in line with their interests and aptitudes. (p. xii)

---

1 Anatolia is the part of Turkey on the Asian continent, but Anatolian schools are found in both Anatolia and European part of Turkey.
As shown in Table 1.1, there are 15 types of secondary education schools in the Republic of Turkey; these schools operate under several distinct directorates within MEB. There are five types of high schools under the general directorate of secondary education: general high schools, Anatolian high schools, science high schools, social science high schools, and Anatolian fine arts and sports high schools (MEB, 2009a, 2011). Anatolian teacher training high schools function under the general directorate of teacher training. Private Turkish high schools, minority high schools, international high schools, and foreign high schools are the secondary high schools under the directorate of private education institutions. There are also numerous vocational and technical secondary education schools, one open secondary education school, several conservatories, and two police colleges (MEB, 2011).

Table 1.1

<table>
<thead>
<tr>
<th>Types of Secondary Schools in Turkey</th>
</tr>
</thead>
<tbody>
<tr>
<td>General Directorate of Secondary Education</td>
</tr>
<tr>
<td>Social Sciences H. S. (27)</td>
</tr>
<tr>
<td>Anatolian Fine Arts and Sports H. S. (89)</td>
</tr>
</tbody>
</table>

Note. The numbers in parantheses represent the number of schools in 2011.
Secondary schools in Turkey include Grades 9–12 since 2005. Anatolian, general, and science high schools cover a wide range of aims and purposes. Anatolian and science high schools emphasize mathematics and science education, which make them of particular interest for this study and its research questions. Moreover, students who attend to science high schools and Anatolian high schools have always had more success on the ÖSYS. General high schools, too, are of interest to the study, because the vast majority of Turkish students attend these schools and, unlike Anatolian and science schools, are found throughout the country.

Anatolian high schools provide an alternative to private schools. The objective of Anatolian high schools is to prepare students for higher education programs according to their interests, capabilities, and achievements. Because foreign languages are emphasized, these comprehensive schools provide students with the ability to follow scientific and technological progress around the world. The primary foreign languages are English, German, and French. Lessons are taught in Turkish but if at least 12 students demand to be taught in foreign languages and if there is a teacher who can teach in that language, then mathematics and science (physics, chemistry, and biology) can be taught in the primary foreign languages (MEB, 2008a). These schools were first opened in 1955 as Ministry of Education colleges in several major provinces. In 1975, their name was changed to Anatolian high schools (Dönmez, 2005). The number of Anatolian high schools has increased since the 1980s; there were 1,354 in operation in 2010–2011.

General high schools are secondary schools that prepare students for institutions of higher learning. Since 2005, these comprehensive schools have had a 4-year program
that follows primary education. In 2011, there were 1,477 general high schools (MEB, 2011). These schools focus on the sciences, Turkish, mathematics, social sciences, and foreign languages. All lessons are taught in Turkish. English is the primary foreign language in general high schools. Students are admitted to these schools without any entrance examinations.

Science high schools generally are boarding schools, although commuting students can attend with parental consent. MEB limits class sizes to 24 students and the number of students who are admitted to a science high school in any academic year cannot exceed 96. Science high schools emphasize research and laboratory activities. The primary foreign language is English. The first of these schools was established in 1964 through the support of the Ford Foundation. In 2011, there were 115 science high schools across Turkey (MEB, 2011).

MEB (2008b) defined the objectives of the science high schools as follows: To provide an education to exceptionally gifted mathematics and science students by facilitating a higher level of education in these areas; to provide necessary sources in order to produce highly qualified scientists; to motivate students toward research and to create environments and conditions for those who are interested in new scientific discoveries and technological developments; to train individuals who are capable of using new technologies, producing new knowledge, and preparing new projects; to prepare students to do scientific research and to teach them a foreign language that allows them to follow current scientific and technological developments throughout the world.
Anatolian and science high schools admit their students based on scores on the nationwide high school placement exam. Besides this exam, students’ achievement scores at the end of the academic year, their behavior scores, and students’ preference for the schools are taken in consideration in order to place of students at Anatolian and science high schools. Table 1.2 summarizes the features of Anatolian, general, and science high schools.

Table 1.2

*Features of Anatolian, General, and Science High Schools*

<table>
<thead>
<tr>
<th>Anatolian High Schools</th>
<th>General High Schools</th>
<th>Science High Schools</th>
</tr>
</thead>
<tbody>
<tr>
<td>There were 1,354 of them.</td>
<td>There were 1,477 of them.</td>
<td>There were 115 of them.</td>
</tr>
<tr>
<td>Admit students by nationwide high school placement exam</td>
<td>Admit students without any entrance examination</td>
<td>Admit students by nationwide high school placement exam</td>
</tr>
<tr>
<td>Class size is limited to 30 students.</td>
<td>Class size is limited to 24 students.</td>
<td>Class size is limited to 24 students.</td>
</tr>
<tr>
<td>Each school decides their quota.</td>
<td></td>
<td>Number of students cannot exceed 96 students in each year.</td>
</tr>
<tr>
<td>Primary foreign languages are English, German, and French.</td>
<td>Primary foreign language is English.</td>
<td>Primary foreign language is English.</td>
</tr>
<tr>
<td>Teachers are chosen by examination.</td>
<td></td>
<td>Teachers are chosen by examination.</td>
</tr>
</tbody>
</table>

Anatolian and science high schools choose their teachers by examination (MEB, 2011). The required qualifications for being a teacher in these schools are described as follows: (a) based on the agreement of the Board of Education regarding the determination of who shall be appointed, teaching and learning areas of applicants should
be appropriate for the educational institution to be appointed, (b) it is required that applicant have served as a teacher in a school of the Ministry for at least 3 years, and (c) the minimum average performance of the applicant for the last 2 years should be very good. Selection exam topics and their weights are 20% Turkish, 15% principles of Atatürk and history of revolution, 15% teaching profession, and 50% knowledge of the special field. Exam is assessed based on 100 points, and appointments are made based on the rule of points, and ones who attain 60 points are considered successful. For instance, applicants typically have to earn more points to be a teacher in a science high school than others (MEB, 2010).

Higher Education in Turkey

Öğrenci Seçme ve Yerleştirme Merkezi (ÖSYM), which means Student Selection and Placement Center, known as Ölçme, Seçme ve Yerleştirme Merkezi (ÖSYM) which means Assessment, Selection, and Placement Center since 2011, organizes the ÖSYS in Turkey. Since 1974, almost all institutions of higher education in Turkey have accepted students based on the results of the ÖSYS (ÖSYM, 2006). The purpose of higher education in Turkey is “to train manpower within a system of contemporary educational and training principles to meet the needs of the country. It provides high level specialized education in various fields for students who have completed the secondary education” (ÖSYM, 2006, p. 2). Higher education consists of universities, military and police colleges and academies, and vocational schools. All of these institutions are regulated by the Higher Education Law (Law no. 2547), which has been effective since 1981.
Over time, the number of students who are admitted in universities has increased because both the number of universities and their quotas have increased. For instance, while 21.98% of 892,975 applicants were admitted to universities in 1990, 55.06% of 1,587,993 applicants were admitted to universities in 2010 (ÖSYM, 2006). A brief history of the ÖSYS will provide further context for the study.

**History of access to higher education in Turkey.** In the 1950s, the student population grew and implementing admission criteria for universities became problematic (ÖSYM, 2006). Before the 1950s, there were graduation examinations for high schools and matriculation examinations administered through the support of MEB. Some of the universities developed their own student selection examinations as the number of applicants increased. But these examinations were mostly essay based, and an accurate assessment of the success of students was difficult. Therefore, the higher education institutions began to use standardized tests for selection and placement of students. In order to maintain equity for all the institutions, the Interuniversity Entrance Examination Commission was established. This commission examined a system which had initially been used by Ankara University and then modified it to be used in all universities in Turkey. As a result, a partially centralized system was accepted for admission of students to higher education institutions in the 1964–1965 academic year. However, the number of applicants kept increasing so that the placement of applicants was becoming more difficult by the commission. To solve this problem, Hacettepe University developed a central placement system and put into effect in the 1974–1975 academic year (Berberoğlu, 1996; ÖSYM, 2006). This central placement system had a
one-stage examination. In 1981, Interuniversity Entrance Examination Commission
started to operate under the Higher Education Council under the title the ÖSYM by the
Higher Education Law (ÖSYM, 2006).

A two-stage examination was adopted in 1981. The reasons for the changes were
(a) the rapid increase in the number of applicants from 1974 to 1981, (b) difficulty of
assessing the knowledge and skills of students who attended various types of schools by a
one-stage examination, (c) objectionability of selecting students for higher education
based on a one-stage examination, and (d) the fact that the solution methods of questions
in the general ability test were exposed, some improvements were necessary for both tests
and application conditions of centralized system (Kutlu, 2003). Therefore, the Higher
Education Council put the two-stage examination into effect.

Stage 1 was the Öğrenci Seçme Sınavı (ÖSS), that is Student Selection
Examination, and Stage 2 was the Öğrenci Yerleştirme Sınavı (ÖYS), that is Student
Placement Examination. The aim of the ÖSS was to select students for the ÖYS.
However, placement in some higher education institutions was based only on the Stage 1
scores (Berberoğlu, 1996). Additionally, the high school grade-point averages of students
were considered alongside their ÖSYS scores (ÖSYM, 2006). The ÖYS was
administered approximately 2 months after the ÖSS which was administrated in April.
Students who were in the last year of the secondary school, ones who graduated from the
secondary school and were not placed at any higher education program, or students who
wanted to continue their higher education in a different program took these exams.
The items of the ÖSS reflected the content areas of the courses of the high school level although the ÖSS was ability-oriented (Berberoğlu, 1996). A two-test battery was used for the ÖSS. Battery 1 tested language proficiency and reasoning in the basic and general concepts of social sciences. Battery 2 measured “the ability to make use of basic mathematical concepts and rules and the ability to reason using basic concepts and principles” (p. 365) of natural sciences. Berberoğlu indicated that the items could be categorized broadly as computation, word problems, and geometry. A five-test battery was used in the ÖYS, including (a) Turkish language and literature, (b) mathematics, (c) natural sciences, (d) social sciences, and (e) foreign languages (ÖSYM, 2006). For some intended higher education major, however, students were required to take only three of these batteries including the Turkish language and literature battery, which was required for all students. The major requiring only three batteries were science and engineering, economics and social sciences, and foreign languages and literature. Students who chose programs spanning these areas had to take all the five test batteries (ÖSYM, 2006). For instance, if a student’s preferences for higher education included the computer engineering, business administration, and English language and literature, the student had to take all of the five batteries. If a student’s preferences for higher education were all in the engineering programs, then the student had to choose Turkish language and literature, which was required for all, mathematics, and natural sciences. All of the items for both the ÖSS and the ÖYS were in multiple-choice format, each with five options. In order to minimize guessing, the raw scores of the tests were obtained by starting with the total
numbers of correct answers, then subtracting one of the correct answers for every four incorrect answers (Berberoğlu, 1996; ÖSYM, 2006).

In 1999, the Higher Education Council decided to use only the ÖSS results in selection and placement of students for higher education. Besides the high correlation between the first and second stages (ÖSYM, 2006), the main reason for this decision was to provide tests to students based on a common curriculum (“ÖSYM’den ÖSS,” 2010). “The application procedure, organizing the examination, ranking preferences for higher education programs, the placement system, special cases and test structures and item development were all carried out in a similar manner” (ÖSYM, 2006, p. 10) from the previous system. In 2006, test structure and test content were changed in such a way as to encourage students to take seriously the whole secondary education curriculum (ÖSYM, 2009). ÖSYM (2006) explained the changes as follows:

[The new tests were] Turkish, Social Science-1, Mathematics-1, Science-1, Literature-Social Science, Science, Social Science-2, Mathematics-2, Science-2, and Foreign Language. The contents of Turkish, Social Science-1, Mathematics-1, Science-1, and Foreign Language tests [were] about the same as those in the ÖSS administered before 2006. In these tests, content in general [were] based on the curricula of basic education and the first year of the secondary education. The contents of Literature-Social Science, Science, Social Science-2, Mathematics-2, and Science-2 tests [were] based on the whole curricula of the secondary education. (p. 21)
The first part of the test was required for all students. Then students needed to select two batteries from the second part of the test based on their field of concentration in high school.

This system lasted until the 2009–2010 academic year when the Higher Education Council changed the exam’s implementation but not its content. The two-stage system was implemented in the 2009–2010 academic year. The first stage was called Yüksek Öretime Geçiş Sınavı (YGS) [Transition to Higher Education Examination], and the second stage was called Lisans Yerleştirme Sınavı (LYS) [Undergraduate Placement Examination]. Ünal Yarimağan, previous president of the ÖSYM, stated that the new system had more questions than the previous exams. Students will be led to the areas in which they are interested and have the potential to be successful. Additionally, they will not be placed into higher education programs that they do not want (“ÖSYM’den ÖSS,” 2010).

Other significant changes are that the first exam, the YGS, measures students’ knowledge in science, mathematics, and language arts. The exam lasts 160 min for 160 items comprising 40 questions about the Turkish language, 40 questions about social sciences (17 history, 14 geography, 9 philosophy), 40 questions about mathematics, and 40 questions about natural sciences (14 physics, 13 chemistry, 13 biology).

The second exam, the LYS, is administered over 4 days; each day’s subtest assesses student in one or two of the following subject areas: LYS 1: mathematics and geometry; LYS 2: natural sciences; LYS 3: Turkish language arts and geography; LYS 4: social sciences; and LYS 5: foreign languages. LYS 1 and LYS 5 are administered on the
same day. To increase reliability, there now are more items in each subject area than there were prior to 2010. For instance, the 2006 ÖSS included 30 questions for natural sciences: 13 for physics, 9 for chemistry, and 8 for biology. Beginning in 2010, however, the LYS 2 has included 30 questions for each of these three natural science subjects. In addition, the LYS 1 includes 50 mathematics questions to be answered in 75 min and 30 geometry questions to be answered in 45 min. LYS 3 is compulsory, but students choose which of the other parts of the LYS they will take. Additionally, testing center president Yarımaga stated that there will be another change in 3–5 years: the exam will include open-ended questions in addition to multiple-choice questions, which it now exclusively contains (“ÖSYM’den ÖSS,” 2010).

Table 1.3 summarizes the ÖSYS since 1981. The table shows the differences and similarities among the examinations administered in the periods 1981–1998, 1999–2005, 2006–2009, and 2010–present. It represents the stages of the examinations in terms of their content and aims, as well as the batteries for each stage of examination.

The high school curriculum in Turkey has gained increasing importance because students’ high school grades will have increased weight in determining their overall exam scores. A student’s high school grades figure into his or her success score, which is the part of a student’s score on the YGS that is calculated based on high school grades, the year of graduation, and the type of high school. A brief outline of the Turkish high school curriculum is provided in the following section.
Table 1.3

*Summary of the ÖSYS Since 1981*

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<tr>
<td><strong>Stages</strong></td>
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<tr>
<td>Two stages</td>
<td>ÖSS (ability oriented)</td>
<td>ÖYS (knowledge oriented)</td>
<td>One stage ÖSS (ability oriented, basic education, &amp; Grade 9)</td>
<td>One stage ÖSS (whole curriculum of the secondary education)</td>
</tr>
<tr>
<td>Two stages</td>
<td>ÖSS (ability oriented)</td>
<td>ÖYS (knowledge oriented)</td>
<td>One stage ÖSS (ability oriented)</td>
<td>Two stages YGS (ability oriented)</td>
</tr>
<tr>
<td>ÖYS (knowledge oriented)</td>
<td>LYS (knowledge oriented)</td>
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<tr>
<td><strong>Batteries</strong></td>
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<tr>
<td>Turkish; social sciences</td>
<td>Turkish; social sciences</td>
<td>Turkish; social sciences</td>
<td>Turkish Literature; social</td>
<td>Turkish</td>
</tr>
<tr>
<td>Math.; natural sciences</td>
<td>Math.; natural sciences</td>
<td>Social sciences 1</td>
<td>Social sciences 2</td>
<td>Social sciences</td>
</tr>
<tr>
<td>Natural sciences</td>
<td>Math. 1</td>
<td>Math. 2</td>
<td>Basic math.</td>
<td>LYS 1: Math.; geometry</td>
</tr>
<tr>
<td>Social science</td>
<td>Natural sciences 1</td>
<td>Natural sciences 2</td>
<td>Natural sciences</td>
<td>LYS 2: Natural sciences</td>
</tr>
<tr>
<td>Foreign languages</td>
<td>The foreign languages test was administered separately on a different day from 1999 through 2009.</td>
<td>LYS 3: Turkish language and literature; geography</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>LYS 4: Social sciences</td>
<td>LYS 5: Foreign languages</td>
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**Turkish High School Curricula**

MEB has been the sole authority that determines the national curricula of education, its structure, implementation, modification, and revision, since 1924. This is based on the Law of Common Education (Koc, Isiksal, & Bulut, 2007). Türkiye Büyüklük
Millet Meclisi (TBMM), means that Turkish Grand National Assembly, is the sole legislator entity (TBMM, 2008). The 1962 curriculum was used until 1968. The revised curriculum was used from 1968 to 1982. MEB presented a new curriculum, which was developed in collaboration with universities in 1982. The World Bank supported the curriculum changes in the 1990s as part of the National Education Development Project (Koc, Isiksal, & Bulut, 2007). The Development of National Educational Research and Development of Education adapted a new curriculum in 1993 but revision continued until 2003. For example, the mathematics curriculum was revised in 1998, and the science curriculum was revised in 2000 (Koc, Isiksal, & Bulut, 2007). The goal of the curriculum developers was to examine the whole curricula at the primary and secondary school levels. Additionally, improving the curricula in accordance with the changing needs of the students and the Turkish society was another important goal (Yıldırım, 1999).

The last significant curriculum reform since the 1980s was begun in 2003. It was rooted in an agreement between the European Commission and the Republic of Turkey in 2000 (Bükmaz, 2006). Turkey has been a member of the Council of Europe since 1949 and of the North Atlantic Treaty Organization since 1952. Negotiations with the European Union to become a full member of the European Economic Community have been going on since 2005 (Koc, Isiksal, & Bulut, 2007). One of the requirements of being a member of the European Union is to fulfill the Copenhagen and Maastricht criteria. This requires a reorganization in political, institutional, economical, social, and educational areas.
Turkish students were ranked well-below the average in international assessments in mathematics and science areas such as Trends in International Mathematics and Science Study (TIMSS) 1999 and Program for International Student Assessment (PISA) 2003 (Babadogan & Olkun, 2006; Berberoğlu & Kalender, 2005; MEB, 2009b; World Bank, 2005). Educators and decision makers began to search for how the Turkish education system could be improved. Based on this and requirements of being a member nation to the European Union, a new curriculum change movement began in Turkey in 2003.

Curriculum changes were planned in three stages (Aksit, 2007). The first stage was to develop and pilot a new curriculum for Grades 1–5 concerning five content areas, including mathematics, science, social science, life science, and Turkish. In this regard, this curriculum was piloted in 120 schools in selected areas in the 2004–2005 academic year. The revised curriculum was implemented throughout the whole nation. The second stage was developed for Grades 6–8. And the third stage was to develop a new curriculum, which took place in 2005, for the new 4-year high school (Aksit, 2007).

Aksit (2007) summarizes the main objectives of the curriculum reform in following 11 steps:

1. to reduce the amount of content and number of concepts,
2. to arrange the units thematically,
3. to develop nine core competencies across the curriculum,
4. to move from a teacher-centered didactic model to a student-centered constructivist model,
5. to incorporate information and communication technology into instruction,
6. to monitor student progress through formative assessment,
7. to move away from traditional assessment of recall, and introduce authentic assessment,
8. to enhance citizenship education,
9. to introduce second language courses from the primary school,
10. to widen the scope of religious education,
11. to establish a system of student representation, and engage students in community work. (pp. 133–134)

Hence, there were significant changes in the 2005 curriculum in its aims, content, teaching, learning, and assessment approaches.

MEB released the 2005 secondary school mathematics education program defines the objectives of mathematics education for high school students as follows:

At the end of the program, students will be able to:

1. Understand mathematical concepts and systems, make connection among them, and use them in daily life and other learning areas.
2. Acquire mathematical skills and abilities which are necessary for further education in mathematics or other areas.
3. Use inductive and deductive reasoning.
4. Express their mathematical thinking during the problem solving process.
5. Correctly use mathematical terminology and language in order to explain their mathematical thinking meaningfully.
6. Effectively use their abilities for estimation and calculation from mind.
7. Develop problem solving strategies and use them to solve problems in daily life.
8. Set up models and express them verbally and mathematically.
9. Develop a positive disposition toward mathematics and have self-confidence.
10. Appreciate the power of mathematics and its structure, which contains a web of relations.
11. Improve their intellectual curiosity.
12. Understand the development of mathematics history and its role and value for the improvement of human thinking, and use of it in other areas.
13. Improve their ability to be systematic, careful, patient, and responsible.
14. Improve their ability to do research, and to produce and use knowledge.
15. Make connections between mathematics and art and improve their aesthetic senses. (Translated by the researcher, p. 12)

By these objectives, the secondary school mathematics education program aims to improve students’ skills in areas of setting up a mathematical model, mathematical thinking, problem solving, communication, connection, and reasoning.

In summary, Turkey has seen significant curriculum changes since the 1980s. Although there are some research studies regarding the effectiveness of the curriculum reform at the primary education, there is a need for research at the secondary education. Additionally, the relationship between the exam and the curriculum should be researched.
because the ÖSYS is a milestone of students’ academic lives, and preparation for it is taken seriously.

**Statement of the Problem**

These significant changes in the curriculum have drawn great attention from researchers in Turkey. Primary school teachers’ perspectives about the curriculum reform hold a critical place for gaining insight of the teacher-student and teaching-learning interaction. In the literature, although there are research studies about Turkish primary school mathematics curriculum reform and its effects on students, there is lack of research for the high school level, which motivates the research question posed below. Students mostly begin to prepare for the ÖSYS during high school. Parents also take seriously the preparation of their children for the examinations and spend money for the private tutoring institutions. Because curriculum, proficiency, and examinations are inextricably connected, and teachers are responsible for implementation of the curriculum, the extent to which they implement the changes, and those changes affect students’ mathematical proficiency and their success on these exams need to be explored. There are various types of schools in Turkey. So perspectives of teachers who teach at different types of schools may show differences regarding the curriculum reform and its effects because of the differences between their students’ achievement levels. Perceptions of teachers who have different years of teaching experience may also show differences regarding the curriculum reform and its effects, because some of them experienced the old system, and their opinions may be influenced by their tendency to compare the
different systems they have seen. There is a need to investigate those perceptions to improve the Turkish secondary education mathematics program.

**Research Questions**

The purpose of this research is to investigate the perceptions of high school mathematics teachers regarding the 2005 Turkish secondary education mathematics curriculum reform, its effects on students’ mathematical proficiency and their success on the ÖSYS. Moreover, exploring differences among the perceptions of teachers who teach at different types of schools and have different years of teaching experience is of interest. In this regard, the research questions for this study are the following:

1. (a) What are the perceptions of high school mathematics teachers regarding the Turkish secondary education mathematics curriculum reform, and (b) what are the differences in these perceptions across the types of schools and years of teaching experience?

2. (a) What are the perceptions of high school mathematics teachers regarding the impact of the Turkish secondary education mathematics curriculum reform on students’ mathematical proficiency, and (b) what are the differences in these perceptions across the types of schools and years of teaching experience?

3. (a) What are the perceptions of high school mathematics teachers regarding the impact of the Turkish secondary education mathematics curriculum reform on students’ success on the ÖSYS, and (b) what are the differences in these perceptions across the types of schools and years of teaching experience?
Significance of the Study

This study focuses on high school mathematics teachers’ perceptions regarding the Turkish secondary education mathematics curriculum reform, its impact on students’ mathematical proficiency and their success on the ÖSYS. Moreover, another aim of the study is to explore whether these perceptions show any differences across types of schools and teachers’ experience levels in terms of their years on the job. Some high school mathematics teachers were interviewed, and the survey was disseminated to some high school mathematics teachers to obtain information regarding these issues. First, the information gleaned may be useful for the decision making processes regarding the secondary education mathematics curriculum in Turkey because the results of the study provide insight into the thoughts and opinions teachers, who have a first-hand role in the implementation of the curriculum. Second, this study may help decision makers gain another perspective to approach the effectiveness of the secondary education mathematics curriculum reform because the study reveals strengths as well as weaknesses of the new curriculum. Third, the perceptions of the high school mathematics teachers who teach at different types of schools which emphasize mathematics and science education will give better insight into the effectiveness of the mathematics curriculum. The reason is that they have a more intense involvement in mathematics education than those who teach at schools which do not emphasize mathematics more than the other subjects. Moreover, the investigation of the years of experience of the high school mathematics teachers allows us to understand another aspect of the differences among the perceptions of the teachers.
regarding the issues of the study and will lead to more research regarding this issue. Therefore, this study will provide useful information for the teacher education programs.

The ÖSYS is the most important milestone for the future of students. The mathematics score is the ultimate determining factor in the placement of a student in a university program. This study explores the high school mathematics teachers’ perceptions about the relationship between the 2005 curriculum and students’ success on the ÖSYS in order to provide information to improve the secondary education mathematics curriculum.

**Delimitations and Limitations**

There are three delimitations in this study. In Turkish secondary education, there are five types of high schools under the general directorate of secondary education. This study sampled mathematics teachers only from three types of high schools: Anatolian high schools, general high schools, and science high schools, because Anatolian and science high schools emphasize mathematics and science education and students who graduate from these schools always have greater success on the ÖSYS. General high schools are of interest to the study because the vast majority of Turkish students attend to these schools. Therefore, it is not possible to learn all of the high school mathematics teachers’ perceptions regarding the topic of the study.

There have been three major curricular changes since the 1980s in Turkish educational system. This study focuses on one, which was implemented in 2005 and after in high schools. The researcher interviewed only teachers who had at least 10 years of
teaching experience so that comparison could be made between before and after the last curriculum reform.

There are also some external limitations in this study. The ÖSYM releases national statistics about the ÖSYS on its Web page. Although the third research question is related with the students’ success on these exams, such exam data could not be used for analysis because, despite the similarities between the structure and content of the exam questions, these tests technically are not comparable across years.

Another limitation was that the contact information of the survey samples was not available directly. Survey studies should be performed with help by school administrators in accordance with the regulations of MEB in Turkey. Therefore, either school principals were contacted before disseminating the survey to the teachers or the survey was sent to the schools’ email addresses. This caused the response rate to drop.

**Definition of Terms**

*Anatolia*, for purposes of this investigation, is defined as the part of the Republic of Turkey on the Asian continent.

*Anatolian high schools* are a type of Turkish secondary education institution that admits students based on a nationwide high school entrance examination. These schools were established as an alternative to private schools. Within a comprehensive curriculum, they provide lessons in a selected foreign language and emphasize mathematics education (MEB, 2011).
Curriculum has various meanings in various contexts. In this study, it refers to “expectations for instruction laid out in policy documents or frameworks” (Stein, Remillard, & Smith, 2007, p. 321).

European Union is an economic and political union of 27 member nations and 6 candidate nations (Europa, 2012). The Republic of Turkey is one of the candidate nations of the European Union.

Factorial analysis of variance (factorial ANOVA) is employed “in research situations where two or more group membership variables are used to predict scores on one quantitative outcome variable” (Warner, 2008, p. 504).

General high schools are a type of Turkish secondary education public institution. These comprehensive schools admit students without any entrance examinations and prepare students for higher education. All lessons are taught in Turkish, and English is the primary foreign language (MEB, 2011).

Mathematical proficiency refers to an individual’s collective knowledge and skills that can be brought to bear in completing mathematical tasks.

Millî Eğitim Bakanlığı (MEB) means the Ministry of National Education, which is the educational organization that has determined the national curriculum, its structure, implementation, modification, and revision in Turkey since 1924.

Mixed method is “an approach to inquiry that combines or associates both qualitative and quantitative forms of research” (Creswell, 2009, p. 230).

Öğrenci Seçme ve Yerleştirme Merkezi (ÖSYM) means Student Selection and Placement Center. Its new name is Ölçme, Seçme ve Yerleştirme Merkezi, which means
Assessment, Selection, and Placement Center. This agency prepares and administrates a variety of educational assessments in Turkey, including the nationwide university entrance examination.

Öğrenci Seçme ve Yerleştirme Sınavı (ÖSYS) means Student Selection and Placement Examination. Its new name is Ölçme, Seçme ve Yerleştirme Sınavı, which means Assessment, Selection, and Placement Examination. That is a nationwide university entrance examination.

Quality of student(s), in this dissertation, refers to the perceived level of problem-solving ability, background knowledge, and general mathematical skills of a student or group of students. This term, which is closely related to mathematical proficiency, emerged from the interview data.

Science high schools are public boarding high schools that provide its students with room, refectory, study rooms, and several sports areas. Students at such schools are admitted based on the nationwide high school entrance examination. These comprehensive schools emphasize natural sciences, mathematics, research, and laboratory activities. English is the primary foreign language. These schools provide an education to exceptionally gifted mathematics and science students by facilitating a high level of education in these areas and provide necessary resources in order to produce highly qualified scientists (MEB, 2011).

Sixteen (16) years of teaching experience. The significance of number 16 years of teaching experience is that teachers with more than 16 years of teaching experience were
not influenced, in their opinion of the current system, by the credit system that was implemented between 1991 and 1996. Detailed information can be found on page 89.

**Snowball sampling** “involves asking participants who have already been selected for the study to recruit other participants” (Onwuegbuzie & Leech, 2007, p. 113).

**Standardized tests** are given under uniform conditions, and the students respond to the same questions at the same time (Wilson, 2007).

**Stratified purposeful sampling** means that “sample framing is divided into strata, then a purposeful sampling is selected from each stratum” (Onwuegbuzie & Leech, 2007, p. 114).

**Type of school** is an independent variable that includes three categories: Anatolian high schools, general high schools, and science high schools. It is a group membership variable used in conducting the factorial analysis of variance.

**Years of teaching experience** is an independent variable that includes two categories: less than 16, and 16 or more years of teaching experience. It is a group membership variable used in conducting the factorial analysis of variance. Additionally, specific years of teaching experience were reported for the interviewees.

**Organization of the Remaining Chapters**

Chapter 2 provides an overview of the history of mathematics education in the United States of America, some member nations of the European Union, and the Republic of Turkey. Constructivism is viewed from an international perspective including mathematical tasks and teacher knowledge as a theoretical framework. Related literature is included. The purpose of the chapter is to situate the study within a historical
and cultural context and to explain the curricular changes in Turkey over time and their relationship to curricular changes in other selected countries.

Chapter 3 provides details about the study’s methodology. The research design, sampling plan, profiles of samplings, measuring of sample characteristics, and the credibility of the design are presented. The nature of the data and how they will be collected, organized, and analyzed are explained.

Chapter 4 and Chapter 5 present the analysis and results of the statistical tests and survey, and of the interviews, respectively. Chapter 6 includes a discussion of the results as well as recommendations and suggestions for further studies.
Chapter 2: Literature Review

Chapter 1 summarized the Turkish educational system and introduced the study. This chapter places the study in the context of relevant literature. The chapter opens with the history of mathematics education related to curriculum and pedagogy in the United States of America and the history of educational decisions and development in the European Union. Relevant literature is reviewed about curriculum reform in Turkey. Information about constructivism from an international perspective is given as a theoretical framework. Constructivism is compared to behaviorism because the previous curricula in Turkey were based on behaviorist theory. As a part of the theoretical framework, relevant literature for mathematical tasks and teacher knowledge are reviewed because of their close relation to the constructivist approach in teaching and learning mathematics. Following the framework, information about standardized and high-stakes tests and the preparation for these tests in Turkey and in some other countries are explained and compared to provide better understanding the importance of such tests in Turkey.

History of Mathematics Education in Selected Nations

Over the past several decades, school mathematics has changed dramatically in many countries such as the United States, some European nations, and Turkey. However, the goal remains the same: educating all citizens well. As new learning theories and educational systems became popular in the U.S., this affected some other nations. For example, John Dewey was invited to Turkey to analyze the Turkish educational system and make suggestions for reorganizing it in 1924 (Argün, Arıkan, Bulut, & Sriraman,
Since that time, educational contact has been developed between these two countries, and educators in Turkey have kept an eye on reform movements and major publications in the U.S.

One of the reasons for the 2005 curricular changes in Turkey was rooted in the agreement between the European Commission and Turkey in 2000 (Bikmaz, 2006). Because the reform of the educational system was one of the requirements for admission to become a member nation of the European Union, it is important to understand the place and importance of education within the nations of the European Union. Following section summarizes of the history of mathematics education in the U.S.

United States of America. In 1957, the launch of Sputnik by the Soviet Union made manifest the need for scientists and mathematicians in the U.S. to compete in the race to explore space (Fey & Graeber, 2003; Payne, 2003; Senk & Thompson, 2003). The National Science Foundation (NSF) funded instructional programs in school mathematics and science to develop high-quality teaching materials. Several major national initiatives, including the University of Illinois Committee on School Mathematics and the School Mathematics Study Groups, developed textbooks during the period between 1957 and 1970; this era was known as *Modern Mathematics* or “*New Math*” (McLeod, 2003; Senk & Thompson, 2003). Bruner’s discovery learning and Piaget’s cognitive development theories became popular among the educators during this era (Fey & Graeber, 2003). At that time, mostly mathematicians had been leading the mathematics education, and they emphasized mathematical rigor and abstraction (McLeod, 2003). Unfortunately, teachers found the new materials hard to teach; parents were not able to help their children; and
students had difficulty with the rigor of the mathematics. In addition, in 1977, College Board reported that the scores had been decreasing for 10 years on the Scholastic Aptitude Test (SAT), one of the criteria for admission to higher education in the U.S. This was one of the effective reasons for moving away from the new math era (Fey & Graeber, 2003).

In the 1970s, arithmetic computation and algebra skills were emphasized instead of new math, and the back to basics movement started. Curricular materials were changed to include fewer references to mathematical principles and to more exercises computational skills (Fey & Graeber, 2003).

Given the data indicating the modest influence of new math proposals, some may wonder whether “back to basics” might not have aptly been called “on with basics.” The 1970s were a much quieter period for mathematics education than the turbulent new math era, but the back-to-basics movement was a reality that influenced school mathematics textbooks, teaching practices, and student assessment. (pp. 538–539)

Instructional approaches changed from emphasizing the discovery learning to behaviorist approach during the “back-to-basics” era. The National Advisory Committee on Mathematics Education reported the strengths and weaknesses of the new math era in 1975 (McLeod, 2003). Toward the late of 1970s, the National Council of Supervisors of Mathematics (1977) adopted a broader definition of basic skills than computational and algebraic skills.
Based on the reports published in the second half of the 1970s, new curriculum change movement began (McLeod, 2003). The National Council of Teachers of Mathematics (NCTM) published *An Agenda for Action* in 1980. The U.S. students scored considerably below the average in the Second International Mathematics Study in 1987, and the mathematics curriculum in the U.S. was found to have lower expectations than those in other developed countries (Senk & Thompson, 2003). In 1989, the NCTM published the *Curriculum and Evaluation Standards for School Mathematics* adopting the view that all students will develop “mathematical power” (p. 5) if they are exposed to the outlines of the standards. NCTM (1989) classified four standards to guide mathematics instruction at all levels: problem solving, communication, reasoning, and mathematical connections.

Following the *Curriculum and Evaluation Standards*, NCTM published the *Professional Standards for Teaching Mathematics* in 1991 and the *Assessment Standards for School Mathematics* in 1995. NCTM’s 1991 standards provided the “standards for teaching mathematics, the evaluation of the teaching of mathematics, the professional development of teachers, and the support and development of mathematics teachers and teaching” (Senk & Thompson, 2003, p. 12). NCTM (1995) stated that assessment can be used for “monitoring students’ progress, making instructional decisions, evaluating students’ achievement, and evaluating programs” (p. 25).

Beginning in 1991, the NSF funded projects to develop Standards-based instructional materials for K–12. After NCTM released standards, the efforts to improve mathematics education increased. As a result, in 2000, NCTM published the *Principles*
and Standards for School Mathematics (NCTM, 2000). This document consisted of some new standards but excluded some of the standards that were included in the NCTM 1989 document. For example, on the one hand, the NCTM 2000 standards included representation, but on the other hand, it did not include discrete mathematics and statistics. Algebra and functions were separated in the 1989 standards, however, NCTM 2000 standards included them together under the algebra standard. Additionally, NCTM 2000 emphasized equity and technology as a principle more than the NCTM 1989 did due to increase use of technology and graphic calculators.

In 2001, the NRC published *Adding It Up: Helping Children Learn Mathematics*. To capture all aspects of expertise, competence, knowledge, and facility in mathematics, the NRC (2001) defined mathematical proficiency as comprising five interwoven strands: conceptual understanding, procedural fluency, strategic competence, adaptive reasoning, and productive disposition. This document provided recommendations to educators, researchers, and policy makers, as well as parents to improve teaching and learning for K–8 school mathematics.

In 2002, the *No Child Left Behind Act* (NCLB) was passed. NCLB supports standards-based education reform. But the Act stipulates the development of basic skill assessments as a necessary condition for a state to receive federal funds for its schools (NCLB, 2002). This Act included some of the NCTM 2000 principles and the NRC’s mathematical proficiency. For example, NCLB stresses that all children must have an equal opportunity for being well educated and reaching targeted proficiency on state academic assessments.
In 2005, Achieve, as an independent education reform organization, initiated the *American Diploma Project Network* to get the states to pay attention to college and career readiness. Its goal was to help states increase high school standards and graduation requirements. Additionally, it works to provide rigorous assessments and an accountability system (Achieve, 2010).

In 2006, NCTM published the *Curriculum Focal Points for PreKindergarten through Grade 8 Mathematics* to be a guide on how to focus the mathematical content for K–8. This document used the NCTM 2000 Principles and Standards as a reference. However, it focused on content while the NCTM 2000 document focused requirements and necessities for learning mathematical contents (NCTM, 2006).

In 2007, American Statistical Association published the *Guidelines for Assessment and Instruction in Statistics Education (GAISE) Report*. This report presented a conceptual framework for K–12 statistics education based on the NCTM 2000 document. This conceptual framework also supported required competencies for high-school graduation defined by the American Diploma Project (Franklin et al., 2007).

In 2009, *Focus in High School Mathematics: Reasoning and Sense Making* was published by the NCTM. It proposes “curricular emphases and instructional approaches that make reasoning and sense making foundational to the content that is taught and learned” (p. xi) differently from previous publications that focused on the topics in each course of high school mathematics. This document also included statistics like the NCTM 1989 document. The NCTM Research Committee (2011) states that high school students
at all levels will be able to investigate mathematical claims and justify results after sufficient application of this document.

In 2010, the Council of Chief State School Officers and the National Governors Association Center for Best Practices presented the *K–12 Common Core State Standards* (CCSS) because of the need for “the development of common standards that would give consistency and coherence to the K–12 mathematics curriculum” (NCTM Research Committee, 2011, p. 210). The NCTM 2000 standards and the strands of the mathematical proficiency were the base for the CCSS. Additionally, the college- and career-readiness standards have been incorporated into the K–12 standards. Mathematical practices were identified by synthesizing the previous documents (CCSS Initiative, 2010).

The objectives of the 2005 Turkish secondary education mathematics program overlap with those of several of documents published in the U.S. since the 1980s, although some of them were published after 2005. Turkish curriculum emphasizes reasoning and proof, connections, representation, and mathematical communication as in the NCTM 2000 document. It stresses conceptual understanding, productive disposition, strategic competence, and adaptive reasoning as in the NRC 2001 document. By reducing the amount of content and the number of concepts in order to focus on and emphasize the reasoning and making sense of the content that is taught and learned, the objectives of the 2005 Turkish secondary education mathematics program carry similarities with those of the NCTM 2009 document. One of its objectives is to prepare students to acquire mathematical skills and abilities which are necessary for further education and a future
career. So this aim carries similarities with the Achieve 2005 project. To improve students’ mathematical thinking and understanding, the 2005 Turkish secondary education mathematics program emphasizes setting up models and expressing them verbally and mathematically. This aim is also similar with the standards regarding modeling with mathematics and attending to precision in the CCSS. Additionally, the 2005 Turkish secondary education mathematics program encourages the use of technology appropriately as the NCTM and CCSS documents do.

In summary, the Turkish curriculum and the documents published in the U.S. have similar objectives in order to improve students’ mathematical thinking and understanding not only for their future education but also on order to be a good citizen. In the following section, educational decisions and progressions in the European Union are briefly discussed as one of the main reasons of the 2005 curriculum reform in Turkey.

**European Union.** The European Union (EU) was founded in with the aim of ending wars among neighbors after the Second World War, and established under the current name by the Maastricht Treaty in 1992 (Europa, 2012). Initially, the European Coal and Steel Community united European countries economically and politically to induce peace. Belgium, France, Germany, Italy, Luxembourg, and the Netherlands were the founding members of the EU. As of 2011, the EU had 27 member nations and six candidate nations; Turkey is a candidate nation since 1999. Between 1948 and 1968, little attention was paid to education; the focus was on strengthening economies. The six founder countries of the EU determined several principles for job training, and recognized, by Treaty of Rome (1957), standards for worker qualifications within these
countries. In 1976, education ministers approved the first community action plan on
education. This plan included “educating the children of migrant workers, closer relations
between education systems in Europe, the compilation of documentation and statistics,
higher education, the teaching of foreign languages, and equal opportunities” (Europa,
2012, para. 5). Additionally, school education became a main interest. Hence, in the
1980s, several education projects were launched, including Comett, Erasmus, PETRA,
Youth for Europe, Lingua, Eurotecnet, and FORCE (Europa, 2012). In 1992, education
 gained legal status in the EU by the Maastricht Treaty. The European Parliament and
The Knowledge-Based Society and Lifelong Learning projects became well known.
Lifelong Learning Project included the Comenius actions, which focus on all levels of
school education. One of its goals was to improve pedagogical approaches (Europa,
2012).

In 2000, education and training became of key importance to the EU by the
Lisbon Strategy, an action and development plan for the economy of the EU. An
agreement on the strategic framework for European cooperation in education and training
(‘ET 2020’) was signed by EU member states and the European Commission (Council of
the European Union, 2009). There are five benchmarks identified in this program for
2020:

1. “At least 95% of children between 4 years old and the age for starting compulsory
   primary education should participate in early childhood education;” (p.7)
2. “The share of low-achieving 15-years olds in reading, mathematics and science should be less than 15%;” (p. 7)

3. “The share of early leavers from education and training should be less than 10%;”
   (p.7)

4. “The share of 30–34 year olds with tertiary educational attainment should be at least 40%;” (p. 7)

5. “An average of at least 15% of adults should participate in lifelong learning.” (p. 7)

The working committee in the commission selected the 16 indicators on quality of school education:

(a) mathematics; (b) reading; (c) science; (d) information and communication technologies; (e) foreign languages; (f) learning to learn; (g) civics; (h) drop out;
(i) completion of upper secondary education; (j) participation in tertiary education; (k) evaluation and steering of school education; (l) parental participation; (m) education and training of teachers; (n) participation in preprimary education; (o) number of students per computer; and (p) educational expenditures per student (European Commission, 2001, p. 6)

These indicators were the benchmarks for observing the achieved progress. In 2002, the Copenhagen Process was developed for cooperation in vocational education and training across Europe.

The EU does not organize or develop the educational systems of its member nations. It only supports and helps them improve their own educational systems. “The European Commission works closely with member nations to help them develop and
modernize their education and training policies” (Commission of the European Communities, 2007, p. 1).

**Republic of Turkey.** Since the 1980s, Turkey has been going through dramatic reforms in education. A brief summary regarding the changes was given in Chapter 1. There are some research studies regarding the curricular changes at the primary school level. In this section, some of those studies are reviewed.

Haser and Star (2009) explored the belief of middle school teachers in Turkey regarding teaching mathematics by interviewing them before they started to teach and after their first teaching year. Additionally, Haser and Star investigated the influence of the national curriculum context on the novice teachers’ beliefs. One of the findings of the study was that even though the novice teachers learned how to teach based on a student-centered approach during their undergraduate programs, they tended to teach based on a teacher-centered approach. According to Haser and Star, the national curriculum systems brought pressure on teachers to address whole curriculum and prepare students for national exams in a limited time; evidently, teachers taught based on a more teacher-centered approach. The nature of their beliefs became closer to each other because they were impacted by the national curriculum context in similar ways.

Yapıcı and Leblebicier (2007) analyzed the teachers’ views about primary school curricula based on the constructivist teaching and learning by considering years of teaching experience. They conducted a study in Afyonkarahisar, a province in the Midwest Anatolia, with 200 primary school teachers. They obtained significant result about the teachers’ attitude toward the implementation of curricula. Attitudes of teachers
with 1–10 years of teaching experience were more positive than those of teachers with 11 or more years of teaching experience.

Türkyılmaz and Kuş (2010) examined the perspectives of elementary and middle school teachers regarding school quality. They conducted a study in Kırşehir, a province in middle Anatolia, with 309 teachers. One of the results of their study was that the attitudes of the female teachers toward the quality of the curriculum and evaluation are more positive than those of the male teachers.

Özerbaş (2010) examined the perspectives of primary school teachers regarding the use of technology within the application of the constructivist curricula in Turkey. He collected data from 573 primary school teachers; 12.4% of them were mathematics teachers. He found that teachers with 10 and less years of teaching experience believed that they implemented the new curriculum sufficiently, and they were willing to use technology more than the teachers with 15–20 years of teaching experience were. Additionally, Özerbaş suggested that the class size should be around 20 for a better implementation of the constructivist teaching and learning.

Erbas and Ulubay (2008) stated, based on the EARGED² report, that the years of teaching experience were positively correlated to finding the curriculum guidebook sufficient. They found that the attitudes of teachers with less teaching experience toward the innovations and implementation of the new curriculum were more positive than those of teachers with more teaching experience. However, they also found that teachers with

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² EARGED is an abbreviation of Eğitim Araştırmaları ve Geliştirme Dairesi, meaning Department of Educational Research and Development.
21 or more years of teaching experience used time and tools that were emphasized in curriculum more efficiently than teachers with less teaching experience.

Butakın and Özgen (2007) studied the effectiveness of the constructivist based learning approach on the new primary education mathematics curriculum. They surveyed primary school mathematics teachers in Diyarbakır, which is a province in the Southeast Anatolia region. They found that the primary school mathematics teachers who had more than 15 years of teaching experience agreed that the new primary education mathematics curriculum was very effective. The curriculum was somewhat effective according to the other participated teachers.

Gömleksiz and Bulut (2007) determined and compared the perceptions of primary school mathematics teachers about the effectiveness of the new primary education curriculum. They surveyed 792 teachers in various provinces in Turkey and analyzed the data considering gender, teaching experience, province, classroom, education level, and number of students. They reported that male teachers viewed the effectiveness of the curriculum significantly more positively than female teachers. According to their result, there was no significant difference in the views of teachers with respect to the varying levels of teaching experience. They also reported that teachers who taught in less crowded classrooms could implement the new curriculum more effectively than those who taught in crowded classrooms.

Birgin, Tutak, and Türkdoğan (2009) investigated the perceptions of primary school teachers about the new Turkish primary education mathematics curriculum. They surveyed 60 teachers in Trabzon, which is a province in the western part of the Black Sea
(Karadeniz) region in Turkey. One of their results was that teachers were knowledgeable regarding the changes; however, inservice training programs were insufficient. They found that there were some difficulties putting the changes in practice because of lack of tools and guidance.

Some research shed light on vague or missing points of the implementation of the 2003 curriculum. For example, according to Bıkmaz (2006), teacher training was ignored during the curriculum implementation. Only a small number of teachers could attend a seminar, which was held for 10 days, although there were around 400,000 primary school teachers during the 2005–2006 academic year. This seminar was about basic philosophy, epistemology, and measurement and evaluation approach for the Turkish, mathematics, life studies, science, and social sciences. According to Bıkmaz, teachers’ beliefs were essential for the adaptation and implementation of the new curriculum so that they should be supported by long-term professional development programs.

Another neglected point was that most of the classrooms have a large number of students. Especially in big provinces, the number of students can reach 60–70 in each classroom. Implementation of a new, student-centered curriculum is difficult in these crowded classrooms. Bıkmaz (2006) indicated that although informational technology can support constructivist learning activities, it is difficult to implement uniform technology-based applications across the country in a very short time. According to Bıkmaz, teachers who did not receive the supporting materials represent another concern. Teachers accessed sample activities by using only the website of the National Board of Education. The last neglected issue in the curriculum implementation process, according
to Bıkmaz, was for publishers to publish the textbooks structured according to the constructivist approach after a 3-day workshop. Textbooks had scientific and technical mistakes as a result of under-preparation due to lack of time.

Aksit (2007) presented some controversies regarding the implementation of the 2003 curriculum. One of them was that the curriculum was prepared in a short time, and it had not been discussed sufficiently in a wider context. For instance, students, teachers, inspectors of MEB, parents, and academics should have been consulted during the curriculum change process, but university faculties were not formally involved in this process. Another major point that Aksit presented was related to the results of the piloting process. It was decided to have feedback from teachers and students, so revisions would be completed based on this feedback, but it was never reported nor discussed in a debate. Teachers and students received the new textbooks, and they were expected to use them immediately. Aksit indicated that university faculties’ biggest concern was the lack of information at the beginning of the implementation of the new curriculum. Therefore, they could not sufficiently prepare preservice and inservice teachers for the implementation of the new curriculum sufficiently.

Any change in curriculum also influences parents as well as students. The parents’ perspectives were not known about the curriculum changes. Their children’s success in the ÖSYS was always the major issue for parents. Aksit (2007) states the relationship with the curricula, parents, and the ÖSYS in the following:

In the past, these examinations interfered with the effective implementation of the curriculum, as parents wanted their children to attend private intensive coaching
establishments called *dersane* to prepare them for the examinations. The response of the parents to the new curriculum is yet to be seen, but it is possible that it will be based on its usefulness in helping their children to be successful in national examination. (p. 135)

In other words, curricula and the ÖSYS have a strong relationship. Although the parts of the ÖSYS primarily measures students’ verbal and quantitative reasoning, these tests contain items that require knowledge based on the high school curriculum. Parents want their children to be successful on those tests, and they want the curriculum to help students achieve their goals.

Argün, Arıkan, Bulut, and Sriraman (2010) analyzed the changes in mathematics education in Turkey through the lens of historical perspective and concluded that the main reasons for mathematics curriculum reform after 1990s were “the desire to become a member of the European Union, and international factors and political situations” (p. 429). In the new curriculum, there were major changes in regard to the aims, scope, teaching and learning method, and assessment. Argün, Arıkan, Bulut, and Sriraman (2010) stated that the 2005 secondary education curriculum emphasized the necessities of teaching and learning mathematics and stressed on “mathematics education, mathematical modeling, relations among concepts, generalizations, mathematics and culture, rigor, conceptual thinking, connecting concepts, and obtaining results, etc.” (p. 440). Moreover, geometry also is taken into consideration. This new curriculum supports students’ cognitive development.
Summary. In this section, the development of mathematics education in the U.S. and the importance of the education within the European Union as well as their relationships with the Turkish secondary education program are discussed. Then, the literature about the primary education curriculum reform in Turkey is reviewed. Following section provides the theoretical framework of the study.

Theoretical Framework

In this part of the literature review, constructivism is defined and explained from an international perspective. Because mathematical tasks are central for high-level thinking in a constructivist approach, the researcher provides relevant literature about it. In a constructivist class, teacher should make wise decisions for selecting, setting up, and implementing such tasks. So, classification of teacher knowledge is explained. Additionally, this section includes the comparison with constructivist and behaviorist approaches.

Constructivism from an international perspective. Constructivism has been an under great debate among researchers, educators, and teachers during the last few decades. Theories of Piaget, Vygotsky, and Bruner have influenced education and made significant changes in teachers’ approaches for teaching and learning mathematics (Smith, 2006). Their ideas constituted the roots of constructivism. “A theory that views the child as creating knowledge by acting on experience gained from the world and then finding meaning in it. Children recreate or reinvent mathematics as they interact with concrete materials, math symbols, and story problems” (Smith, 2006, p. 14). Fowler and
Poetter (2004) described the constructivism using Sergioranni’s (1996) definition as follows:

Constructivists emphasize the importance of relating new learning to prior knowledge, and the importance of immersing teaching in the world of “authentic” learning. Learning is always contextual. What is learned depends on one’s prior knowledge, on the social context for learning, and on the connections between what is being learned and the real world. (As cited in Fowler & Poetter, p. 309)

In other words, constructivism allows students to learn by actively performing tasks and building new knowledge based on their prior knowledge. From this perspective, the goal of learning is the deep understanding, not imitative behavior (Brooks & Brooks, 1999). In the constructivist approach, it is expected that students can construct, demonstrate, and exhibit their work.

2005 Turkish secondary education mathematics program adopted the constructivist approach in teaching and learning as the primary approach of education. Based on the objectives of the Turkish secondary education mathematics curriculum, the educational system is related to the social constructivism. Social constructivism is a theory which “acknowledges that both social processes and individual sense making have central and essential parts to play in the learning of mathematics” (Ernest, 1994, p. 69).

The European Council has emphasized the role of education and training for the lifelong learning. Therefore, the European Union implemented the European Framework of Key Competences, which “is a reference tool on the key competences that all people require for a successful life in a knowledge society” (Commission of the European
Communities, 2007, p. 5). Key competences refer to “the knowledge, skills, and attitudes that serve for personal fulfillment, social inclusion and active citizenship, and employability” (p. 5). Preparing Europeans for lifelong learning is the one of the key competences. An individual is expected to have “the ability to carry on learning in different ways throughout life, and to adapt rapidly and effectively to changing situations” (Commission of the European Communities, 2007, p. 6). Under these expectations and perspective, many members of the European Union have reformed their educational systems toward constructivist approach.

In 1982, The United Kingdom nationally implemented constructivism in schools as a result of Cockcroft Report and continued with the 1989 and 1991 national curricula, but it has been affected by the “back-to-basics” campaign (Boaler, 1998). Since 2008, United Kingdom’s curriculum reform has stressed that students should be “independent inquirers, creative thinkers, team workers, self-managers, effective participators, and reflective learners” (National Curriculum, n.d, p. 6) for development of skills for life.

In the mid-1990s, the results of TIMSS caught the attention of politicians, educators, and the public. As a result, many researchers have begun to investigate the mathematics education of countries which got high scores on TIMSS. Stigler and Hiebert (1999) conducted a video study to learn how teachers teach mathematics to eighth grade in the United States, Germany, and Japan. Japan has always scored near the top in international comparisons of mathematics achievement. Stigler and Hiebert (1999) found that mathematics lessons in Japan emphasized learning on concepts and solving problems by different methods more than those in the U.S. and Germany mathematics classrooms.
Shimizu (1999) found that Japanese mathematics teachers set up an entire lesson around a single problem by developing multiple solutions in a class discussion. Teachers analyze a topic regarding the goals of the lessons and considering the mathematical connections among the contents. The process of the regular lesson is following: The teacher poses the problem and expects students to try to solve it by themselves. As students are working on the problem, the teacher observes and guides them if they have any difficulties. Then, the whole class discusses the methods for solving the problem. In the Japanese class, teachers strongly encouraged students to share their ideas whether they were right or wrong. At the end, the teacher summarizes the lesson, and he or she gives an exercise, so that students can apply what they have learned.

France, one of the founding countries of the European Union, performed very well in mathematics achievement in TIMSS (Fowler & Poetter, 2004). Their national curriculum is also built on constructivism. Fowler and Poetter stated that “the French national curriculum makes it clear that teachers must work to connect the words of the classroom, the subject matter, and the lives of learners in order for learning to take hold and to last” (p. 310). Their lessons derive from a real-life situation from the children’s experience. The French curriculum emphasizes logical reasoning, proof making, critical analysis, and discovery at all levels (Grugnetti & Jaquet, 1996; Sriraman & Törner, 2008). Pepin (1999) analyzed the French teachers’ beliefs and conceptions of mathematics and made the following statement:

The reasoning and training-of-the-mind aspect of mathematics is repeatedly emphasized by French teachers and the researcher could see this conviction in
practice in the classroom. Pupils had to reason (sometimes with rigorous proof) their results and they were given cognitive activities (problem-solving) to discover mathematics for themselves. The emphasis was on the process and not the result...French teachers focused on developing mathematical thinking. They tried to pose thought-provoking problems and expected students to struggle with them. (p. 141)

This statement supported the claim that French students constructed their own learning, and implementing cognitively demanding tasks helped them learn meaningfully. In the following section, how the mathematical tasks help students learn is discussed.

**Mathematical tasks.** There is an increasing amount of evidence that well-designed tasks based on a constructivist approach can help increase understanding and learning in mathematics. A mathematical task is defined as “a set of problems or a single complex problem that focuses students’ attention on a particular mathematical idea” (Boston & Smith, 2009, p. 121). According to Henningsen and Stein (1997), mathematical tasks are the key tools to a student’s learning. The nature of a task has a potential to affect and format the way students think, and enhances their perspective of mathematics from their actual experiences. Students are able to continuously think at high level when they are assigned appropriately prepared high-level tasks based on their level and prior knowledge (Henningsen & Stein, 1997). Tasks designed in various forms influence the thinking and learning of students in different ways. These tasks can lead the students to memorize facts and rules, or can lead them to engage deeply with concepts and make connections with other concepts.
Stein, Grover and Henningsen (1996) examined mathematical tasks as task features and cognitive demands. Task features are explained as:

[A]спектs of tasks that mathematics educators have identified as important considerations for the engagement of student thinking, reasoning, and sense-making: the existence of multiple-solution strategies, the extent to which the task lends itself to multiple representations, and the extent to which the task demands explanations and/or justifications from the students. (p. 461)

That is, it is possible to gain information about whether students engage in high-level thinking or memorize facts by analyzing cognitive demands during the implementation of tasks.

Stein et al. (2000) provided the classification of mathematical tasks based on the levels of cognitive demand. Memorization and procedures without connections are the low-levels of cognitive demand, and procedures with connections and doing mathematics are the high-levels of cognitive demand. Preparing high-level tasks for students does not mean that students engage in high-level thinking. Stein et al. gave an example: When a teacher gives a high-level task to the students, instead of thinking and finding the solution without using the rules, some of them will use the rules that they had memorized previously. Despite the task being at a high-level of cognitive demand, the students’ outcomes could be at a low-level of cognitive demand. Consequently, the attitude of the teacher can influence the students’ attitude toward the task. When the teacher is concerned about time or cannot wait for the students to work on the task without
answering their questions, students do not show enough interest in the task because they know that the teacher will give the answer anyway.

Maintaining the cognitive demands of mathematical tasks is provided by asking questions (Stein, Remillard, & Smith, 2007). Teachers support student engagement with a task and push students to explain and justify their thinking with appropriate questions. A teacher’s goal for a particular lesson gives a shape to the task. For example, if the goal is to make students remember the facts, definitions, and rules, then the task should be chosen from the memorization category. If the goal is to make students solve problems faster, then tasks should be chosen from the procedures without connections category (Stein et al., 2000). All these classifications should be used to increase the students’ abilities for learning and understanding mathematics. Low-level tasks can be used to solve high-level tasks. When teachers prepare a lesson, they should design the tasks considering the age, grade level, previous knowledge, and experiences of the students. For instance, a task could be low-level for fifth grade students, but the same task could be high-level for first grade students (Stein et al., 2000).

Boston and Smith (2009) analyzed mathematics teachers’ selection and implementation of instructional tasks before, during, and after a professional development program. One of the results of their study was that teachers who participated in the professional development program selected and implemented high-level tasks frequently and improved the engagement of high-level cognitive demands. According to Boston and Smith, selecting and implementing high-level cognitively demanding tasks
improves a student’s opportunities to learn mathematics with sufficient understanding of it.

When a task-based method is embedded in the constructivist approach, student learning increases. According to Tzur (2004),

[F]or mathematics teaching as a form of social interaction to systematically foster intended conceptual advances in students, …, the activity of selecting/using problem situations should be designed, implemented, and continually adjusted on the basis of and as a mediating tool between the activity of analyzing students’ current conceptions and the activity of deciphering the intended mathematics to be learned/taught. (p. 111)

Bruner (1960) stated that “any subject can be taught effectively in some intellectually honest form to any child at any stage of development” (p. 33). This assertion is intertwined with selection tasks within the curriculum design. Gagne and Driscoll (1988) suggested that enthusiasm might be a characteristic of effective training regardless of curriculum content, teacher, students, and grade level. Therefore, a teacher’s content knowledge, understanding, actions, and choices, along with a student’s readiness and willingness to learn, and plus classroom organization can influence what students learn (Senk & Thompson, 2003; Tarr et al., 2008).

**Constructivism versus behaviorism.** In Turkey, up until the middle of 20th century, national education programs and the items on the university examinations were prepared with respect to Bloom’s taxonomy of educational objectives. High-level thinking skills were emphasized in the university exam contents (Berberoğlu, 1996;
Bloom’s taxonomy contains knowledge, comprehension, application, analysis, synthesis, and evaluation (Bloom, 1956). This taxonomy was revised in the 1990s. Categories were renamed as remembering, understanding, applying, analyzing, evaluating, and creating (Anderson et al., 2001). Educational behaviors are arranged “from simple to complex based on the idea that a particular simple behavior may become integrated with other equally simple behaviors to form a more complex behavior” (Bloom, 1956, p. 18). Heavily influenced by B. F. Skinner and Robert Gagné, the prevailing view among the education policy makers at that time was that the goals of the mathematics curriculum should be “defined in terms of explicitly observable student performance, that the curriculum should be organized by hierarchies of logical dependence among those behavioral objectives, and that instruction should emphasize mastery of objectives in a step-by-step path through the curriculum hierarchy” (Fey & Graeber, 2003, p. 540).

In 2005, MEB initiated curriculum reform for secondary schools due to some negative aspects of the behaviorist approach. These negative aspects included lecture-based teaching, a heavy dependence on textbook usage, teacher-centered education, and convenience for memorization of knowledge for exams (MEB, 2009b).

Some mathematicians are against the constructivist approach in mathematics education. They argue that students are expected to rediscover or reinvent concepts and procedures of solutions in constructivist classrooms (Wu, 1997). This process is facilitated by group work, and the teacher serves as a guide. Wu (1997) argues that although group work and leading students to discover concepts are useful for learning,
too much emphasis on these prevents good education. It will cause to create more poorly performed students.

However, Even and Tirosh (2008) indicate that in the behaviorist approach, teachers do not know how students think, and that they focus on the correctness of students’ responses instead of their conceptions. Knowledge is viewed as a hierarchical order of facts, skills, and procedures. Therefore, specific types of knowledge are emphasized by lecture-based teaching. Teachers present procedures and allow students to do practice individually as much as possible.

Alternatively, the constructivist approach allows teachers to know and understand how students think and what their conceptions are (Even & Tirosh, 2008). Teachers provide students opportunities to develop various types of knowledge, such as “conceptual knowledge, problem-solving strategies, and meta-cognitive abilities” (p. 214). Instruction becomes learner-centered, and the needs of each student are considered.

**Teacher knowledge.** There is a great and ongoing debate about what teacher knowledge and teaching methods are necessary to provide the expected student outcomes. Shulman (1987) implied that content knowledge is essential, but having this knowledge would be useless without pedagogical knowledge. He says,

We expect a math major to understand mathematics…But the key to distinguishing the knowledge base of teaching lies at the intersection of content and pedagogy, in the capacity of a teacher to transform the content knowledge he or she possesses into forms that are pedagogically powerful and yet adaptive to the variations in ability and background presented by the students. (p.15)
Therefore, Shulman categorized teacher knowledge under three headings: content knowledge, curricular knowledge, and pedagogical content knowledge.

Peterson (1988) developed a framework for categories of student and teacher cognitional knowledge related to classroom teaching and learning. In this framework, she explained cognitional knowledge for classroom learning as “knowledge of general processes or facilities by which learners acquire knowledge through classroom learning, or subject-matter specific knowledge of processes by which learners acquire knowledge through classroom learning” (p. 7). Metacognitional knowledge for students was defined as “the learners’ self-awareness of their own cognitional knowledge through which they acquire information, gain understanding, and learn in the classroom” (p. 7). Peterson (1988) defined the cognitional knowledge for classroom teaching as “knowledge of the mental process or facilities by which learners acquire knowledge through classroom teaching” (p. 7). Peterson defined the metacognitional knowledge for classroom teaching as “the teachers’ self-awareness and ability to reflect upon the cognitional knowledge that he or she has, both general and content-specific” (p. 7). Furthermore, she argues that cognitional knowledge and metacognitional knowledge not only provide greater understanding of teaching and learning processes but also improve the quality of teaching and learning. She discusses that content knowledge must be intertwined with these categories.

Ball, Thames, and Phelps (2008) defined domains of mathematical knowledge for teaching: subject matter knowledge and pedagogical content knowledge. Subject matter knowledge includes common content knowledge, specialized content knowledge, and
horizon content knowledge. Pedagogical content knowledge includes knowledge of content and students, knowledge of content and teaching, and knowledge of content and curriculum.

Common content knowledge is defined as “the mathematical knowledge and skill used in settings other than teaching” (Ball, Thames, & Phelps, 2008, p. 399). Teachers should know the content they teach. They have to know mathematical terms and notations they will use correctly. If teachers get confused while they are solving a problem or lecturing, students may lose their attention and get confused.

Specialized content knowledge is defined as “the mathematical knowledge and skill unique to teaching” (Ball, Thames, & Phelps, 2008, p. 400). Teachers should have knowledge beyond what they teach to students. When students ask a question related to further topics, the teacher should be capable of answering it. More complex and harder contents can be taught in a more understandable and easier way if the teacher has strong knowledge about it, because the teacher has the ability to pull out the main ideas from a huge mass of information and bring them to students in a meaningful way. This enables students to understand and use sophisticated mathematical ideas and procedures.

Knowledge of content and students is the “knowledge that combines knowing about students and knowing about mathematics” (Ball, Thames, & Phelps, 2008, p. 401). Teachers should know common conceptions and misconceptions of students. When students make mistakes in their problem solving, teachers should be able to see where the mistake is, and why it is made. Teachers should anticipate possible reaction and thoughts
of students, as well as possible sources of their confusion, and know which kinds of tasks are interesting and motivating for them.

Knowledge of content and teaching is the knowledge that “combines knowing about teaching and knowing about mathematics” (Ball, Thames, & Phelps, 2008, p. 401). Teachers should know what kind of tasks and tools should be used for teaching important mathematical ideas and how to design and manage classroom discourse. A teacher should know how to sequence particular content for instruction and when to interrupt class discussion and give further information, or ask a new question.

**Summary.** In this section, relevant literature for constructivism from an international perspective were given and discussed as a theoretical framework. Purposefully designed and implemented mathematical tasks are the inseparable parts in a constructivist teaching and learning approach. Both of them can be integrated by knowledgeable teachers. Because the nature of mathematical tasks is crucial for student learning, and teacher knowledge plays a central role to orchestrate the learning environment in a constructivist classroom, relevant literature was provided for these subsections. Additionally, comparison was made between a constructivist and behaviorist approaches because the educational system before the 2005 curriculum reform was based on the latter one.

**Standardized and High-Stakes Tests**

A test is an instrument to measure student knowledge and learning. Standardized tests are given under uniform conditions, and the students respond to the same questions at the same time (Wilson, 2007). In most countries, scores on standardized admission
tests are crucial for students who want to apply to 4-year colleges. These tests are a turning point for students’ academic lives. In Turkey, the ÖSYS is such a test. Because the demand for higher education increases every year, the ÖSYS is highly competitive (Berberoğlu, 1996; Tansel & Bircan, 2006).

Most of the U.S. 4-year colleges and universities require, for admission, the scores of Scholastic Aptitude Test (SAT) or the American College Test (ACT). The SAT was developed for identifying students who could not attend northeastern U.S. prep schools in 1926 (Syverson, 2007). Moreover, students could use it to apply to multiple higher education institutes. While a small number of students took the SAT in the 1950s, over 1,000,000 students took it in 1997 (Madaus, Clarke, & O’Leary, 2003). The SAT includes a verbal and a mathematics section. It had been redesigned as SAT-I Reasoning Tests and SAT-II Subject Tests by the College Board in 1990 (Madaus, Clarke, & O’Leary, 2003; Syverson, 2007).

The ACT was developed in Iowa City in 1959 (Syverson, 2007). Midwestern and some of the Southeastern colleges initially accepted the ACT, but most of the colleges in the U.S. now accept either ACT or SAT from their applicants. Syverson (2007) states that the ACT and SAT assess different skills:

The SAT was designed to assess higher order reasoning skills to help predict aptitude for success in college; it was not specifically tied to the high school curriculum. By contrast, the ACT was considered to be closely linked and was an assessment of mastery of that curriculum. (p. 57)
In the U.S., the ACT and SAT affect not only students, but also parents, teachers, and university presidents. Atkinson (2001) states that teachers know that they will be judged by their students’ scores, parents are willing to spend a considerable amount of money for private tutoring for their children’s success on tests, and university presidents consider their colleges’ rank among colleges. Hence, the ACT and SAT scores put them under pressure. Atkinson (2001) indicates that “America’s overemphasis on the SAT is compromising [the U.S.’s] educational system” (p. 139).

Phelps (2000) investigated the standardized testing in the member countries of the Organization for Economic Cooperation and Development (OECD), China, and Russia. He found that five countries—China, France, Germany, Japan, and Sweden—introduced new university entrance exams from 1974 to 1999. Phelps (2000) concluded that the testing increased or decreased based on demand for places in higher education programs and current international trend.

Accessibility to higher education varies in the EU nations. For instance, higher education institutes are self-governing. For example, they determine their admissions policies and requirements in England in the United Kingdom (European Commission, 2010a). Students need to pass university entrance examinations to access higher education in Spain. Additionally, there is an opportunity for adults over 45 years of age to pass specially designed entrance examination, but if their professional experience is found sufficient, then they do not need to pass an entrance examination to access higher education programs (European Commission, 2010b). In Hungary, students’ performance during secondary school and their scores on the secondary school exit examination are
considered for admission to higher education programs. Some of the programs adapt specific admission requirements depending on the academic subject (European Commission, 2010c).

Consequently, the university entrance examination system in Turkey shows some similarities with and differences from those in the U.S and the nations of the EU. Some of the features of the ÖSYS are to measure reasoning, ability and knowledge of students for attending higher education considering the secondary education grade-point averages. However, the ACT or SAT do not influence or steer the U.S. education system, and those tests are not the sole requirement for admission to university. The ÖSYS has influenced and steered the Turkish education system for years, and it is the only requirement for admission to university in Turkey.

**Preparation for standardized admission tests.** Generally, parents want their children to be placed in higher education programs based on students’ personal preferences in Turkey. Based on Tansel and Bircan’s study (2006), they estimated that parents spend 1–15% of their income to enroll their children in private tutoring centers to help them attain high scores on the exams. Because of high demand, private tutoring has dramatically increased and become a major business sector in Turkey, as well as in other countries, such as Canada, Greece, Japan, and South Korea (Lee, 2007; Tansel & Bircan, 2006). For instance, more than 60% of top-ranked school students have been preparing for an extra year for university entrance exams after their graduation from high school in Japan (Dang & Rogers, 2008). Because the Japanese education system does not provide
adequate preparation for the actual entrance examinations, parents spend huge amounts of money for private tutoring courses (Russell, 2002).

On the other hand, although there are private tutoring centers in the United States, for example, the Princeton Review and Kaplan Test Prep, private tutoring practices and the role of supplementary education are relatively unknown; the most typical forms of private tutoring are school-based after-school programs (Lee, 2007). “Under the No Child Left Behind Act of 2001 (NCLB), low-achieving schools that fail to meet their academic performance target should offer supplemental educational services to low-income students through private organizations, including for-profit learning centers and community organizations” (Lee, p. 1209).

Private tutoring centers and educators who are working in these centers assess their own effectiveness (Davies & Aurini, 2006). They develop their own methods of assessment. Students are frequently assessed and retested, and parents receive evaluations of their children. These centers offer test-taking strategies, their textbooks, practice questions, and practice exams that are similar to the real exams. Some of them in the U.S., such as Kaplan Test Prep, guarantee that their students will attain high scores, or they promise that they will return students’ money in case of failure. According to Tansel and Bircan (2005), receiving private tutoring during the last year in high school increased the ÖSYS scores significantly in Turkey. Kim and Lee (2001) found a similar result regarding Korean private tutoring. On the other hand, the National Education Longitudinal Survey of 1988 data set showed that private tutoring has a small effect on students taking the mathematics section of the SAT and no effect for students taking the
mathematics section of the ACT (Briggs, 2001). However, the number of students who receive private tutoring increases, as does the perceived importance of the tests (Syverson, 2007).

However, when the aim of these centers is mostly preparation for standardized admission tests, they put the greatest emphasis on test-taking strategies. For example, the ÖSYS is a multiple-choice exam with limited time. Students have to answer the test questions as fast as possible. Karacağça and Threlfall’s (2004) case study revealed how teachers prepared students to such tests in private tutoring centers. They examine the conflict between beliefs of teachers who teach at such centers and their practices. One participant of their study states that:

The aim of mathematics teaching in private courses is not to teach mathematics basically, but to prepare students for the examination they will take—to make them able to answer the questions that they will face in the examination in the most practical and easiest way. Our aim is not to teach mathematics deeply and with its theory. As an educator in private courses, our aim is to prepare them for the examination in a practical manner. (p. 138)

Teachers’ beliefs may conflict with the way they prepare students for the standardized admission tests in a highly competitive environment.

In Turkey, private tutoring centers provide supplementary education for students. Private tutoring centers mostly “focus on individual academic needs and learning aspects and also demonstrated the strongly positive effects of tutoring on academic outcomes at the individual student level” (Lee, 2007, p. 1210). Because these centers’ aim is to help
students attain high scores on standardized admission tests, whether students learn mathematics deeply or not is questionable even if they attain high scores on the tests. Students practice mostly for learning procedures and finding shortcuts for the solutions of problems. They solve a number of similar types of problems so that they recognize a particular solution method for that type of problems as soon as they see them. On the other hand, the complexity level of the ÖSYS questions is mostly high, and it plays a crucial role in the selection of the best students for the most competitive higher education programs.

**Summary**

In this chapter, the history of mathematics education in the U.S. and history of the educational progress of the EU was summarized with a discussion of their relationship to the Turkish educational system. The relevant literature was reviewed for the primary education mathematics curriculum reform in Turkey. Because of the low student achievement on the international assessments and the agreements with the European Council, MEB had to change the education system from behaviorist approach to constructivist approach, adopting some main aspects of the constructivist approach such as mathematical tasks, teacher knowledge; and comparison of those approaches were reviewed from an international perspective as the theoretical framework. In addition, because the university entrance examinations and the preparation for them are considered serious issues and occupy an important place for teachers, students, and parents, the literature was reviewed making comparisons with the exams in the U.S. and some other selected countries to give a better insight of how they influence the educational systems.
Chapter 3: Methodology

This study used a mixed methods design to investigate the perceptions of high school mathematics teachers regarding the 2005 curriculum reform and its impact on students’ mathematical proficiency, as well as students’ success on the ÖSYS over the past decade. This chapter presents an overview of the study, research design, data collection procedures, and data analysis methods.

Overview of the Study

This study examined perceptions of mathematics teachers at Anatolian, general, and science high schools. The research investigated their perceptions of 2005 curriculum reform and the effects of this reform on students’ mathematical proficiency and on students’ success on the ÖSYS. The research questions guiding this investigation were as follows:

1. (a) What are the perceptions of high school mathematics teachers regarding the Turkish high school mathematics curriculum reform, and (b) what are the differences in these perceptions across the types of schools and years of teaching experience?

2. (a) What are the perceptions of high school mathematics teachers regarding the impact of the Turkish high school mathematics curriculum reform on students’ mathematical proficiency, and (b) what are the differences in these perceptions across the types of schools and years of teaching experience?

3. (a) What are the perceptions of high school mathematics teachers regarding the impact of the Turkish high school mathematics curriculum reform on students’
success on the ÖSYS, and (b) what are the differences in these perceptions across the types of schools and years of teaching experience?

**Research Design**

This study used mixed methods. This “is an approach to inquiry that combines or associates both qualitative and quantitative forms of research” (Creswell, 2009, p. 230). This investigation was divided into two parts. A survey analyzed quantitative data, and a set of interviews analyzed qualitative data. The data for both parts were collected concurrently, and then the qualitative data were integrated with the quantitative data.

- Part 1 used a survey that addressed all of the research questions. The survey analyzed opinions of high school mathematics teachers. The researcher used a concurrent embedded strategy. This strategy has “a primary method that guides the project and a secondary database that provides a supporting role in the procedures” (Creswell, 2009, p. 214). Survey was the primary method, and it was supported by qualitative data. Survey questions were prepared based on qualitative theory for dependent variables, and the data were analyzed based on the quantitative theory for independent variables. Namely, factorial analysis of variance was used to analyze the survey results. This part addressed all of the research questions.

- Part 2 used a series of interviews that addressed part (a) of the research questions. Interviews delved deeper into the opinions of high school mathematics teachers. Grounded theory was used to obtain information about perceptions of teachers. Teachers who have been teaching at least 10 years were interviewed.
qualitative research framework was used to collect and analyze the data. This part supported data obtained from part 1.

The mixed method approach was used to gain deep and broad perspectives as a result of using two different types of data. The quantitative method consisted of different questions than the qualitative method and sought different information from part (b) of the research questions.

**Sampling**

This section describes the population, sample and sampling procedures that were used in the research.

**Population and sample size.** In the 2010–2011 academic year, there were 1,354 Anatolian high schools, 1,477 general high schools, and 115 science high schools in Turkey. The population of the samples is described in the following: there were 45,274 Anatolian high school mathematics teachers, 44,756 general high school mathematics teachers, and 2,517 science high school mathematics teachers in 2010–2011 (MEB, 2011).

The sample size for piloting was considered based on the recommendation of Johanson and Brooks (2010). They suggest that 24–36 representative participants from the population of interest are enough to obtain acceptable reliability in a piloting study. Although there were 31 responses to the pilot survey, 6 of them were excluded because they were not completed. Hence, 25 responses were analyzed.

Warner (2008) states that population effect size needs to be known “to make a reasonable judgment about a minimum number of participants required to have adequate
statistical power” (p. 523). Power desired was .80, and $\alpha$, level for significant tests was .05. The sample size for the survey was identified using G*Power 3 which is a general power analysis program, because literature does not provide any idea of the population effect size. By considering medium effect size, the G*Power 3 calculated that 158 responses would be enough for analysis of the survey. In the study, there were 162 responses which satisfied the required number for analysis.

The researcher interviewed 18 high school mathematics teachers (6 teachers from each type of school who had at least 10 years of teaching experiences), which was sufficient for a deeper understanding of their experiences regarding the curriculum changes. Because these samples have similar characteristics, they satisfy the Kuzel’s recommendation, that is, “6–8 sampling units often will be sufficient when homogeneous samples are selected in qualitative research” (Onwuegbuzie & Leech, 2007, p. 116).

**Samples.** Samples of interest were the end users of nationally adopted curriculum. These included high school mathematics teachers of various age groups, with various experiences and from various types of schools, such as Anatolian high schools, general high schools, and science high schools.

Anatolian and science high schools are the government schools that emphasize mathematics and science. The students in these schools are selected via nationwide examinations. Because the success rate of the students in these schools is considerably high in the ÖSYS, it was important to explore the perceptions of the mathematics teachers who have been teaching in these schools regarding the curriculum reform and its effects on students’ mathematical proficiency and success on the ÖSYS. Moreover, the
variety of high school mathematics teachers in these schools gives insight to discover the differences of perceptions of these teachers across types of schools and years of experience.

Six teachers from each type of school for a total 18 teachers were interviewed. Ten of them are male and eight of them are female. The range of their years of teaching experience was between 12 and 37 years. Five of the participants graduated with a degree in mathematics education, and the rest of them graduated with a mathematics degree. Six participants were teaching at all grade levels, four participants were teaching at Grades 9–10, two participants were teaching at Grades 11–12, three participants were teaching at Grades 9, 10, and 12, two participants were teaching at Grades 9–11, and one participant was teaching at Grades 9, 11, and 12 in the areas of mathematics and geometry. However two participants were teaching only geometry not mathematics at Grade 12.

**Data Collection for Survey**

The nation of Turkey comprises 81 provinces. As planned, only one province was used for the pilot. This was one of the five largest provinces in Turkey. In order to understand the perceptions of high school teachers in a wide range, the survey was sent to three types of government schools—Anatolian high schools, general high schools, and science high schools—across geographically diverse parts of Turkey. Provinces were chosen via *simple random sampling*, which means that “[provinces] are selected in such a way that every [province] in the population has the same probability of being selected for the study, and the selection of the individual [province] does not affect selection of any other individual [province]” (Onwuegbuzie & Leech, 2007, p. 110). For the survey, 15
provinces were chosen initially. After data collection started, the researcher selected 44 of the remaining 66 provinces randomly because the numbers of schools and teachers that agreed to participate in the survey were not enough. Hence, the study used 59 provinces for survey.

The researcher was able to obtain the number of schools and e-mail addresses from the Web page of MEB (MEB, n.d). *Stratified purposeful sampling* was used. This means that “sample framing is divided into strata, then a purposeful sampling is selected from each stratum” (Onwuegbuzie & Leech, 2007, p. 114), to choose the schools—Anatolian, general, and science high schools. School type was the only strata because of the centralized curriculum system.

Before disseminating the survey, permission from MEB was required to do research in Turkish schools. The researcher obtained the permission (Appendices A in Turkish, B in English) after dissertation proposal approval because MEB required the methodology section of the approved proposal both in English and in Turkish. The first semester of an academic year of Turkish secondary schools begins in the middle of September and lasts until the end of January. After a 15-day break, the second semester begins. For this reason, the researcher’s aim was to start disseminating the survey in the second half of September, 2011. Nevertheless, disseminating the survey began at the end of October, 2011, because of some bureaucratic changes, which affected obtaining permission from MEB. Additionally, researchers are not allowed to survey teachers during the last three weeks of each semester. Therefore, data collection lasted until the middle of January, 2012.
After permission was obtained, the researcher contacted the principals of the schools by phone for piloting the survey. They were informed of the aim of the study and were requested to disseminate the invitation letter and the survey’s link to the mathematics teachers who were teaching at their schools. Once they agreed, the researcher sent the documents including the invitation letter, the survey’s link, and the permission letter obtained from MEB to the principals to be disseminated to the teachers. This procedure was applied to 10 schools initially, and 18 schools were added in order to obtain enough responses. After two weeks of disseminating the pilot survey, the researcher sent reminder e-mails to these schools without contacting school principals again.

This procedure was initially applied for 36 Anatolian high schools, 35 general high schools, and 17 science high schools in 15 provinces for the survey. After 3 weeks of disseminating the survey, the researcher chose 13 provinces and sent the documents to 14 science high schools in order to obtain enough responses from science high school teachers. Because the number of science high schools and teachers who teach in those schools are limited in each province, the researcher had to choose new provinces. Additionally, the documents were sent to the 43 science and 187 general high schools’ e-mail addresses that were derived from the Web page of MEB in another 31 provinces without contacting school principals by phone because of the large number of schools.

Disseminating the survey was planned using only Qualtrics online survey software. However, the drop-off/pick-up method was also employed because of the low response rate. This method is used “where resources are available to supplement
sampling frames and where residents are conducive to visitors” (Steele et al., 2001, p. 248). The drop-off/pick-up method provides advantages to researchers gaining additional insights from the community life of samples. The researcher visited 6 Anatolian, 4 general, and 3 science high schools in two urban provinces to disseminate the survey. By using the drop-off/pick-up method, 58 responses were collected.

Simultaneously, the survey was disseminated using Qualtrics online survey software. E-mail invitations for each participant can be seen at Appendices C (Turkish), D, E (Turkish), F. Many researchers have preferred e-mailing the survey to mailing it through the postal service because of the speed and cost efficiency. Sheehan (2001) stated that response rates to the e-mail surveys have decreased over the past 15 years. People may not want to open unsolicited e-mails because of the threat of viruses, or because they are wary of information overload. Cook, Heath, and Thompson (2000) stated that less than 30% response rate is expected if follow up e-mails are not sent. Because of this limitation, the researcher made phone calls to school principals to explain the study and its importance before she sent the documents. Moreover, Cook, Heath, and Thompson’s (2000) and Umbach’s (2004) recommendations were taken into consideration, and one additional reminder was sent. By using this method, 104 responses were collected.

Data Collection for Interview

For the interviewing of high school mathematics teachers, the researcher used her personal contacts in the field of education and in particular schools in two of the urban provinces in Turkey. She obtained teachers’ names and contact information from the Web page of schools. The Web pages of most schools included in neither teachers’ e-
mail addresses nor their personal telephone numbers. The researcher sent an e-mail to five science high school teachers. But three of the e-mails did not successfully reach their addresses. Two of the teachers were willing to be interviewed but one of them said he was not working at that science high school anymore. Hence, the researcher contacted one teacher from a science high school when she arrived in Turkey, and the meeting was held at his school. After the interview, he introduced the researcher to two of his colleagues, and they agreed to be interviewed. Hence, three science high school teachers were interviewed on the same day. The researcher contacted two other science high school teachers by calling them at their school, and they agreed to participate in the study. They introduced the researcher to their colleague who also agreed to be interviewed. Meetings with those three science high school teachers were held at their school on different days. Hence, the researcher used snowball sampling, “which involves asking participants who have already been selected for the study to recruit other participants” (Onwuegbuzie & Leech, 2007, p. 113), to reach other high school mathematics teachers.

The interviews with three Anatolian high school teachers and one general high school teacher were arranged by the researcher’s personal contacts in the field of education. Three Anatolian high school teachers and five general high school teachers agreed to participate in the study when the researcher visited their schools in order to disseminate the survey in person. All the interviews were held at their schools.

The researcher conducted face-to-face interviews that lasted for 30–60 min. Semi-structured interview protocol was used to collect data, and follow up questions were
asked when it was possible. Questions were mostly open-ended for a deeper understanding of participants’ perceptions to address part (a) of each of the research questions (Appendix G in Turkish and Appendix H in English). The interviewees were informed that the aim of the interview and the study was to understand their perceptions regarding the curriculum reform in secondary education and its impacts, rather than judging or supporting their teaching styles or the current educational system. All of the interviews were recorded by two digital tape recorders; one of them was used for backup. Data were saved and protected in the researcher’s personal computer.

**Subjectivity and bias.** In a qualitative research, understanding personal interests and values of researchers is a necessary condition (Glesne & Peshkin, 1992). According to Glesne and Peshkin, emotions of researchers when they are considering the subject and the questions of their studies are important issues. The following statements address the subjectivity and bias of the researcher.

When I was a student in the 1980s, I did not experience the constructivist approach in teaching and learning in Turkey. However, I think that mathematics education was stronger than today. I graduated from a general high school. Unlike today, students at general high schools were more successful on the university entrance examinations. Also, I think that questions in the university entrance examinations were more challenging than those of today. The most challenging questions were playing a key role to select students to well-known universities. Today, on the contrary, questions are easier, and success is measured rather by quantity and depth.
When I was a teacher at a private tutoring institution in Turkey, I noticed that, over time, the number of students with insufficient background of mathematical knowledge increased because of the educational system at that time, in the late 1990s. We had to teach them the missing knowledge, so that they could answer mathematics questions on the university entrance examinations, which were crucial for being placed in a program. I always tried to encourage students to build a strong knowledge of theory rather than relying on memorization. However, most of our students persisted in trying to memorize the types of questions that were asked on the ÖSYS. When I began doctoral study in 2008 in the United States, I learned about the constructivist and curriculum theories. When I heard that the educational system in Turkey had been changed to emphasize constructivist teaching and learning, I was curious about whether high school teachers successfully adopted this approach, and what the impact of these changes was on students’ success on the ÖSYS. Consequently, the idea of conducting research about Turkish curriculum reform was born in my mind at the end of the second year of my doctoral study.

**Developing the Survey Instrument**

The survey was prepared based on the qualitative theory to measure teacher attitude (Appendix I in Turkish and Appendix J in English). The survey included 14 demographic questions, three subscales that had 10 items each (approximately half of them are negative) each using five-point Likert-type scale and three open-ended questions so that teachers could describe their perspectives regarding curriculum reform, its impacts on the students’ mathematical proficiency and success on the ÖSYS. Because
increasing the number of response categories diminishes the ability of respondents to
distinguish categories reliably and increases random variance to the score distribution
(Mueller, 1986), a five-point Likert-type scale was chosen to be used including

*Strongly Agree* (2), *Agree* (1), *Neutral* (0), *Disagree* (−1), *Strongly Disagree* (−2)

options. For the negatively worded items, the scoring was reversed. By this method,
“responses indicating a positive attitude toward the attitudinal object result in high scale
scores. Responses indicating a negative attitude toward the attitude object result in low
scale scores” (Mueller, 1986, p. 13). The item formats of the survey were created based
on Converse and Presser’s suggestions (1986), and Crocker and Algina’s (2008)
guidelines.

The researcher needed a tool to identify characteristics of the informants who
were working at the Anatolian high schools, general high schools, and science high
schools. To this end, the survey included some demographic questions. Particularly, the
researcher needed to know these teachers’ gender and ages, their working status, years of
their teaching experience, the types of schools where they had worked before and
currently, and the types of schools where they got their education. Moreover, in order to
learn whether teachers had been trained in the use of constructivist theory for teaching
and learning, and whether they have used this theory in their classes, related questions
were asked in this section.

Following the demographic questions, the survey contained three subscales. The
first one measured teacher attitude toward curriculum reform, the second one measured
teacher attitude toward the impact of the curriculum reform on students’ mathematical
proficiency, and the third one measured teacher attitude toward the impact of the curriculum reform on students’ success on the ÖSYS. Items for the second subscale were prepared considering the general objectives of Turkish mathematics education described in the Turkish secondary school education program (Turkish high school curriculum), which is given in Chapter 1, page 29–30, in translated form.

Piloting was applied in a small group of teachers in order to get valid, reliable, and unbiased responses from a bigger group of teachers. Data obtained from 25 teachers were input in the SPSS software program. The researcher checked internal consistency (reliability) and applied item analysis. If a survey instrument “produces highly reliable scores, then each respondent’s score can be believed; it can be depended upon in drawing conclusions and making decisions; it is trustworthy” (Mueller, 1986, p. 58). Respondents were asked for feedback to identify ambiguities and difficult items, by writing in a comment box at the end of each section of the survey.

The reliability for the teacher attitude toward curriculum reform was .713. The item-total statistics table showed that the second and the fifth items were negatively correlated with the other items. The reliability for the teacher attitude toward the impact of the curriculum reform on students’ mathematical proficiency was .876. The item-total statistics table showed that all of the items were positively correlated with each other. The reliability for the teacher attitude toward the impact of the curriculum reform on students’ success on the ÖSYS was .627. The item-total statistics table showed that the seventh item was negatively correlated with the other items.
George and Mallery (2003) provide rules for the alpha value such as “$\alpha > .9$—Excellent, $\alpha > .8$—Good, $\alpha > .7$—Acceptable, $\alpha > .6$—Questionable, $\alpha > .5$—Poor, and $\alpha < .5$—Unacceptable” (p. 231). Therefore, only the internal reliability of the third scale was relatively low. The analysis of the pilot study was discussed with committee. Based on their suggestions, the negatively correlated items were reworded, and two more items were added at the third scale in order to increase the value of alpha. Moreover, the verbs that made the meaning of sentences negative were changed from lower-case to upper-case to get the respondents attention. In the third scale, the researcher changed five items (21, 23, 24, 26, and 27) only by adding “I think” to make the sentence opinion-based rather than knowledge-based (Appendices K in Turkish and L in English).

**Data Analysis for Survey**

Screening was used against violations of assumptions. It was assumed that scores on the outcome variable were approximately normally distributed. For this, a histogram of the frequency distribution for a dependent variable was examined. It was also assumed that the variances of scores were homogeneous across groups. For this, SPSS software has Levene’s test to assess homogeneity.

In order to analyze the data obtained from the survey, the statistics test called *Factorial Analysis of Variance (Factorial ANOVA)* was used. This test is used where two or more factors are used to predict scores on one quantitative outcome variable (Warner, 2008). In this study, *type of school* in which high school mathematics teachers were teaching at the time of study and *years of teaching experience* of teachers were the independent variables. *Type of school* variable is Factor $A$ and includes three categories:
Anatolian high schools, general high schools, and science high schools. *Years of teaching experience* variable is Factor B and includes two categories: less than 16 and 16 or more years of teaching experience. The significance of the number 16 is that, in the 1991–1992 academic year, the Turkish schools began implementing the so called *credit system*, according to which, students could fail or pass each course instead of failing or passing the grade level. For example, if a teacher started to go to college during the year 1991–1992, then they would normally finish school during the 1995–1996 academic year so that they would not have taught in the system prior to the credit system. Although this study does not analyze the extent of the effect of that change on the perceptions of the teachers regarding the 2005 curriculum reform, the researcher considers that question as a possible significant follow-up research question to her study. With this in mind, and with the hope that this study will motivate research on that question, 16 was chosen as a cut-off number for the level of experience of teachers. Thus, if a research study in the future is to be concerned with this follow-up question, some relevant survey material can be found here.

There were three dependent variables obtained from the subscales of the survey. The first dependent variable was the *curriculum reform* obtained from the first part of the survey, the second dependent variable was the *impact on proficiency* obtained from the second part of the survey, and the third dependent variable was the *impact on the test* obtained from the third part of the survey. To assess the pattern of outcomes, three separate null hypotheses were tested: test of the main effect for Factor A

\[ H_0 : \mu_{A1} = \mu_{A2} = \mu_{A3} \]

, test for the main effect for Factor B \( H_0 : \mu_{B1} = \mu_{B2} \), and test of
the $A \times B$ interaction ($H_0$: No $A \times B$ interaction). To test the null hypotheses of no main effect for Factor $A$, $F$ ratio was computed with $(a - 1, N - ab)$ degrees of freedom. To test the null hypotheses of no main effect for Factor $B$, $F$ ratio was computed with $(b - 1, N - ab)$, degrees of freedom. The value of the $F$ ratio tends to be higher as the total sample size ($N$) increases. When $F$ was significant, some indication of effect size was presented, and the magnitudes and directions of the differences among group means were discussed and interpreted. The follow up tests were applied.

At the end, results obtained from both qualitative and quantitative analyses were embedded through the lens of constructivism, and grounded theory supported the results of the survey.

**Data Analysis for Interviews**

Data obtained from interviews were transcribed directly to the researcher’s personal computer. The researcher conducted content analysis. Content analysis is “careful, detailed, systematic examination and interpretation of a particular body of material in an effort to identify patterns, themes, biases, and meanings” (Berg, 2009, p. 338). That is, after the researcher coded transcribed data—by using a word or short phrase that explains how the data segments were related based on the research questions—into categorical labels or themes, she sorted them in these themes for identifying patterns, relationships, similarities, and differences. Then she examined sorted data to discern meaningful patterns and processes. To provide confidentiality, interviewees were designated by codes; for instance,

- teachers at Anatolian high schools were coded as A1, A2, A3, A4, A5, A6
teachers at general high schools were coded as G1, G2, G3, G4, G5, G6; and
teachers at science high schools were coded as S1, S2, S3, S4, S5, S6.

Credibility

The researcher used triangulation, peer debriefing, record keeping/audit trail, and statistical conclusion methods for the sake of credibility and reliability of the study.

Triangulation refers to use “different data sources of information by examining evidence from the sources and using it to build a coherent justification for themes” (Creswell, 2009, p. 191). As is explained in earlier sections, multiple sources and methods in data collection and interpretation were used. Glesne and Peshkin (1992) stressed that using this method increases the trustworthiness of the research.

Peer debriefing was used to review and provide critical feedback on analyses and a study’s results (Brantlinger et al., 2005). The data were checked for possible misinterpretation.

The record keeping/audit trail is “keeping track of interviews conducted and/or specific times and dates spent observing as well as who was observed on each occasion; used to document and substantiate that sufficient time was spent in the field to claim dependable and confirmable results” (Brantlinger et al., 2005, p. 201). The record keeping/audit trail consists of raw data, analyses notes, reconstruction and synthesis products, process notes, personal notes, and preliminary developmental information. The researcher kept every school’s and every person’s information in her personal computer and kept all the records including dates, lengths of interviews, times when records were
reviewed, step by step of what had been done and what information had been gained. This helped the researcher understand what she did and replicate it.

Additionally, because the study is related to the Turkish educational system, and samples of the study are Turkish mathematics teachers, interview questions and the survey were developed in Turkish. A person who is a Turkish language and art teacher checked the instruments for meaning and punctuation use. After they were corrected, these tools were translated by the researcher and someone else whose native language is also Turkish. She was a graduate student at linguistic department in one of the well-known universities in the United States. Then the researcher cross-checked the translated document to be sure the translation matched the original. The same process was applied to analyze collected data. A mathematics faculty, whose native language is Turkish, living in the United States, translated all of the quotes that were used in the analysis. Because some part of the data included some mathematical terms, this method allowed the researcher to cross check the terminology.

All these credibility methods were used to demonstrate that the study is sound. After clarifying the methods used and the rationale for them, the reports will be reliable and worthy of attention.

**Summary**

The purpose of this research was to explore the teachers’ perceptions regarding the 2005 curriculum reform in Turkish high school mathematics education. In this regard, the research questions for this study were as follows:
1. (a) What are the perceptions of high school mathematics teachers regarding the Turkish secondary education mathematics curriculum reform, and (b) what are the differences in these perceptions across the types of schools and years of teaching experience?

2. (a) What are the perceptions of high school mathematics teachers regarding the impact of the Turkish secondary education mathematics curriculum reform on students’ mathematical proficiency, and (b) what are the differences in these perceptions across the types of schools and years of teaching experience?

3. (a) What are the perceptions of high school mathematics teachers regarding the impact of the Turkish secondary education mathematics curriculum reform on student’s success on the ÖSYS, and (b) what are the differences in these perceptions across the types of schools and years of teaching experience?

As a summary, the researcher explored the perceptions of high school mathematics teachers regarding the 2005 curriculum reform and its effects on students’ mathematical proficiency and on students’ success on the ÖSYS in Turkey. Survey results were supported with interview results. It is important to understand teachers’ perceptions regarding the curriculum reform because they have a crucial role in educating students. These techniques helped answer the research questions.
Chapter 4: Survey Results and Analysis

This dissertation explores the perceptions of mathematics teachers regarding the 2005 curriculum reform in secondary education, its impact on the students’ proficiency and their success on the ÖSYS. Another aim is to explore possible differences among the perceptions of teachers who work in different types of schools and have different level of teaching experience.

This part of the study includes the data collected through the survey which was designed and piloted by the researcher. It was disseminated to the teachers who taught at Anatolian high schools, general high schools, and science high schools in various provinces of Turkey, by using both Qualtrics survey software and drop-off/pick-up method. A total of 162 mathematics teachers responded. In this study, type of school (in which high school mathematics teachers were teaching at the time of study) and years of teaching experience of teachers were the independent variables. There are three dependent variables obtained from the subscales of the survey. The first dependent variable is the curriculum reform obtained from the first part of the survey, the second dependent variable is the impact on proficiency obtained from the second part of the survey, and the third dependent variable is the impact on the test obtained from the third part of the survey.

Characteristics of Participants

The survey included some demographic questions to provide detailed information about participants (\(N = 162\)). Among the participants, 59.3% (\(n = 96\)) of them were male whereas 39.5% (\(n = 64\)) of them were female. Two of the participants (1.2%) did not
clarify their genders. Approximately 39% \((n = 63)\) of the participants had less than 16 years of teaching experience, whereas approximately 61% \((n = 99)\) of them had 16 or more years of teaching experience. The range of their teaching experience changed from 1 to 39 years. The results showed that approximately 83% \((n = 134)\) of the participants had a bachelor’s degree. Approximately 15% \((n = 24)\) of them had master’s degree and 2% \((n = 3)\) of them had doctoral degree. One of the participants did not report his educational level. Among the participants, approximately 76% \((n = 123)\) of them had a degree in mathematics, and the rest of them \((38\%, n = 38)\) had a degree in mathematics education. One of them did not response to this item.

When the types of schools where the participants are currently teaching were considered, the data revealed that there were 70 (43%) participants from Anatolian high schools, 50 (31%) participants from general high schools, and 42 (26%) participants from science high schools. The participants were asked whether they had taken any courses related with the constructivist teaching and learning when they were a student at university. Approximately 27% \((n = 43)\) of the participants reported that they had taken such a course, whereas approximately 54% \((n = 87)\) of them reported that they had not. Almost 19% \((n = 31)\) of them reported that they were not sure about having taken such course. One participant did not respond to this item.

Participants were asked whether they had attended any workshops or seminars related with the constructivist teaching and learning. The data showed that 72 (45%) participants attended some workshops or seminars, whereas 86 (53%) participants did not attend such programs. Four (2%) of the participants did not respond to this item. Majority
of the participants (79%, \( n = 127 \)) considered their teaching styles as student-centered, whereas a minority of them (22%, \( n = 35 \)) considered their teaching styles as teacher-centered teaching and learning.

Because type of school and years of teaching experience are independent variables in this study, their cross tabulation table also was examined. The table displayed that 25 of the participants who taught at Anatolian high schools, 24 of them who taught at general high schools, and 14 of them who taught at science high schools have less than 16 years of teaching experience. On the other hand, 45 Anatolian high school teachers, 26 general high school teachers, and 28 science high school teachers have 16 or more years of teaching experience.

The cross tabulation table and the summary of the characteristics of the participants in frequencies and percentages were presented in Table 4.1 and Table 4.2, respectively.

Table 4.1

*Type of School and Years of Teaching Experience*

<table>
<thead>
<tr>
<th>Type of School</th>
<th>Years of Teaching Experience</th>
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<td>Less than 16</td>
<td>16 or more</td>
<td>Total</td>
<td></td>
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<tr>
<td>Anatolian</td>
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<td>45</td>
<td>70</td>
<td></td>
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<tr>
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<td>26</td>
<td>50</td>
<td></td>
</tr>
<tr>
<td>Science</td>
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<td>28</td>
<td>42</td>
<td></td>
</tr>
<tr>
<td>Total</td>
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<td>99</td>
<td>162</td>
<td></td>
</tr>
</tbody>
</table>
Table 4.2

*Characteristics of the Participants (N = 162)*

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<th>$f$</th>
<th>%</th>
</tr>
</thead>
<tbody>
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<td></td>
</tr>
<tr>
<td>Female</td>
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</tr>
<tr>
<td>Male</td>
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<td>59.30</td>
</tr>
<tr>
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<td>1.20</td>
</tr>
<tr>
<td>Teaching (Years)</td>
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<td></td>
</tr>
<tr>
<td>$&lt; 16$</td>
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<td>38.90</td>
</tr>
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<td>$\geq 16$</td>
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<td>Faculty Graduated From</td>
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<td>Mathematics</td>
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</tr>
<tr>
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<td>23.45</td>
</tr>
<tr>
<td>Type of School</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Anatolian</td>
<td>70</td>
<td>43.20</td>
</tr>
<tr>
<td>General</td>
<td>50</td>
<td>30.90</td>
</tr>
<tr>
<td>Science</td>
<td>42</td>
<td>25.90</td>
</tr>
<tr>
<td>Take Course Related Constructivist</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>43</td>
<td>26.50</td>
</tr>
<tr>
<td>No</td>
<td>87</td>
<td>53.70</td>
</tr>
<tr>
<td>Not Sure</td>
<td>31</td>
<td>19.10</td>
</tr>
<tr>
<td>Missing</td>
<td>1</td>
<td>0.60</td>
</tr>
<tr>
<td>Attend Workshops or Seminars</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>72</td>
<td>44.40</td>
</tr>
<tr>
<td>No</td>
<td>86</td>
<td>53.10</td>
</tr>
<tr>
<td>Missing</td>
<td>4</td>
<td>2.50</td>
</tr>
<tr>
<td>Pedagogical Approach</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Student-Centered</td>
<td>127</td>
<td>78.40</td>
</tr>
<tr>
<td>Teacher-Centered</td>
<td>35</td>
<td>21.60</td>
</tr>
</tbody>
</table>
Data Screening

The researcher examined the histograms of the frequency distribution to test the normality assumption of the outcome variables. As seen in the Figure 1, attitudes toward curriculum reform variable is normally distributed. Skewness and kurtosis scores were also examined. Skewness has a value of 0 if the distribution is perfectly normal and symmetrical (Warner, 2008). The descriptive statistics indicates that the skewness was 0.045 for the curriculum reform variable. Only a couple of extreme scores were detected on the positive side of the distribution. Kurtosis has a value of 0 if the distribution is normal. The descriptive statistics indicates that the kurtosis was 0.440 for the curriculum reform variable. This small positive score indicates that the distribution of scores is a little more sharply peaked than in a normal distribution.

Attitudes toward impact on proficiency variable are normally distributed. The descriptive statistics indicates that the skewness was 0.049. Kurtosis was –0.176, which indicates that the distribution of scores is a little flatter than in a normal distribution (Figure 2).

Attitudes toward impact on the test are relatively normally distributed as seen in Figure 3. Skewness was –0.230, indicating that there is a slightly longer tail on the left-hand of the distribution. Kurtosis was –0.178, which indicates that the distribution of the scores is a little flatter than in a normal distribution.
Figure 1: Histogram of attitude toward curriculum reform.

Figure 2: Histogram of attitude toward impact on proficiency.

Figure 3: Histogram of attitude toward impact on the test.
Box plots were examined to determine whether there was any outlier. In the *curriculum reform* variable for Anatolian high school group, the box plot indicates that the middle 50% of the distribution of mean scores of teacher attitudes is between about –0.30 and 0.50. Variance of mean scores changes from –1.20 to 1.50. There are two outliers; case 24 with mean score –1.60 and case 53 with mean score 2.00. In the *curriculum reform* variable, the box plot indicates that the middle 50% of the distribution of mean scores of teacher attitudes with 16 or more years of teaching experience is between about –1.60 and 1.30. (Figure 4) There is one outlier; case 53 with mean score 2.00. Seeing that there were no significant changes in the analysis when those outliers were deleted, the researcher decided not to remove those outliers.

In Figure 5, the box plots indicate that the variance of the mean scores of the attitudes of the Anatolian high school teachers toward the impact of the changes on students’ mathematical proficiency covers all the intervals, whereas the variance of the mean scores of the attitudes of the general high school teachers changes from –1.75 to 0.83, and that of science high school teachers ranges between –1.40 and 1.00. Box plot indicates that there is no significant difference in the variances of the mean scores between the years of teaching experience groups.

In Figure 6, the box plots indicate that the variances of the mean scores of the attitudes of the teachers toward the impact of the changes on students’ success on exams among the type of school and between the years of teaching experience groups show no big differences. However, the median score of the mean scores of the science high school teachers is lower than that of the other two teacher groups.
Figure 4: Box plots of curriculum reform by type of school and years of teaching experience.

Figure 5: Box plots of impact on proficiency by type of school and years of teaching experience.

Figure 6: Box plots of impact on the test by type of school and years of teaching experience.
The Levene test indicated that the assumption of homogeneity of variance was not violated. Outcome variables were strongly correlated with each other. However, the relationships between the outcomes and the independent variables were too weak. (Table 4.3)

Table 4.3

*Correlations Between the Dependent and Independent Variables*

<table>
<thead>
<tr>
<th></th>
<th>Impact on proficiency</th>
<th>Impact on the test</th>
<th>Years of teaching experience</th>
<th>Type of school</th>
</tr>
</thead>
<tbody>
<tr>
<td>Curriculum reform</td>
<td>.776</td>
<td>.631</td>
<td>−.046</td>
<td>−.134</td>
</tr>
<tr>
<td>Impact on proficiency</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Impact on the test</td>
<td>.720</td>
<td>−.036</td>
<td></td>
<td>−.138</td>
</tr>
<tr>
<td>Years of teaching experience</td>
<td></td>
<td></td>
<td>−.074</td>
<td>−.034</td>
</tr>
</tbody>
</table>

**Internal Reliability**

The Cronbach’s alpha coefficients for the scales were examined. The reliability for the teacher attitude toward curriculum reform was .728; the impact of the curriculum reform on students’ mathematical proficiency was .892; and the impact of the curriculum reform on students’ success on the ÖSYS was .823. Table 4.4 displays the differences between the reliabilities obtained from the pilot study and the main survey.
Table 4.4

*Cronbach Alpha Obtained From Pilot Study and Main Survey*

<table>
<thead>
<tr>
<th>Scale</th>
<th>Pilot study</th>
<th>Main survey</th>
</tr>
</thead>
<tbody>
<tr>
<td>Curriculum reform</td>
<td>.713</td>
<td>.728</td>
</tr>
<tr>
<td>Impact on proficiency</td>
<td>.876</td>
<td>.892</td>
</tr>
<tr>
<td>Impact on the test</td>
<td>.627</td>
<td>.823</td>
</tr>
</tbody>
</table>

**Descriptive Statistics**

A five-point Likert-type scale was used for measuring teacher attitude. The attitude scales consist of a total of 32 items. The first two scales have 10 items each, and the third one has 12 items. A five-point Likert scale was coded as follows:

Strongly Agree = 2, Agree = 1, Neutral = 0, Disagree = –1, Strongly Disagree = –2.

For the negative items, the scoring was reversed. So, if scores are greater than 0, attitudes were considered positive, and if scores are less than 0, attitudes were considered negative toward the attitudinal objects.

The descriptive statistics of the data indicated that teachers generally tend to think slightly positively, rather close to being neutral, regarding the curriculum reform. Teachers generally tend to think slightly negatively regarding the impacts of the curriculum reform on students’ mathematical proficiency, and their attitude toward the impacts of the curriculum reform on students’ success on the ÖSYS is generally negative. Table 4.5 displays teachers’ attitude tendencies.
Table 4.5

*Teacher Attitudes*

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>Min.</th>
<th>Max.</th>
<th>M</th>
<th>Std. Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Curriculum Reform</td>
<td>162</td>
<td>−1.60</td>
<td>2.00</td>
<td>0.0040</td>
<td>0.58908</td>
</tr>
<tr>
<td>Impact on Proficiency</td>
<td>162</td>
<td>−2.00</td>
<td>2.00</td>
<td>−0.0459</td>
<td>0.74775</td>
</tr>
<tr>
<td>Impact on the Test</td>
<td>159</td>
<td>−2.00</td>
<td>1.17</td>
<td>−0.3046</td>
<td>0.60278</td>
</tr>
</tbody>
</table>

**Missing Data**

Descriptive statistics indicated that the percentages of the missing data of the items were all less than 5%, which is considered acceptable (Enders, 2010). Percentages ranged from 0.6% to 3.7%. Therefore, there was no need to do further analysis for missing data.

**Perceptions of High School Mathematics Teachers Across the Types of Schools and Years of Teaching Experience**

In order to explore the differences between the perceptions of high school mathematics teachers across different types of schools and different levels of teaching experience, factorial ANOVA was conducted. The main effects for each independent variable and the possibility of an interaction of these variables were tested. If one of the independent variables affects the dependent variable because of the other independent variable, then the interaction effect occurs.

In this regard, factorial ANOVA were conducted for each of three dependent variables at a time. Firstly, the researcher used $3 \times 2$ factorial ANOVA to explore the
attitudes of the high school mathematics teachers toward the curriculum reform based on the type of school where they taught ($A_1 =$ Anatolian, $A_2 =$ General, $A_3 =$ Science), years of teaching experience ($B_1 =$ Less than 16, $B_2 =$ 16 or more), and the interaction between type of school and years of teaching experience. This was a nonorthogonal factorial design; each of the six cells had different number of participants (Table 4.4, p. 103).

Preliminary data screening was done to assess whether the assumption for homogeneity of variance was violated. The Levene’s test indicated that there was no violation of the homogeneity of variance assumption, $F = 1.559, p = .175$.

The result of the factorial ANOVA was not statistically significant, $F_A(2,156) = 2.039, p = .134, F_B(1,156) = .288, p = .592$; and $F_{A \times B}(2,156) = 0.518, p = .596$. In other words, perceptions of mathematics teachers regarding the curriculum reform cannot be predicted from the type of school where they teach nor years of teaching experience.

Secondly, $3 \times 2$ factorial ANOVA was conducted to assess whether the attitudes of the teachers toward the impacts of the curriculum reform on students’ mathematical proficiency could be predicted from type of school, years of teaching experience, and the interaction between type of school and years of teaching experiences.

Preliminary data screening indicated that the homogeneity of variance assumption was not violated, $F = 2.189, p = .058$. The result of the analysis was not statistically significant, $F_A(2,156) = 2.324, p = .101; F_B(1,156) = 0.113, p = .737$; and $F_{A \times B}(2,156) = 1.663, p = .193$. That is, attitudes of mathematics teachers regarding the
impacts of the curriculum reform on students’ mathematical proficiency could not be predicted from their school types nor from years of their teaching experience.

Thirdly, in order to test whether the attitudes of the mathematics teachers toward the impacts of the curriculum reform on the students’ success on the ÖSYS could be predicted from type of school, years of teaching experience, and the interaction between those variables was conducted.

Preliminary data screening indicated no violation of the homogeneity of variance assumption, \( F = 1.011, p = .413 \). There was a statistically significant type of school by years of teaching experience interaction, \( F_{A \times B}(2,153)=3.404, p = .036 < .05 \). The corresponding effect size estimate \( (\eta^2 = .02) \) indicated a small effect.

The graph of cell means indicated that the science high school teachers who have less than 16 years of teaching experience have a lower level of mean of the impact on the test than the other five groups (Figure 7). For the science high school teachers, the mean of the attitude toward the impact on the students’ success on the ÖSYS was lower for the teachers with less than 16 years of teaching experience \( (M = –0.651) \) than for the teachers with 16 or more years of teaching experience \( (M = –0.302) \) (Table 4.6). On the other hand, for teachers who taught at Anatolian and general high schools with less than 16 years of teaching experience, the means of the attitude toward the impact on the students’ success on the ÖSYS was almost the same \( (M = –0.133 \text{ and } M = –0.138, \text{ respectively}) \). Moreover, the means of the attitudes of the Anatolian and general high school teachers with less than 16 years of teaching experience toward the impact on the
students’ success on the ÖSYS were higher than those of the Anatolian and general high school teachers with 16 or more years of teaching experience \((M = -0.317\) and \(M = -0.420\), respectively).

![Figure 7: Graph of cell means.](image)

Table 4.6

<table>
<thead>
<tr>
<th>Types of Schools</th>
<th>B1 (Less than 16)</th>
<th>B2 (16 or more)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anatolian</td>
<td>(M_{AB11} = -0.133)</td>
<td>(M_{AB12} = -0.317)</td>
</tr>
<tr>
<td>General</td>
<td>(M_{AB21} = -0.138)</td>
<td>(M_{AB22} = -0.420)</td>
</tr>
<tr>
<td>Science</td>
<td>(M_{AB31} = -0.651)</td>
<td>(M_{AB32} = -0.302)</td>
</tr>
<tr>
<td></td>
<td>(M_{B1} = -0.307)</td>
<td>(M_{B2} = -0.346)</td>
</tr>
</tbody>
</table>

Planned contrast were done to assess whether these differences (between the attitudes of teachers with less than 16 years of teaching experience and those of teachers
with 16 or more years of teaching experience) were significant within the attitudes of teachers who taught at Anatolian, general and science high schools. In this regard, independent sample $t$ tests were used to compare pairs of cell means, and the Bonferroni procedure was used to control overall risk of Type I error.

For the attitudes of teachers with less than 16 years of teaching experience, the difference between means for the Anatolian versus science high school teachers’ attitudes towards the impacts of the curriculum reform on students’ success on the ÖSYS was statistically significant, $t(37) = 2.562, p = .015 < .016$. The effect size, $\eta^2$, was .15; this is a medium effect. For the attitudes of teachers with 16 or more years of teaching experience, the difference between the means for the Anatolian and science high school teachers’ attitudes toward the impact of the curriculum reform on students’ success on the ÖSYS was not significant, $t(68) = –0.094, p = .926$. For the attitudes of teachers with less than 16 years of teaching experience, the difference between the means for the general and science high school teachers’ attitudes towards the impact of the curriculum reform on students’ success on the ÖSYS was also statistically significant, $t(36) = 2.907, p = .006 < .016$. The effect size, $\eta^2$, was .19, which is considered large. However, for the attitudes of teachers with 16 or more years of teaching experience, the difference between the means for the general and science high school teachers’ attitudes toward the impacts of the curriculum reform on students’ success on the ÖSYS was not significant, $t(52) = –0.787, p = .435$.

These tests indicated that among the teachers with less than 16 years of teaching experience, science high school teachers tend to think more negatively regarding the
impacts of the curriculum reform on students’ success on the ÖSYS than Anatolian and general high school teachers.

**Additional Findings**

The researcher analyzed the data for further investigation. Factorial ANOVA was conducted for different independent variables; type of school where they taught 
\((A_1=\text{Anatolian}, A_2=\text{General}, A_3=\text{Science})\), gender \((B_1=\text{Male}, B_2=\text{Female})\), and the interaction between type of school and gender. This was a nonorthogonal factorial design; each of the six cells had different number of participants (Table 4.7).

<table>
<thead>
<tr>
<th>Type of School</th>
<th>Male</th>
<th>Female</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anatolian</td>
<td>36</td>
<td>33</td>
<td>69</td>
</tr>
<tr>
<td>General</td>
<td>28</td>
<td>22</td>
<td>50</td>
</tr>
<tr>
<td>Science</td>
<td>32</td>
<td>9</td>
<td>41</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>96</td>
<td>64</td>
<td>162</td>
</tr>
</tbody>
</table>

As a result, gender was found to be an effective factor on the second subscale, impact on proficiency. Preliminary data screening indicated that the homogeneity of variance assumption was not violated, \(F = 1.000, p = .420\). The result of the analysis was statistically significant for the gender effect, and was not statistically significant for the type of school and the interaction between them, \(F_{A}(2,154) = 2.336, p = .100;\)
\( F_B(1,154) = 4.880, p = .029 < .05; \) and \( F_{A \times B}(2,154) = 0.307, p = .736. \) The corresponding effect size estimate \( \eta^2 = .02 \) indicated a small effect. In other word, the attitudes of mathematics teachers toward the impact of the curriculum reform on students’ mathematical proficiency could be predicted from gender.

Warner (2008) said “when a factor has only two groups and if the \( F \) for the main effect for that factor is statistically significant, no further tests are necessary to understand the nature of the differences between group means” (p. 527). Therefore, because the main effect for gender was statistically significant, no further tests were conducted. However, as shown in Table 4.8, male teachers tend to perceive the impacts of the curriculum reform on students’ mathematical proficiency more positively than the female teachers.

Table 4.8

<table>
<thead>
<tr>
<th>Gender</th>
<th>( N )</th>
<th>Mean</th>
<th>Std. Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>96</td>
<td>0.060</td>
<td>.741</td>
</tr>
<tr>
<td>Female</td>
<td>64</td>
<td>-0.209</td>
<td>.744</td>
</tr>
</tbody>
</table>

In summary, three factorial ANOVA tests were conducted to address the research questions. The research questions were about the possible differences among the teachers’ perceptions across the type of school and years of teaching experience regarding the curriculum reform and its effects on students’ mathematical proficiency and students’ success on the ÖSYS. The analysis of the data shows that teachers’ perceptions of the curriculum reform and the impacts of this reform on the students’ mathematical
proficiency are about the same regardless of school types and years of teaching experience. However, the analysis of the data shows that among the teachers with less than 16 years of teaching experience, teachers from science high schools perceive the impact of the curriculum reform on students’ success on the ÖSYS more negatively than their colleagues do who teach at Anatolian and general high schools, although all of them view it negatively. Additional analysis shows that the male teachers perceive the impact of the curriculum reform on students’ mathematical proficiency more positively than females.

Analysis of the Open-Ended Questions

The survey included three open-ended questions. Participants were asked about their positive and negative opinions about the 2005 curriculum reform, about the impact of this reform on students’ mathematical proficiency, and on students’ success on the ÖSYS.

Teachers’ opinions about the 2005 curriculum reform. To the first open-ended question, 127 out of 162 participants (78%) responded. Approximately 42% of them taught at Anatolian high schools \((n = 53)\), 29% of them taught at general high schools and science high schools \((n = 37)\). Approximately 36% of these who responded had less than 16 years of teaching experience \((n = 46)\), and the rest of them had 16 or more years of teaching experience \((n = 81)\). Among the participants with less than 16 years of teaching experience, there were 17 Anatolian (13.3%), 16 general (12.5%) and 13 science (10.2%) high school teachers. On the other hand, among the participants with 16 or more years of teaching experience, there were 36 Anatolian (28%), 21 general (17%) and 24
science (19%) high school teachers. According to descriptive statistics, more male participants \((n = 79, 62\%)\) responded to the first open-ended question than female participants \((n = 47, 27\%)\). Table 4.9 summarizes the frequencies and percentages of the participants who responded to the first open-ended question.

Table 4.9

*Descriptive Statistics for Participants Responded to the First Open-Ended Question*

<table>
<thead>
<tr>
<th></th>
<th>(f)</th>
<th>(%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>79</td>
<td>62.20</td>
</tr>
<tr>
<td>Female</td>
<td>47</td>
<td>37</td>
</tr>
<tr>
<td>Anatolian</td>
<td>53</td>
<td>41.73</td>
</tr>
<tr>
<td>General</td>
<td>37</td>
<td>29.13</td>
</tr>
<tr>
<td>Science</td>
<td>37</td>
<td>29.13</td>
</tr>
<tr>
<td>Less than 16</td>
<td>46</td>
<td>36.22</td>
</tr>
<tr>
<td>16 or more</td>
<td>81</td>
<td>63.77</td>
</tr>
</tbody>
</table>

Analysis of the first open-ended question indicates that majority of the participants generally tend to think that the reform was good in theory but it was insufficient, and there were difficulties with its implementation. Three teachers from each type of schools agreed that geometry in Grades 9 and 10 was intense and confused students. One of the Anatolian high school teachers with 17 years of teaching experience said, “the geometry program is too complex, and it is difficult for students to understand.” A science high school teacher with 30 years of teaching experience made the following statement: “Especially building the geometry program on vectors made
more difficult the understandability of geometry than ever. Students do not understand it and prefer memorization.”

Eight Anatolian, three general and two science high school teachers agreed that the curriculum should be simplified, and some of the topics in Grade 12 should be taught at the university level. One of the general high school teachers with 11 years of teaching experience said, “I think that a positive result cannot be attained with this system unless the curriculum is simplified.” One of the Anatolian high school teachers with 22 years of teaching experience favored the simplified curriculum in the following statement:

As some of the topics were simplified, students’ attention increased. If they want to learn Grade 12 mathematics in detail, they will learn it at the university. We do not have to teach everything. I think the program is good in this way.

However, three Anatolian and one science high school teachers agreed that the curriculum was simplified unnecessarily, and it caused the curriculum to lose its meaning. One of the Anatolian high school teachers with 21 years of teaching experience said, “some of the topics are simplified redundantly.”

One Anatolian high school teacher thought that the curriculum did not emphasize theory of content sufficiently. Four Anatolian, two general, and two science high school teachers agreed that the curriculum was too intense, so that covering all of the topics was difficult. One of the Anatolian high school teachers with 12 years of teaching experience said,

I think that those changes are important because such changes allow students to learn by discovering. However, the implementation of them is difficult because of
the time issue. The intensity of the curriculum and inadequate mathematics lesson hours make the application of student-centered program difficult.

Eight Anatolian, five general, and five science high school teachers reported that the changes were good but such changes could not be applied as expected because of the university entrance examinations. One of the science high school teachers with 28 years of teaching experience said, “the idea and the aim of the program are correct, however, it is in conflict with the exams and the practice.” Another science high school teacher with 12 years of teaching experience responded as follows: “The program is good in theory. However, there are problems in its applications. It is redundant unless either the examination system or the types of exam questions are changed.” They perceived the exam as an obstacle against the changes.

Six Anatolian, five general, and four science high school teachers agreed that the changes were made before teachers and students’ background were sufficiently strengthened. They thought that the changes were made suddenly, and they were not ready for it. Additionally, they found the inservice support offered insufficient. One of the Anatolian high school teachers with 17 years of teaching experience said, “teachers are not knowledgeable about this system.” One of the general high school teachers with 14 years of teaching experience said, “the program is good, and teachers should be convinced and trained to implement it.” A science high school teacher with 25 years of teaching experience said, “I think it is beneficial; however, teachers were not ready for it.”
Two Anatolian, three general, and three science high school teachers agreed that the activities in textbooks were good but they needed more time for those activities, however, the intensity of the curriculum was an obstacle against such activities. An Anatolian high school teacher with 11 years of teaching experience said, “the program should be prepared more carefully, and it should be student-centered. There are activities, which are good to have; however, it is not possible to cover the whole curriculum with activities.” A science high school teacher with 11 years of teaching experience said, “This system has too many activities. It prevents the application of the intense curriculum that science high schools should have.”

Three Anatolian, one general, and four science high school teachers agreed that the curriculum and textbooks should have been prepared separately for different types of schools. An Anatolian high school teacher with 32 years of teaching experience said, “achievement level of schools should be determined, and education programs should be prepared based on those achievement levels.” One of the science high school teachers with 26 years of teaching experience said, “because types of schools were not considered, the program is too easy for some of the schools, and it keeps students busy for some of the schools. Hence, the changes do not yield the expected effects.” Two Anatolian high school teachers found the changes appropriate for general high school students rather than Anatolian high school students. An Anatolian teacher with 17 years of teaching experience said, “I think the changes made in 2005 do not work for Anatolian high schools. It is waste of time for us. I think it may be more beneficial for general high schools.”
Two Anatolian, one general, and one science high school teachers claimed that attendance to private tutoring institutions increased because of the negative effects of the changes. A general high school teacher with 30 years of teaching experience said, “I believe that the changes are harmful rather than beneficial. Students began to expect to learn mathematics by attending private tutoring institutions. They expect only getting grades from schools, and they perceive knowledge as unnecessary.” A science high school teacher with 20 years of teaching experience agreed that “students prefer to learn mathematics at private tutoring institutions more than ever.”

One Anatolian, three general, and one science high school teachers claimed that most of the students relied on memorization to be successful on the exams because the system did not help them at all. An Anatolian high school teacher with 21 years of teaching experience said, “the changes are positive; however, we cannot apply them so much in Anatolian high schools. Students try to learn the topics only by solving problems without reading the theory and relying on memorization.” A science high school teacher with 9 years of teaching experience said, “I still think that the curriculum is too intense, and because the university entrance examinations are still multiple-choice tests, students prefer to memorize the types of questions on them.”

As a result, majority of the teachers tend to think that the idea of the changes were beneficial but the implementation of such a system had difficulties mainly because of time, university entrance examinations, and lack of support for inservice teachers.

**Teachers’ opinions about the impact of the 2005 curriculum reform on students’ mathematical proficiency.** For the second open-ended question, 114 out of
162 participants (70%) responded. Approximately 43% of them taught at Anatolian high schools ($n = 49$), 28% of them taught at general high schools ($n = 32$) and 29% of them taught at science high schools ($n = 33$). Approximately 35% of those who responded had less than 16 years of teaching experience ($n = 40$), and the rest of them had 16 or more years of teaching experience ($n = 74$). Among the participants with less than 16 years of teaching experience, there were 16 Anatolian (14%), 14 general (12%) and 10 science (9%) high school teachers. On the other hand, among the participants with 16 or more years of teaching experience, there were 33 Anatolian (29%), 18 general (16%) and 23 science (20%) high school teachers. According to descriptive statistics, male participants ($n = 73$, 64%) responded to the first open-ended question more than female participants ($n = 41$, 36%). Table 4.10 summarizes the frequencies and percentages of the participants who responded to the second open-ended question.

Table 4.10

<table>
<thead>
<tr>
<th></th>
<th>$f$</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>73</td>
<td>64.03</td>
</tr>
<tr>
<td>Female</td>
<td>41</td>
<td>35.96</td>
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<tr>
<td>16 or more</td>
<td>74</td>
<td>64.91</td>
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</table>
Analysis of the second open-ended question showed that the attitudes of teachers were relatively close to each other. Among the total of 114 responding teachers, 27 teachers (24%) (12 Anatolian, 8 general, and 7 science) made positive statements about the impact of the curriculum reform on students’ mathematical proficiency, whereas 32 teachers (28%) (11 Anatolian, 10 general, and 11 science) made negative statements. Twenty teachers (18%) (10 Anatolian, 3 general, and 7 science) observed no effect at all.

Three of the Anatolian high school teachers and one general high school teacher thought that the changes enhanced students’ self-confidence and made their attitude toward mathematics positive. One of the Anatolian high school teachers with 19 years of teaching experience made following statement: “Students can discover a definition or a theorem by their own skills. Then students’ self-confidence increases.” Other Anatolian high school teacher with 15 years of teaching experience stated: “Generally it is positive. They enjoy lessons, and their negative attitude toward mathematics decreased.”

Two Anatolian and one science high school teachers observed that the changes enabled students’ mathematical thinking skills to improve. However, students still preferred solving multiple-choice tests because they are used to utilizing such techniques. One of the Anatolian high school teachers with 17 years of teaching experience said,

This system enables students’ mathematical thinking to improve. So, they can analyze problems by using concepts. However, it takes too much time. And, students usually do not want to learn how formulas are derived because they are too much accustomed to the multiple-choice test technique.
A science high school teacher with 20 years of teaching experience stated the following:

“The system makes students’ thinking skills improve. Students can discuss questions or topics and can solve high level problems.” Another science high school teacher with 19 years of teaching experience said, “their understanding of content became fast.”

Two Anatolian, one general, and two science high school teachers agreed that student quality decreases each year. An Anatolian high school teacher with 8 years of teaching experience said, “unfortunately, we will not find the same student quality in the next year. So, I do not think there is any positive effect on students’ mathematical proficiency.” Other Anatolian high school teacher with 18 years of teaching experience said, “students do not take mathematics seriously; quality has dropped. Students’ mathematical intelligence is very weak in comparison with past years.” A general high school teacher with 20 years of teaching experience spoke as follows:

Students come to high schools without learning the required knowledge from the second part of the primary education. Hence, they become unsuccessful at high school. Parents think that their children learn something at primary school, but they do not because there is no repeating the same grade level in the second part of the primary education anymore.

A science high school teacher with 21 years of teaching experience also indicated the same problem regarding student quality:

In this year, computational skills of 9th graders are too weak. They do not want to think on the questions; they want to answer immediately when they see the questions because the system does not work appropriately at primary education.
Other science high school teachers with 30 years of teaching experience claimed that “students do not learn anything about Algebra in the primary school.”

Two general and two science high school teachers thought that students’ conceptual understanding, analyzing and synthesis skills diminished as a result of the new system. One of the general high school teachers with 23 years of teaching experience said, “I think that this system harms students’ mathematical proficiency; it leads students toward memorization. Their procedural fluency is too weak. I believe that students do not understand the problems.” A science high school teacher with 18 years of teaching experience said, “students learn practical ways of solving problems only, without thinking.”

Two Anatolian, one general, and four science high school teachers indicated that students learn by memorization. One of the Anatolian high school teachers with 20 years of teaching experience said,

Students want a system that relies on memorization. They want to learn formulas, and solve problems. Even if we explain how those formulas are derived, they resist learning it because such knowledge is not asked to them on the university entrance exams.

One of the science high school teachers with 23 years of teaching experience claimed that “before building sufficient background for students, we try to teach them new mathematics. This causes them to memorize some concepts instead of learning them.”

One of the Anatolian high school teachers with 22 years of teaching experience found the activities in textbooks insufficient. She thought such activities caused students’
creativity skills to improve. One Anatolian and one science high school teacher agreed that the system enabled students’ understanding and analyzing skills improve, however, problem solving skills were getting weaker. An Anatolian high school teacher with 22 years of teaching experience said, “the curriculum should be different for Anatolian and similar kind of schools. Problem solving skills of students are weaker than those of former students; but this system is beneficial.” A science high school teacher with 12 years of teaching experience said, “conceptual understanding and reasoning of students improved. However, a problem occurred in problem solving, and that problem still continues.”

A general and a science high school teacher indicated that the system led students to attend to private tutoring institutions. A science high school teacher with 11 years of teaching experience said, “while trying to improve their procedural fluency, the system leads students to the tutoring institutions.”

Two Anatolian teachers and one science high school teacher agreed that the implementation of the activities which are supposed to increase students’ mathematical proficiency is impossible when students are selected and placed to universities by an examination. They stated that, “naturally, students want an educational system that prepares them toward the exams.” One of the Anatolian high school teachers with 31 years of teaching experience said,

I think those changes cannot be effective on the students’ mathematical proficiency because those changes cannot be implemented appropriately. The main reason is the university entrance examination pressure. Because everybody
expects success on it, problem solving is emphasized in a practical way. The first obstacle is that the 9th graders who have just passed the SBS\(^3\) try to solve problems without even using pencils. Also, those students are having difficulties to build a background knowledge because they are used to studying for SBS by learning everything all over again.

A science high school teacher with 13 years of teaching experience indicated that because the educational system focuses on the university entrance examinations, students’ mathematical proficiency does not change.

An Anatolian high school teacher with 16 years of teaching experience stated that students cannot make connections between the concepts. “We cannot see integration of concepts in mathematics, geometry, and analytic geometry. Therefore, students cannot understand the relationships between concepts, and it causes a drop in the success level.”

**Teachers’ opinions about the impact of the 2005 curriculum reform on students' success on the ÖSYS.** To the third open-ended question, 115 out of 162 participants (71%) responded. Approximately 42% of them taught at Anatolian high schools \((n = 48)\), 29% of them taught at general high schools \((n = 33)\) and 30% of them taught at science high schools \((n = 34)\). Approximately 37% of the responding teachers had less than 16 years of teaching experience \((n = 43)\), and the rest of them had 16 or more years of teaching experience \((n = 72)\). Among the participants with less than 16 years of teaching experience, there were 16 Anatolian (14%), 15 general (13%) and 12 science (10%) high school teachers. On the other hand, among the participants with 16 or

\(^3\) SBS is a central examination that is held at the end of Grade 8 in order to determine students’ achievement levels by MEB.
more years of teaching experience, there were 32 Anatolian (28%), 18 general (16%) and 22 science (19%) high school teachers. According to descriptive statistics, more male participants \((n = 71, 62\%)\) responded to the third open-ended question than female participants \((n = 43, 37\%)\). One participant did not clarify his or her gender. Table 4.11 summarizes the frequencies and percentages of the participants who responded to the third open-ended question.

Table 4.11

Descriptive Statistics for Participants Responded to the Third Open-Ended Question

<table>
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<td>37.39</td>
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<td>16 or more</td>
<td>72</td>
<td>62.60</td>
</tr>
</tbody>
</table>

Analysis of the third open-ended question shows that teachers tend to think slightly negatively about the impact of the curriculum reform on the students’ success on the ÖSYS. Among the respondents, 27% of them reported a negative outlook whereas 23% of them reported a positive outlook. The percentage of the teachers who observed no effect on students’ success on the exams was 21. Approximately 5% of teachers stated that they were not sure about this issue.
A majority of the teachers agreed that the changes did not positively affect students’ success on the exams. Seven Anatolian, 5 general, and 5 science high school teachers indicated that the changes were not effective because the curriculum and the examination system are in conflict with each other. Although the changes emphasized conceptual understanding, reasoning, connections, and discovery, the examination was based on the multiple-choice test. One of the Anatolian high school teachers with 8 years of teaching experience said, “the changes have not been reflected by the examination system yet. The content and style of the examination are not different from those of the examinations before 2005.” Another Anatolian high school teacher with 21 years of teaching experience said, “unless the examination system changes, the implementation of the changes is very difficult.” A science high school teacher with 27 years of teaching experience said, “I do not think the changes affect students’ success on the exams because students have still been successful by studying for multiple-choice tests. There is no relationship between the changes and the examinations.”

Four Anatolian, three general, and one science high school teachers indicated that students attended to the private tutoring institutions more than ever because of the changes. Hence, some of the teachers stated that it was difficult to observe the effects of the changes because private tutoring centers were extremely influential on students’ success on the exams. One of the Anatolian high school teachers with 22 years of teaching experience said,

The private tutoring institutions are highly effective in the process of preparation for the ÖSYS. Also, big changes were made in the suplemental textbooks sold in
markets. If this competition-based system is not changed, the curriculum changes will not be meaningful.

One general high school teacher with 12 years of teaching experience thought that the interest of students toward the mathematics and the departments that admit students based on mathematics score increased because of the changes. One Anatolian high school teacher with 14 years of teaching experience and two science high school teachers with 19 and 23 years of teaching experience also thought that the changes enabled students’ average of mathematics scores on the exams to increase.

Three Anatolian and three science high school teachers indicated that there was no change in the level of students’ success on the exams after the curriculum reform because their students have always been successful. One Anatolian high school teacher with 17 years of teaching experience said, “our students’ success is increasing continuously because our lessons are so intense, and our students are already good. Besides they are attending the private tutoring institutions, as a consequence of which their successes on the exams is increasing.” One science high school teacher with 21 years of teaching experience stated that “our students were successful in the past, and they are successful now, too. The education in this science high school is very intense and we expand on the current curriculum. I think their success is related with this.”

One Anatolian high school teacher with 31 years of teaching experience thought that there were some positive effects on the students’ success on the exams; however, the changes could not be implemented completely. Another Anatolian high school teacher
with 17 years of teaching experience agreed that the changes were not implemented well enough to be effective on the achievement on the ÖSYS.

Three Anatolian high school teachers and one general high school teacher agreed that students’ problem solving skills became weaker and slower. A general high school teacher with 14 years of teaching experience claimed that “because the new program affected students’ mathematical proficiency negatively, their problem solving skills on multiple-choice tests were affected negatively, too.”

One Anatolian high school teacher with 8 years of teaching experience and one general high school teacher with 11 years of teaching experience agreed that it was difficult to observe any effect because the number of universities increased. He said, “because there are universities in each province today, the ratio of being placed in university is higher than previous years.” A general high school teacher said, “because of the number of universities increasing, students are placed in the universities even when their proficiency is weak, unfortunately. So, I cannot discern any effect of the changes on students’ success on the exams.”

In summary, there were no significant differences between the teachers’ attitudes toward the curriculum reform, the impact of this reform on students’ mathematical proficiency, and the impact of this reform on students’ success on the ÖSYS. However, teachers’ attitudes toward the reform were slightly positive whereas their attitudes toward the impact of the students’ mathematical proficiency and the students’ success on the exams were negative. A majority of the teachers indicated that the curriculum reform and
the university entrance examination system conflicted with each other. This prevented a proper implementation of the curriculum reform.
Chapter 5: Interview Results and Analysis

This part of the study includes the data collected through face-to-face interviews with 18 secondary education mathematics teachers. The interview protocol was semi-structured and consisted of both demographic and open-ended questions. Follow-up questions were asked in order to gain a deeper understanding of participants’ perceptions and to address the part (a) of the research questions. Each interview lasted 30–60 min. The interviews were held at the schools where participants taught.

Demographics of the Participants

In this section, each of 18 of the participants (6 from each type of school) is introduced briefly. Eight of the participants are female, and ten of them are male. Five of them hold a bachelor’s degree in mathematic education, whereas 13 of them have a degree in mathematics. The range of their level of teaching experience was between 12 and 37 years. Some of the participants have taught at the same schools; Participants A4 and A6; Participants G1 and G3; Participants G4 and G6; Participants S1, S2, and S3; and Participants S4, S5, and S6. Table 5.1 summarizes the demographics of the participants.

Participant A1 is female who had a bachelor’s degree in education. She has 13 years of teaching experience. She has worked at general high schools, vocational high schools, and mostly Anatolian high schools, has now been teaching 9th and 10th grades mathematics and geometry for 2 years at an Anatolian high school that had previously been a general high school which admitted relatively low scoring students.
Participant A2 is female who had a bachelor’s degree in education and has a master’s degree in applied mathematics. She has 22 years of teaching experience, which she has working at general high schools and Anatolian high schools. She is currently teaching 11th and 12th grades mathematics, geometry, and analytic geometry at an Anatolian high school whose students have an average success level.

Participant A3 is also female who hold a bachelor’s degree in mathematics and has 22 years of teaching experience. She has previously worked at religious vocational high schools, general high schools, and Anatolian high schools. She is currently been teaching 11th and 12th grades mathematics, geometry, and analytic geometry at an Anatolian high school, which ranks among the top five schools in its province.

Participant A4 is male who has a bachelor’s degree in education and educational divinity. He also has a master’s degree in public administration. He has 35 years of teaching experience. He has worked at general high schools, vocational high schools, middle school, and an Anatolian high school. He is currently teaching 9th and 10th grades mathematics and geometry, and 12th grade analytic geometry at an Anatolian high school, which has consistently ranked among the top five schools in Turkey, for 22 years.

Participant A5 is male, has a bachelor’s degree in mathematics and has 19 years of teaching experience. He worked at primary school as an administrator and taught at Anatolian high schools. He is currently teaching Grades 9–12 mathematics, geometry, and analytic geometry at an Anatolian high school, which has ranked among the top 10 schools in its province, for 14 years.
Participant A6 is also male who hold a bachelor’s degree in mathematics and has 32 years of teaching experience. He has previously worked at a teacher high school, general high schools, and Anatolian high schools. He is currently teaching Grades 9–11 mathematics and geometry at an Anatolian high school, which ranks among the top five schools in Turkey, for 14 years.

Participant G1 is female who hold a bachelor’s degree in mathematics and has 17 years of teaching experience. She has previously worked at general high schools and super high schools. She is currently teaching Grades 9–11 mathematics and geometry, and Grade 12 analytic geometry at a general high school that has average success level of students.

Participant G2 is female who hold a bachelor’s degree in mathematics and has 12 years of teaching experience. She has worked at primary schools, an Anatolian high school, a vocational high school, and a general high school. She is currently teaching Grades 9–11 mathematics and geometry at a general high school, which has average success level of students, for two years.

Participant G3 is female who has a bachelor’s degree in education and has 20 years of teaching experience. She has worked at vocational high schools, a religious vocational high school, Anatolian religious vocational high schools, and general high schools. She has been currently teaching Grades 9–10 mathematics and geometry at a general high school, which has average success level of students, for seven years.

Participant G4 is female who hold a bachelor’s degree in mathematics and has 24 years of teaching experience. She has worked at general high schools and is currently
teaching Grades 9–10 mathematics and geometry at a general high school, which ranks among the top five general high schools in its province, for 11 years.

Participant G5 is male with a bachelor’s degree in mathematics and 30 years of teaching experience. He has worked at general high schools, private teaching institutes, and a primary school. He is currently teaching Grades 9, 10 and 12 mathematics, geometry, and analytic geometry at a general high school, which has an average success of students, for seven years.

Participant G6 is female who hold a bachelor’s degree in mathematics and has 21 years of teaching experience. She has previously worked at private teaching institutions, general high schools, and vocational high schools. She is currently teaching Grades 11–12 mathematics and geometry at a general high school, which ranks among the top five general high schools in its province, for six years.

Participant S1 is male who hold a bachelor’s degree in mathematics and has 20 years of teaching experience. He has worked middle schools, a general high school, and science high schools. He is currently teaching at Grades 9–12 mathematics, geometry, and analytic geometry at a science high school, which ranks among the top five high schools in Turkey, for 12 years.

Participant S2 is male with a bachelor’s degree in mathematics and 37 years of teaching experience. He has worked at general high schools, vocational high schools, and a science high school. He is currently teaching Grades 9–12 mathematics, geometry, and analytic geometry at a science high school, which ranks in top five high schools in Turkey, for 28 years.
Participant S3 is male who has a bachelor’s degree in education. He has 17 years of teaching experience. He has worked at general high schools, vocational high schools, Anatolian high schools, and science high schools. He is currently teaching Grades 9, 10, and 12 mathematics, geometry, and analytic geometry at a science high school for eight years.

Participant S4 is male who hold a bachelor’s degree in mathematics and has 24 years of teaching experience. He has worked at general high schools and science high schools. He is currently teaching Grades 9–12 mathematics, geometry, and analytic geometry at a science high school, which ranks among the top five high schools in Turkey, for 7 years.

Participant S5 is male with a bachelor’s degree in mathematics and 27 years of teaching experience. He has worked at general high schools, a teacher high school, a police academy, a religious vocational high school, and a science high school. He is currently teaching Grades 9, 10, and 12 mathematics, geometry, and analytic geometry at a science high school, which ranks among the top five high schools in Turkey.

Participant S6 is male with a bachelor’s degree in mathematics and 28 years of teaching experience. He has worked at general high schools and science high schools. He is currently teaching Grades 9–12 mathematics, geometry, and analytic geometry at a science high school, which ranks among the top five high schools in Turkey, for 14 years.
**Table 5.1**

*Demographics of Participants*

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**Perceptions of Teachers Regarding the 2005 Curriculum Reform**

This section consists of two parts. The first reports the perceptions of teachers regarding the changes on content areas. The second describes the perceptions of teachers regarding the changes on pedagogical approach.
Perceptions of teachers regarding changes in content. As a result of curriculum changes made in 2005, a geometry course was added to the Grade 9 curriculum. All of the participants agreed that the addition was beneficial because, in the old system, students had been staying away from geometry for a year, which caused them to forget the basic knowledge. Although all of the participants favored the idea of teaching less on each subject of geometry in Grade 9, Participant A1 indicated that teaching less on each subject confused students.

Vectors. The use of vectors was emphasized in geometry. All of the participants from Anatolian high schools and general high schools, except Participant G4, agreed that the intense use of vectors in geometry was a problem and unnecessary. For instance, Participant G1 stated that although she agreed in principle use of vectors in geometry, its implementation proved to be difficult, and said that there was no need for it. Participant A6 reported that vectors should have been taught with the complex numbers. Participant G4 reported that she approved of it but students did not understand use of vectors in geometry. However, all of the participants from science high schools agreed that the use of vectors in geometry was beneficial. Participant S1 reported that understanding of vectors was difficult, but once the students understood the idea, they were able to use it effectively. Participants S2, S4, and S5 reported that they liked very much the approach of vectors in geometry because it allows students make connection to physics. Participant S4 made the following statement:

Synthetic geometry alone does not respond to the needs of today. For example, these students solve any problem that you try to solve for days in geometry at a
glance. In such cases, the developing students who are doing only synthetic
gometry cannot analyze the problems well. They think the same way when they
see a similar triangle. However, when you add the analytic or vector aspect to it,
they convey that knowledge to the computerized environment, and they can use
technology with the help of vectors.

**Fractals and tessellations.** Fractals and tessellations were added to geometry. All
of the participants from general high schools and four of the participants from Anatolian
high schools agreed that those new topics were unnecessary, and teachers lacked the
required background to teach them. Participant G1 made the following statement:

> Maybe I am thinking wrong, but first of all, we have to be trained in this subject.
> Let there be changes, but not without sufficient preparation. I do not know this
> subject for years; I did not learn it in high school; and I did not learn it in college.
> But of course, I can learn it if I study. But it should not be this way.

Participant G3 indicated that those topics might be beneficial for the students who are
attending vocational high schools, especially students who will be designers or interior
designers. Otherwise, she said, it was a waste of time. Participants G4 and A3 stated that
students were bored because they found it childish. Participant A1 found it beneficial if it
was taught in primary school. However, Participants A5 and A6 found them beneficial.
Participant A6 said, “It should be included in the curriculum, because it could motivate
their imagination.”

Participants from science high schools offered mostly positive comments on the
new topics in geometry such as fractals and tessellations. Participant S2 said, “students
will love them. Those activities will please the students by showing them an application of geometry.” Participants S4 and S5 stated that the logic in the inclusion of these topics was correct but its implementation did not go beyond a visual experience. Participant S5 said,

Fractals are not new for our students. Our students have done many things related to fractals in their projects….I am looking at the book, good, but there is not enough time for us to focus on only one content. You have to examine it, search it. So the person who will spend time for it has to neglect other things. Nobody does this.

Participant S4 indicated “the system is not conducive to improving those topics.” He continued as follows:

My students made so beautiful projects but I gave a test at the end. It is bad! I mean, if you have a chance to do the assessment of a project involving fractals, you can improve it. But it is not like that….I am following the work of a professor at Boston University, he is an expert in fractals. And geometry must be like that. I mean, if I leave aside teaching angles and triangles, and if I can teach geometry the way I saw from that professor, I would feel it right to take many more steps.

Participant S6 reported that those topics were beneficial and geometry class became more meaningful with them. However, Participant S3 said he did not observe any benefit of them although he expected to see some benefits in the future.

Other changes. There were a few changes in content levels of mathematics. The last topic of Grade 10 (permutation, combination, and probability) was moved to Grade
11. All of the participants agreed that moving the last topic of Grade 10 to Grade 11 made Grade 10 more viable on time. Participant A3 said, “Grade 11 was especially easy. So shifting the last topic of Grade 10 to 11 brought some balance to the situation.”

All of the participants from Anatolian and general high schools agreed that Grade 9 mathematics content was too intense. Participant A1 and G5 reported that the reason of this intensity was the YGS. Participant G5 said the following:

There is a time problem in Grade 9. Some of the topics should be moved to Grade 10. But they [the decision makers] cannot do it because the YGS [First stage of the exam] heavily relies on Grade 9. A student who will choose a language major or a social science major will not take any mathematics course at Grade 10.

However, that student has to take the YGS.

Participant A3 indicated that teaching only sets and numbers would be enough for Grade 9. Participant A4 suggested that if the functions, relations and operations were moved to Grade 10, then logic, sets and numbers would be enough for Grade 9. Participant G2 said, “the lesson hours are not enough. Making it 5 hr a week can increase the application opportunities.”

However, all of the participants from science high schools reported that there was no time problem for them. Because they had highly qualified students who had strong background, they even expanded the curriculum whenever they got the chance possible. Participant S1 said,
There is no time problem for us. We even expand our topics because this is a science high school. If it were a regular high school, I would understand it. But when you say science high school, you need to keep the perspective wide.

Participant S4 said,

Time is not an obstacle for us. Because our students already have the background that is expected by MEB….They come here with a strong knowledge of contents that the Ministry expects us to teach and sufficient preparation, from primary education. We try to make them do different things using their knowledge.

Participants A4, S1, and S4 indicated that some topics were divided at some point and resumed once some other topics were taught. Hence, the unity of the content was interrupted. Participant A4 said,

While we teach the functions in Grade 9, the topic of operations interrupts the flow of topics. We told them [decision makers] that doing so disrupted the unity of the function although the operations are a function. Because some tables are discussed with dealt … some operations without rules interrupt the flow when the students just learn the things with rules.

Participant S1 gave a similar example from geometry:

Just while we teach vectors, we stop and start to teach different topics without vectors. Then you are return to teaching with vectors. Students have difficulties to adapt. Our students still can work and solve problems, but I doubt that the students in general high schools can do it.
In addition, Participant A6 stated that logarithm should be removed from the secondary education curriculum because nowadays it can be done using technology. “If students will attend to some engineering programs, then they can learn it at the university. At the high school level, there is no need for the logarithm anymore. I think it should be removed. “Participant A5 reported that all of the contents in Grade 12 are taught at the university level so that there is no need to spend a whole year for these topics; the essence of them can be taught in a short time. He said, “the topics that need to be taught at the university should be removed from our curriculum and we should raise a well-taught generation by teaching less content in secondary education.” However, all of the participants from science high schools and Participants A1 and A3 indicated that the contents in Grade 12 should contain more detail. Participant S1 said,

If you look at the curriculum, you will see that the inclusion of the topic of sequences is limited in comparison with the past practice….For instance, limits are very important in the discussion of sequences. We were teaching it before. I think this is very important. Why? Because when the students become 12th graders, they should make connection between the concept of limit in functions and the concept of limit in sequence. Otherwise, I think, to only loosely define limit in functions is not sufficient.

Those participants stated that the understanding of the contents of Grade 12 will not be complete if sequences and series are not taught. Participants from science high schools have an opportunity to go beyond the curriculum and they teach the topics mentioned above in detail.
In summary, there were only a few changes in the content level in the curriculum. Most of the Anatolian and general high school teachers find some of the changes ineffective whereas the science high school teachers think, for the most part, that the changes are beneficial.

**Perceptions of teachers regarding changes to student-centered pedagogy.** The participants were asked whether they implemented constructivist approach in their classrooms or not, and if they did, to what extent they implemented it. The perceptions among Anatolian and general high school teachers show similarities. Firstly, although all of them favored the idea of student-centered teaching and learning, they did not implement it totally. Participants A2, A5 and G3 stated that they tried to implement student-centered approach when they heard about it. Participant A2 said,

> We were excited at first….I was working at a general high school at that time. I started to apply it. Students were getting excited, and they, especially 9 graders, thought that mathematics was easy….But we had some problems…it was taking a long time. They were supposed to think at home, on the questions by making connections at a higher level. They did not do it…They understood the essence of the topics but they could not solve problems, and they could not make connections. When you encouraged them saying ‘you can do it’, they preferred to go the easier way: thinking that they could learn how to solve the problems at private tutoring institutions. Hence, I could not continue to implement that.

Participant A5 stated that he attempted to adapt his teaching style the student-centered approach. He said that he could implement it only in classes that not too crowded because
such classes were not appropriate for the student-centered teaching and learning. He complained about the time issue. When he followed this approach a year in one class, they could barely finish the first half of the textbook. As a result, he had to moderate the implementation of that approach. Participant G3 also tried to implement the new system. But she reported that she had difficulties in covering the curriculum, and she said, “it was difficult to use this approach. Our students have low success level. Because they have less knowledge and background, it is difficult to do this kind of thing.” Hence, Participants A2 and G3 returned to teacher-centered teaching and learning while Participant A5 moderated student-centered teaching and learning in his classes that were reasonably small.

Participants A1, G1, G2 and G4 agreed that the student-centered teaching and learning is beneficial for students. However, they claimed that it could not be applied to the low-level students in crowded classes within an intense curriculum. However, they stated that they tried to implement it in their own way. For instance, Participant A1 called her students to the board often and led them talk and have a class discussion. She said that she assigned students some projects. Participant G1 said,

I think that the system that was shown at the beginning is a beautiful system when the conditions are satisfied. To involve students in the lesson! I am doing the same thing in my classes in this semester, that is, teacher leads. I lead and try to make them comment without being impressive for them, and I wait for them to reach some results. But we cannot hold off completely….As a matter of fact, I am a person who had loved to teach based on the student-centered even before the
system was changed….Our classes have 25–30 students at least. In such big
classes and with limited time, it is impossible for the students to reach some
results by themselves doing those activities, as well as for me to keep the class
under the control.

Participant G2 gave similar information with Participant G1. She said,

The system has a beautiful part: students discover things by themselves. On the
other hand, unfortunately, crowded classes do not always allow us to do activities
in 40 min. Mostly, we end up reading about those activities….A system which is
either only teacher-centered or only student-centered does not work. Both of them
should be integrated.

She stressed that she tried to understand her students’ background knowledge at the
beginning of the semester. Then she tried for them to realize their own knowledge. She
believed that “students certainly know something but they do not know how they can
apply it.” She said that she asked different questions to students who had different
achievement levels in the same class by using real-life samples as much as possible.

Participant G4 reported that she always approved of the constructivist approach but she
said that it needed time. In her opinion, the lesson hours should be increased, and teacher
should be able to allot enough time to students’ activities. When the curriculum was
intense, even though she believed that student-centered teaching and learning should be
implemented, she was not able to do it because the education system made it difficult to
do. However, she tried to involve her students in the lessons:
I keep having students come to the board. I believe that it is necessary, even if they cannot do mathematics, and because I think that being able to work at the board is a sign of self-confidence, I want the mathematics course to cause students’ behavior change….I encourage students saying that they can do it. Even though two or three students raise their hands, I want more hands to be raised. I do not judge the student who could not do it even though we had solved the problem ten times. I say that there is no difficult or easy question; the one that you learned is easy, the one that you could not learn is difficult even if it is easy. Hence, I try to implement the student-centered approach by encouraging students in this way.

Participants A3 and A4 reported that they did not change their teaching styles after the curriculum changes. They said that they decided how they should teach based on the students’ needs. For instance, Participant A3 said, “I follow the curriculum at the appropriate content level, however, I have to apply different teaching styles based on the structure of the classes or the achievement level of the students.” She said that her teaching styles included inquiry-based teaching:

I love to ask a question and get answers from students; I love the inquiry method. Before teaching a new topic, if there is any connection with the previous and new topics, I try to assess to what extent students know it, and I will assume that I have reached my goal if they realize those connections. If they do not, then I think that there are some missing parts, and I continue the inquiry about the topic.
Participant A4 reported that he had his own course notes, and he followed those customizing their presentation according to the achievement levels of his classes and perception levels of his students. Participant A6 had a similar teaching style to that of the Participant A4. He stated that he taught considering students’ expectations. Their expectations were mostly to solve problems as much as possible, instead of spending time for learning theories of the concepts, so they can prepare for the university entrance examinations. Participants G5 and G6 reported that they focused on the university entrance examination totally. Participant G5 explained his typical lesson as follows:

First of all, I state the title of the topic then I write how many questions were asked in the ÖSS. For instance, logarithm, a content of Grade 11, there were five questions from logarithm in 2011, and four questions in 2010...I say that I expect four or five question, in 2012. I start with a very simple lecture then I solve two questions that were asked in the ÖSS related to the same topic. Students say that logarithm is simple. I try to warm the students up to the topic. Then I try to teach the theory by asking questions gradually from easier to harder. After discussing the theory, I ask them to solve the ÖSYS questions from 1966 to 2011, related to the topic, which they can find at the end of the textbook that we use....I ensure success in this way.

On the other hand, all of the participants from science high schools reported that the student-centered teaching and learning was in the nature of science high schools. They said that the education in science high schools was different from others, and it had
to be different because they have the best students coming from across the whole country.

Participant S1 made the following statement:

Here, the students are very active. There are selected students because this is a science high school. Implementing the student-centered teaching and learning is much easier. Because when you give the content somehow, the students immediately begin to discover the theory by themselves.

Participant S2 indicated that he had already been implementing the student-centered teaching and learning for years:

As a matter of fact, I have been applying this for years without naming it so. That is, I am not the only person who lectures in my classes; we [he and his students] lecture together. For instance, we describe the subject together in consultation with each other. I ask questions and receive their answers. I try to apply both student-centered and teacher-centered teaching and learning.

Participant S4 stated that his teaching philosophy already included the student-centered teaching and learning. Participant S5 indicated that he had already been applying this approach:

As a matter of fact, this student-centered approach is being applied in our school. In fact, thinking, making decisions, and modeling are applied due to the nature of a science high school at an even more complex level than that of the textbooks. I have already been applying it; it is not new for me.

In summary, all of the participants agreed on the benefits of the student-centered teaching and learning. All of the participants from science high schools have opportunity
to implement this approach in their schools because of their students’ high qualifications. However, there are some differences and similarities between the participants from Anatolian and general high schools. Although some of them believed in the benefits of this approach, some of them preferred to continue to use their own teaching styles, and some others could not apply it because of some obstacles.

**Perceptions of teachers regarding the obstacles to implementing student-centered pedagogy.** All of the participants indicated some realities that impede the implementation of the student-centered teaching and learning completely. These obstacles can be gathered under three categories: Time and class size, university entrance examination, and professional development for inservice teachers.

**Time and class size.** For participants from science high schools, time and class size, which is determined as 24 students by MEB, were not obstacles. However Participants A1, A4, A5, G1, G2, G3 and G4 stated that time and crowded classes were among the problems with the implementation of the student-centered teaching and learning. According to Participant A4, time problem can be solved by decreasing the number of courses. In his school, there were 12–13 distinct courses offered to students. He said that there should only be 7–8 courses including Turkish language and art, mathematics, physics, chemistry, biology, history and geography. He claimed that the main reason for the secondary education being four years-long was to disburden students of some heavy work, to leave leisure time for them to socialize, and to leave some time for preparation toward the university entrance examinations, which are the reality that the
students face. He stated that it did not happen. Instead the program was filled with many elective courses.

There is no time for elective courses. Why? What is the purpose of teaching? Can these students, who are preparing for the university exams, use this knowledge in the exam? They cannot use the knowledge that they learned from the elective courses in the university examinations….Some of our friends who teach different subjects cannot lecture in the classrooms. Why? Because there is no question from those subjects in the university entrance examinations.

Participant A5 reported that time was certainly a problem with implementing the student-centered approach in crowded classes. He said that he had classes with 38 students. He claimed that having a class discussion in such classes caused distraction and arguments and made it impossible to progress in the topic. Projects and group work were two of the basic components of this approach. Participant G1 explained her limitations in doing these studies:

I have eight classes right now. I am not teaching only Grade 12 mathematics. I am teaching 27 hr a week. I think I have a total of 400–500 students. All of their projects, works, need to be filed; and I have to help them with their activities; evaluate their work, support their projects, and control them. Unfortunately, we do not have a chance to do so.

Participant G2 stated that she had 40–42 students in a class, and it was difficult to do group work; even designing a class for this study was difficult. When Participant G3 tried to implement the student-based approach after the curriculum was changed, time
constraints became one of the reasons to leave the implementation of such an approach. Participant G4 also agreed about the same obstacles that her colleagues had stated. She said regarding the assignment of projects:

We do not assign projects to students. But we assign only an annual homework as a project in April. As a matter of fact, students do not have time; they take a lot of courses. So even if we assign projects, we know that they will not be done sufficiently well. They either will download it from the Internet or get someone else to do it. So, I do not believe in the benefit of assigning projects.

Hence, these participants agreed that time and class size are matters against the implementation of student-centered teaching and learning.

All of the participants reported that most of the students in Grade 12 excused themselves from the lessons in order to prepare for the university entrance examinations. They stated that teachers should compress the contents in Grade 12 to cover everything. However, covering all of the contents was not possible in general high schools according to participants from those schools. Participant G5 stated that 15–16 questions came from Grade 12 contents in the university entrance examination. When the students were somehow excused from the lessons, teachers could not cover the latest contents. He stated that the students compensated for their deficiencies by attending the private tutoring institutions or receiving tutoring privately. He claimed that even answering one question in those sections in the exam leaves 15–16,000 students behind; there was a great difference between answering one question and three questions in those sections.
The university entrance examination. All of the participants agreed that the process of preparation toward the university entrance examinations held a significant place within students’ studies during the secondary education period. Because of students’ expectations from their teachers to be left alone to study for the examination, the implementation of the student-centered teaching and learning was interrupted willingly or unwillingly by the teachers. Participants from Anatolian and general high schools emphasized and focused on the types of the university entrance examination questions during their lessons. Participant A1 said that she prepared multiple-choice tests by herself or used the materials that she obtained from some private tutoring institutions and distributed them to her students at the end of the discussion of each topic. Participant A2 reported that students, as well as parents’, interests were how many right answers that the students had. She said,

Understanding the core of the content, interpreting it instead of memorizing it, did not interest students and their parents. They are interested only in the result; how many questions they answer correctly; conflict often occurred on this issue with the expectations due to the curriculum.

Participant A2 also stated that because her students fail to understand some topics and requested her to give them some test practice questions; she prepared some question sheets in an old fashion in order to help them study for the university entrance examinations. Participant A3 reported that she had to give rules directly to the 12th graders although she liked inquiry-based teaching, because the students were attending private tutoring institutions, and they were racing against time. Participants A4 and A6
gave similar information regarding the students’ behavior especially in Grades 11 and 12. They stated that students were impatient and wanted to solve as problems as much as possible instead of focusing to grasp the theory. Participant G4 said,

   We have to work parallel to private tutoring institutions and to the university entrance examinations. If we do not work like this, the students, especially in Grade 11 and 12, blame teachers. They think that their teachers are not teaching well because their one foot is at the private tutoring institutions.

Participants from science high schools agreed with other participants about the behavior of the 12th graders. Although they were able to implement the student-centered approach in their schools, they had to be more flexible for the 12th graders. Participant S3 reported,

   In Grade 12, we move away from the theory a little, and emphasize practice. Students understandably worry about the university entrance examinations….Motivation vanishes if you insist on giving theory in an environment when everybody focuses on the exams.

Participant S6 indicated that he did not teach toward the university entrance examinations, however, he said, “students do not adopt that approach [student-centered] completely when they become a 12th grader. They want the private tutoring institution system….Therefore, unfortunately, students become reluctant if you insist on doing those activities and using that approach.”

   Consequently, the university entrance examinations appeared as an obstacle against the implementation of the student-centered teaching and learning according to all participants.
**Professional Development for inservice teachers.** All of the participants agreed about the lack of workshops or seminars for inservice teachers. Some of the participants attended to professional development programs and found them inadequate while others had not even heard of such programs. Participant A1 stated that she had taught in several schools in different provinces since 2005 but she had not heard any program for inservice teachers. Participants A3, A5, A6, G2, and G4 had not received any training regarding the curriculum reform. Participant A5 gave following information:

> The program is changed from the top but I think teachers should have been trained before the changes, because they are very big. They are not simple changes that teachers can adapt immediately….Teachers neither have any knowledge of this approach nor know how to do it. They end up trying to find the right way by trial and error.

Participant A2 reported that teachers should have been convinced about the benefits of the curriculum reform in advance of their adaption. She said that she had not been trained to implement the student-centered approach when she was a student at the university, or as a practitioner. She stated that if the seminars or workshops had been offered for the teachers, it could be different today. Participant A4 indicated that there was no inservice support. He said that teachers learn it first and then try to teach it. He attended a seminar in 2010, which, he thought, was a total waste of time, because he indicated that there was lack of sincerity and competence. Participants G1 and G3 attended a seminar at their own schools because one of their colleagues was in a group that led the student-centered approach. Participant G3 stated that she tried but she could not do it. She said,
I think workshops or seminars do not work. A teacher who has succeeded in implementing it should prepare a lesson and train us. We need to see a live or recorded lesson. After 20 years, it is difficult to learn from the beginning and do this. Without such help and training, I do not think I will understand how to give homework to students, get them do it in groups, and have them lead the lesson. Because I did not see it from my teachers; [and] I did not see it when I was a student at the university, I did not do it myself.

Participant G5 stated that he attended many workshops and seminars as a practitioner and as an administrator. However, he did not find them useful. He thought there should be more beneficial programs instead. All of the participants from science high schools reported that they attended to the seminars related to the 2005 curriculum reform. However, all of them agreed that those seminars were not beneficial, and they were presented by people who were not experts in the area. Participant S1 said, “offering such a program can be beneficial, but it needs to be taken seriously while it is done.”

Participant S6 gave similar information regarding workshops and seminars. He reported that he also attended to several programs but regretted the waste of time at the end. He said he did not find them beneficial because the presenters were not experts in their areas, and they mostly came unprepared. Participant S5 claimed that such programs would not be useful for the teachers who were older than 25 years old. He said that, although he was one of the first participants who attended the seminars related the 2005 curriculum reform, he struggled for a long time, in their implementation. He stated that the teachers should have been trained before they graduated from the universities.
Perceptions of teachers regarding the computer-aided teaching and learning.

The 2005 curriculum reform emphasizes the use of computer to support teaching and learning. Participants A3, A5, A6, S5, S6, and all the participants from general high schools reported that they did not use computer in their teaching. The rest of the participants reported that they used it more or less.

Participants A3 and A5 stated that they did not support their teaching by using computer because of lack of technological tools in their schools. Both of them agreed that the use of computer in geometry would be beneficial for students in order to understand 3-dimensional objects better. Participant S5 also agreed that there were benefits of the use of computer, and he said that he was planning to use it soon. He said, “especially smart boards, computers, and projectors would be wonderful.” However, Participants A6, S6, and G1–G6 reported that they did not use computer in their teaching because they found the blackboard and chalk more effective. Participant G1 explained it as follows:

I love to use chalk. I think that chalk draws students’ attention better....If I can use technology all the time, I can produce different solutions, I certainly found some points that can draw students’ attention. There is one smart board in our school. And I do not use it actually. If I do not use it each lesson, I do not think that it will be effective. Besides, students do not use paper and pencil, so I think that if a student does not put an effort to understand, he cannot feel happiness comes from that effort.

On the other hand, Participants A1, A2, A4, S1, S2, S3, and S4 reported that they use computer for instruction. Participants A1, A2, and A4 stated that they use the computer
and projector to show the questions and some geometric figures to the students in order to save time. Participant A2 said,

I use technology mostly to project geometry questions on the board because drawing takes too much time, and the imagination of 3-dimensional objects is difficult for the students in space-geometry.

Participant S4 stated that he used the projector from time to time. Participants from science high schools use the computer more actively in their teaching. Especially, Participant S2 has been interested in computer-aided teaching since 1985. He said that after he attended a course about the programming language called Basic, he started to teach a Basic course in a science high school in 1985. He stated “the important thing is to solve a question with a tool.” He explained his interest as follows:

I thought about how we could integrate computers in mathematics. I already had some problems in my mind. For instance, the equation $x^3 = 64$. This is not solvable by use of basic mathematical operations, as far as I know….I solved it in five different ways by using five different programs; BASIC (a program underestimated by most people), Excel, a graphic program called Grafeq, Matlab, and Geogebra.

This participant is highly involved in use of computer programs and solving mathematics problems by them; he even attempted unsolved problems such as the famous Goldbach conjecture—every even integer greater than two can be written as the sum of two primes. He said, “not in order to solve it, but in order to examine it, I made a program by using
Basic to find pairs of primes whose sum, let’s say, is 2012.” He indicated that he prepared over 160 problems with both purely theoretical and computer-aided solutions.

Participants S1 and S3 stated that they tried to support their teaching by using the computer as much as possible with help from their colleague (Participant S2). Participant S3 said, “with his support, we have learned how to use the computer to aid our teaching.” Participant S1 also uses Geogebra and Grafeq programs in his classes.

**The perceptions of teachers regarding the textbooks prepared by MEB.**

Because of the central curriculum, MEB distributed the same textbooks to all high schools. All of the participants, except Participants G2, G3 and G4, reported that they found the textbooks extremely easy and insufficient for students. Except those three participants, all of them either used their own notes or various textbooks. They stated that they only used the textbooks provided by the Ministry to check what kind of changes were in the curriculum.

Participant A1 said, “The textbooks are extremely inadequate in terms of content level and question types. So, we are using other sources.” This participant claimed that this curriculum was not appropriate for the students at vocational high schools, even for students of most of the Anatolian high schools to which statement, she made an exception only for a small number of Anatolian high schools: She said that current curriculum was appropriate for the high achieving students, such as those in science high schools, Anatolian teacher high schools, and a couple of Anatolian high schools. Participant A2 also claimed that the student-centered curriculum was appropriate for the high achieving students. She said, “I think such students can grasp the essence of the content in a short
time, and then they can spend time to discover the details of the theory themselves.”

However, Participant A3 reported that the student-centered curriculum should be applied for the low achieving students in mathematics. She agreed that the textbooks were inadequate for secondary education. “They are at a very simple level for students.” She claimed that there should be different curricula for different types of schools, even different departments in the same school:

The curriculum of Anatolian high schools was different before the mandatory education was increased to 8 years….Even the mathematics content showed a difference between social departments and Turkish-mathematics departments. That is, we excluded some of the topics when teaching to social departments, whereas we included those topics in detail when teaching to science departments. And we could add to the curriculum the way we wanted because students’ level was suitable for it. They did not resist to learning. They were open to knowledge….I admit it, I do not use the current curriculum. I am teaching according to my own understanding.

Participant A4 agreed that the textbooks were inadequate for Anatolian high school students. He had published almost 10 textbooks or supporting sources. Some of them had been accepted by MEB, and some were adapted as supporting material for Grades 6 to ÖSS. He said that high achieving students found the activities easy, and they were impatient to go further with high-level questions. Participant A4 said,
Okay, let the curriculum be national, but let the textbooks of science and Anatolian high schools, those of general high schools and let those of vocational high schools be different. It used to be this way.

Participants G5 and G6 reported that the textbooks were insufficient for the students. These participants were teaching toward the university entrance examination, so they were using different sources.

Participants from science high schools agreed that the textbooks and activities in them were insufficient for their students, and all of them agreed that the curriculum should be different for different types of schools. Participant S4 stated that “the system wants different results from schools with the same curriculum. But it is not possible.” He continued as follows:

In a high school in any town, they are teaching the same curriculum as it is taught here today. But our expectations are different. While 90% of the students who graduated from a school in that town stays there, 10% of the students leave for the cities or overseas for further education. When you look at our school, maybe only 1% of the students cannot be placed in the university program that they want. Moreover, those students are candidates for the best majors in schools. However, they want us to teach the same curriculum.

Participant S3 reported that he found the current system for science high schools inappropriate. He said, “I think that mathematics should be learned in an abstract form by this type of students.”
Participants S5 and S6 gave similar information to what other participants from science high schools provided regarding textbooks and activities. They agreed that different types of schools needed different textbooks and activities, and science high school students needed to have more high-level tasks.

On the other hand, some of the participants from general high schools found the textbooks provided by MEB more clear and understandable than the previous ones. Participant G2 stated that she liked the textbooks in terms of qualitative and quantitative aspects. Participant G3 agreed that the student-centered education is appropriate for high achieving students. She stated that she followed the textbook provided by MEB, but she supported it with other sources. Participant G4 agreed that the science high schools needed a different curriculum but Anatolian and general high schools should not be separated from each other:

Science high schools are special schools. Those schools should be kept. However, I am against to separating Anatolian and general high schools from each other. As a matter of fact, because they are separate, the quality of students in general high schools decreased considerable. These students know it. They say ‘what do you expect from us, if we were good enough, we would not be here.’ This situation causes some psychological effects on them.

She also followed the textbooks provided by MEB.

In summary, all of them agreed that implementation of different curricula at different types of schools would be the best for students. Each group of students needs a different approach in their education. The student-centered approach would be more
appropriate for the high achieving students because they do not have a time problem but they need higher level tasks than those in their textbooks provided by MEB.

**Perceptions of Teachers Regarding the Impact of the 2005 Curriculum Reform on Students’ Mathematical Proficiency**

The teachers that were interviewed reported their perceptions about students’ mathematical proficiency. Emergence of “quality of students” is also reported in the following section.

**Quality of students.** The teaching experience of the interview participants varied from 12 to 37 years. Regardless of the school type and teaching experience, all of the participants stressed that the typical student profile had changed dramatically over the years. All of them reported that the quality of students decreased. Each year, they had students with less mathematical and general knowledge than students of previous years.

Participant A1 stated that students in her current school did not have the quality that students of Anatolian high school are supposed to have. Participant A3 reported some effects of the changes on the students in terms of content: “For instance, I cannot teach limits of a sequence. So you cannot teach derivative adequately. Students do not understand because of the missing parts….That is, it ruins the qualified students; when they attend the university, they experience difficulties.” Participant A4 reported that they had students who had answered 96 correct answers or more out of 100 questions on the high school selection and placement examination, and the student-centered education impeded them. He claimed that there were two reasons for the decrease in the students’ quality:
When the primary schools were combined with the middle schools, our schools lost 50% momentum. That is, those students were coming here like a dough, and we were shaping them beginning with the Grade 6; from the rudimentary. Their foreign languages were very good, because they were taking language preparation courses following the primary school. We were teaching basic courses and terminology in those years. We do not any more. Secondly, I think the students come to us knowing nothing because of this constructivist approach, which is basically a system in which you get a single result after you try 2 hr in class.

Participant A6 agreed with Participant A4 regarding the quality of students before the elementary and middle schools were combined. He said,

Former students were different. Especially students who come after graduating from elementary school and to whom we have taught six to seven years were really different in terms of knowledge and capability. However, today, because the students’ profile changed due to the system, we cannot get previous achievement. Current students are too far behind the former students in terms of quality and achievement level.

Participant S5 claimed that the SBS was one of the reasons for the declining student quality. He said,

I can say that I miss our former students. Because as I lecture, I see, to my astonishment, that students lack some required knowledge. When I check the textbooks that are used at the primary schools, I find the missing knowledge was
included there. Because questions were not asked from those parts in the SBS, students did not learn it.

However, he stated that he was very optimistic about their students’ capacity. He said that if teachers provide required materials and knowledge to them, they can be as qualified as the former students. Participant S6 said, “I have been teaching for almost 20 years in science high schools. I think that the quality of students declined especially during the last 4–5 years.”

Participants from general high schools complained about the quality of students more than the participants from Anatolian and science high schools because their students were not selected to be placed in high schools by the national selection and placement examination. Participant G3 reported that the students’ success level in that school was very poor. She said that students who could not qualify for Anatolian, or even vocational, schools attended to general high schools. Therefore the quality of the students was low, and the system that was brought by MEB could not be implemented with such students. Participant G4 gave similar information to what Participant G3 gave. She stated that their former students had had better success level. She said,

Student quality is getting worse each year. Especially, in last 3 years, we are not pleased with our students, although our school is one of the most successful schools in our district. Students even are getting weaker in terms of language. They do not know how to think any more.

Participant G5 agreed with Participants A4 and A6 about the former and current student quality:
Before the mandatory education was increased to 8 years, students came to high schools well-prepared and knowledgeable. I am saying that the quality has decreased dramatically. For example, there were fewer Anatolian high schools but the quality was high. Currently, the number of Anatolian high schools increased but the quality decreased. There is an Anatolian high school next to our school. Our students compete with their students. However, it would be a miracle if one of their students or ours would be placed in METU. But it would also be a miracle if a student would not be placed there from Atatürk Anatolian. That is the degree of difference between these Anatolian high schools in quality.

All of the participants reported that there was something wrong in the primary education; students should not come to the high schools with so little knowledge. Participant G4 thinks that teachers may be taking seriously their teaching in the first part of the primary school, but not so much in the second part. She said this was because all of the students could pass to the higher grade level regardless of their performance. So teachers in the second part of the primary school do not have the power of grade to force students to learn what they teach.

Participant G5 reported the same issue. He said, “ rewarding and passing grade level regulations in primary school should be changed urgently. Especially, failing the grade level should be considered as a grade option when the students are not competent.” He also stated that all of the general high schools will be transformed to Anatolian high schools in the near future; he said, “a person’s clothes will be changed but he will be the

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4 METU is an abbreviation of the Middle East Technical University, which is one of the top ranking universities in Turkey.
same.” He suggested that emphasizing vocational training instead would be more beneficial in the educational system.

**Mathematical proficiency.** The perceptions of many interview participants indicated that the mathematical proficiency of students varied by school type. Some of the Anatolian and general high school teachers reported negative aspects of students’ mathematical proficiency. Science high school teachers reported that there is no effect of the curriculum reform on the students’ mathematical proficiency.

Participant A1 indicated that the students could not make connections between what they learn and other areas. For instance, she claimed that if students cannot use what she taught in physics, or vice versa, then it means that their learning relies on memorization. Participant A2 stated that she could not say anything about the impact of the curriculum reform on the students’ mathematical proficiency because she had not implemented it. However, she observed that students relied on memorization too much.

Participant A3 expressed concern that the new generation is not inquisitive. “I think those students who do not question now, will not question in their future academic studies or in their jobs, either.” Participant A3 also reported that students paid attention to ÖSS, so they wanted to be proficient in practice. She said, however, that in order to be proficient in practice one must necessarily be proficient in theory as well.

Participant A4 reported that their students had high capacity to learn mathematics, although the general student profile was lower than those of former students. Because their school was one of the best Anatolian high schools, students got significantly higher
scores to be admitted to this school. Hence, students’ procedural fluency and conceptual understanding were significantly high.

Participant A6 reported that although they had high achieving students, he was surprised that some of the students with low proficiency were placed in this school. He said, “we all agree that proficiency level of students in Grade 9 is significantly low.” On the contrary, Participant A5 reported that students’ mathematical proficiency was better when they were at lower grades. He said, “I think their proficiency is getting weaker in Grades 11 and 12. Because students focus on the preparation for the university entrance examinations, they mostly study and learn through multiple-choice tests.” Moreover, Participant A5 reported that students had difficulties with the use of mathematical terminology; they were not comfortable expressing their mathematical thinking in writing. He once started a project with his eight students in order to produce a mathematical alphabet in order to create a common resource and reference for mathematical symbols.

Participants G1 spoke more positively on the proficiency of students than her colleagues at general high schools. Participant G1 said,

I believe that a student who enters high school does not have a problem with graduation. A student who can be in a high school has a capacity to get 45 over 100 in mathematics....I mean, I believe that they will realize their capability to do mathematics, but doing this is difficult in our system.

Participant G2 reported that she could not observe the differences of students’ mathematical proficiency before and after the curriculum changes. She said,
Numbers in Grade 9 is an essential topic. Teaching Numbers starts in primary school. If a student cannot add two negative numbers in Grade 11, how can I say that the system is effective on their proficiency. Students are unsuccessful in using their knowledge. For instance, they forget what they learned in Grade 9, or in Grade 10. Then are these changes really meaningful? No. I do not think that it has an effect on students’ proficiency actually.

Participant G2 believed that students’ attitude toward the mathematics held an important place in their success. She stated that students thought that they could not do mathematics or geometry because they were not aware of their capability. They would prefer someone else to solve the problems rather than trying to solve them by themselves. She said, “because they are afraid of trying to solve the problems, they are afraid of being unsuccessful. This is the issue that we need to overcome.” She also observed that students’ skills to make connections among the concepts were weak. She stated that they knew many things but they could not connect them to each other.

Participant G3 reported that because she did not teach based on the student-centered approach, she could not observe the impact of the changes on the students’ mathematical proficiency. However, she stated that if the students understood the concept, then their self-confidence got stronger consequently, they wanted to solve more problems, and they showed some effort to learn the topic.

Participant G4 claimed that they had difficulties teaching the high school curriculum to high school students. She said, “some of them do not even know how to perform the basic operations of arithmetic. We have students who do not know how to
properly reason. Believe me, we are teaching many things relying on memorization.” She stated that the students did not have the ability to think abstractly.

Participant G6 believed that the students became unknowledgeable within this system. She said, “They learn more superficially. This system relies on neither memorization nor deeper understanding. It relies superficial teaching.” She questioned what the students had learned when they were in primary school, as a result of which she found that procedural fluency of the students was too weak.

Participant G5 stated that he received good responses from his students because of his teaching style emphasizing the ÖSS. His students focused on practicing toward the examinations, so their procedural fluency was adequate. However, he stated that the mathematical background of students should have been supported in primary school.

On the other hand, participants from science high schools agreed that their students’ mathematical proficiency was extremely good despite the declining student quality in general. Participant S1 said, “students were successful before the changes, and they still are successful. There are no differences.” He said that when the students were assigned any problem, they came up with the exact solution. “They can even predict the problems, and they can make a new problem. They have strong reasoning ability.”

Participant S3 gave similar information with Participant S1. He said that their students were highly successful in discovery, and they were talented in abstract thinking. He also said, “our students have been always successful; it is not because of the system.”

Additionally, Participant S5 thinks that the system has no effect on their students’ mathematical proficiency. Because they can learn immediately whatever they are taught.
He said that although students came to science high schools with less knowledge than that of the former students, they reach the same achievement level because these students have high enough an ability to do that.

Participant S4 stated that for their students, the problem was with the primary education. Because of insufficient education at the primary school level, even their students in science high schools had difficulties during their first year. He stated that “there is a disconnection between the primary and secondary education….Our students’ abilities and knowledge levels are high; they are smart and intelligent. Even those students are having difficulties making connection between the topics and their knowledge, in their first year.”

**Summary.** In summary, all of the participants agreed that the quality of students declined over the years dramatically. Some participants could not observe the impacts of the changes on students’ mathematical proficiency because they did not implement the student-centered approach. Some participants from Anatolian high schools and all of the participants from science high schools concurred that their students’ mathematical proficiency was good enough, not because of the system, but because of their own abilities and their background knowledge. Those students were selected by the national examination with high scores. On the other hand, some participants from Anatolian high schools that admitted students with lower scores reported that their students’ mathematical proficiency was not very strong. Participants from general high schools agreed that their students’ proficiency was low, and most of them had poor self-confidence.
Perceptions of Teachers Regarding the Impacts of the 2005 Curriculum Reform on Students’ Success on the University Entrance Examinations

All of the interview participants, regardless of their school types and teaching experience, agreed that the education system conflicted with the ÖSYS. All of them agreed that as long as the university entrance examination stays the same, constructivist approach will not work because the expectations of educational and examination systems are different.

Participant G1 explained her thoughts as follows: “This is because the new education program is a program that leads students to think, do research; but the university entrance examination is totally a multiple-choice test application. Naturally, it is a great conflict.” She stated that “the questions in textbooks [provided by MEB] are not appropriately designed in accordance with the questions in exams.” She was trying to accustom students to the test techniques because their target was ÖSYS.

Participant S2 stated that if the examination system is changed in accordance with the educational system, then the educational system will be more meaningful. Participant S3 said,

The logic of examination and expectations from it are different. Students are not expected to understand the questions, to derive some results, and to develop different solutions. Average time for each question is 1.5 min [in LYS], and they have to read, recognize it and start its solution immediately.

He found that the textbooks provided by MEB were not appropriate for the examination system. However, he stated that the knowledge students gained at school will be
permanent, so the student-centered teaching and learning was better than the previous approach.

Participant S4 stated that he liked the current educational system but he thought that the presence of the examination system was an obstacle to secondary education. He stated that high schools transformed into a preparatory centers for university entrance examinations instead of for the university. Their students’ priority was not only to be placed in a university, but also to be in the top 100 students. He continued as follows:

If you do not choose the students for universities based on the results of the student-centered teaching and learning after you adopt this approach, then the students will not care about your system. Because you are saying that mathematics is learned this way, but I will give you a multiple-choice test. This is not an appropriate approach in educational system. Students are studying for the exam which they will take.

He claimed that when this examination system is removed, the students can be properly encouraged to learn the logic of the concepts and to understand the reasoning and the theory.

Participants A2, A4, A5, and G4 agreed that the curriculum reform has a negative effect on students’ success on the ÖSYS. For instance, Participant A2 reported that she believed that if she would continue to implement the student-centered teaching and learning, it would affect students’ success on the exams negatively. Because the activities in the textbooks were insufficient, and students were getting used to relatively easy question types, they would not able to solve the challenging questions in the exams.
Moreover, students would not cover the curriculum in time, and they would fail to answer the questions from uncovered topics.

Participant A4 reported that the constructivist teaching and learning negatively affected students’ speed in problem solving, and caused their self-confidence to decrease. He stressed that “the system wanted the students to derive a result from a task in 2 hr, but the examination system required the students to answer 180 [160] questions in 180 [160] min. Our students lost their speed. It was not like this.”

Participant A5 also stated that the system caused time waste and encouraged the students to seek recourse in private tutoring institutions. Because of the exams, they emphasized multiple-choice testing in Grade 11 and 12. He said that unless the examination system changed, teachers as well as students would remain confused about what should be done.

Participant G4 reported that questions on the test could come from any part of the curriculum, so the students needed more time for digesting what they learn. However, they could not spend more than 2 weeks for the most important topics.

Participants A3, G2, G3, G5, G6, and all of the science high school teachers agreed that the curriculum reform had no effect on students’ success on the ÖSYS. For instance, Participant A3 reported that because the exams were multiple-choice, the students prepared toward that testing style. She said, “if the students recognized the type of question, they could answer it. However, when the question needed theory-based knowledge, then the students confused. But, they try to remedy their shortcomings by
attending to private tutoring centers.” She also claimed that the curriculum was changed toward the exam style, when it should be the opposite.

Participant A6 reported that exam questions needed knowledge, and new contents such as fractals and tessellations were not useful in the exams. He stated that the students needed to solve geometry problems as much as possible in order to solve one problem in the exam. He also stated that the students could be successful again if they were taught within the student-centered approach, however, they attend to the private tutoring institutions to gain practical test-taking skills. He reported that most of their questions were high-level and designed or chosen in accordance with the examinations.

Participant G2 stated that she could not say anything about the impact of the changes on the students’ success on the exams because she did not implement the student-centered approach exactly. However, she said,

The students’ aim is still the university; they are not interested in what they learn or how much they learn. They are interested in how many problems they can solve on the test. As long as they focus on this, I do not think that there will be any differences.

Additionally, she expressed her thoughts regarding the examination as follows:

Today, students can be placed in the universities solving fewer problems and with less proficiency than in the past, because the number of universities increased. So, that the quality of education increased cannot be said, because more students are placed in universities.
Participant G5 also reported that he did not observe any differences the students’ success on the exams before and after the implementation of the student-centered approach, even though he did not adopt such approach in his classes. He stated that being successful in the exams depended on students’ background knowledge, their families, their environments, and their learning skills. He said, “if the student sets a target for the university he wants to attend to, and studies systematically beginning from Grade 9, then it would be abnormal if he could not be placed in a university.” Participant G6 thinks that if there is any impact of the changes on students’ success on the exams, it will be seen in 5–6 years.

All of the participants from science high schools agreed that the changes did not induce any change in their students’ success because their students had always been extremely successful in the exams. Participant S1 reported that the university entrance examinations did not assess knowledge but rather speed. Because students raced against the time in the exams, they needed to practice. He stated that their students learned knowledge in the school and did practice in the private tutoring institutions. Participant S5 claimed that the question types of the university entrance examinations determined the way of education in schools. He also observed that the university entrance examinations contained simpler questions in the recent years. He thought that adding higher level and open-ended questions would be more effective on the educational system. Participant S6 indicated that the questions showed similarities within the last few years, hence students were able to solve them without studying comprehensively.
In summary, most of the participants agree that the changes have not been effective on the students’ success on the exams because the educational system and the examination system conflict with each other. Their students focus on the examinations rather than the education in schools. Although some participants are able to implement the student-centered approach at lower grades, they also emphasize exam preparation in higher grades. The current examination system is the biggest obstacle for implementation of the constructivist approach in the secondary education.
Chapter 6: Discussion and Recommendations

This dissertation explored the perceptions of high school mathematics teachers regarding the 2005 Turkish secondary education mathematics curriculum reform as well as their perceptions regarding the impact of this reform on students’ mathematical proficiency and students’ success on the ÖSYS. Moreover, the researcher investigated possible differences between those perceptions across type of school and years of teaching experience. This mixed-methods study used a survey and a series of interviews to gather data from teachers at three types of secondary schools—Anatolian, general, and science high schools. The survey targeted teachers at these three types of schools in 73% of the Turkish provinces, and the interviews involved 18 teachers, 6 from each type of school, who had at least 10 years of teaching experience. The surveys provided breadth of coverage, and the interviews sought depth of understanding regarding teacher perceptions.

Discussion

Changes in the 2005 secondary education mathematics curriculum occurred in two areas: content and pedagogy. The most significant content changes were made in geometry. Geometry was added to the Grade 9 curriculum. Additionally, use of vectors was emphasized, and some new topics such as fractals and tessellations were added to geometry. Other changes included moving some topics from one grade level to another and simplifying some of the topics in Grade 12. Changes in pedagogical areas were also significant. The Turkish educational system, as well as the university entrance examination system, was based on the behaviorist approach for years (Berberoğlu, 1996;
MEB, 2009b). After Turkish students got low scores on TIMSS in 1999 and PISA in 2003, politicians and educators began to investigate new educational approaches. With an agreement between the European Commission and the Republic of Turkey in 2000 (Bikmaz, 2006), a constructivist approach was adopted in order to regulate the Turkish educational system. The changes were implemented in three phases, and the implementation for secondary education was the last phase. One of the aims of the secondary education was to prepare students for higher education. Because higher education institutes admit their students based on the nationwide university entrance examinations, these exams hold a significant place for students and parents and for teachers. Because the exam items are prepared based on the curriculum, making any changes in curriculum affects the university entrance examinations. The priorities in teaching and learning change accordingly. There had been lack of research about the perceptions of high school mathematics teachers regarding those changes. This situation is the main motivation for this study.

**Content.** Analysis of the data from both the survey and the interviews revealed that all of the participants favored the addition of geometry in Grade 9. However, most of the Anatolian and general high school teachers found the emphasis of vectors and new topics, fractals and tessellations, unbeneifical and unnecessary, whereas most of the science high school teachers found those topics beneficial. There were three main reasons for the negative attitude among teachers. First, teachers were not ready and not knowledgeable enough to teach these topics. Most of the participants stated that they had difficulties teaching geometry using vectors, and students had difficulties understanding
geometry in this way. They also stated that they were not knowledgeable about the new topics. A majority of teachers had not received any training on the topic they would teach. Teachers had to learn the new topics by individual effort. Second, the new topics needed time, and teachers want to address the whole curriculum in time. Third, there was no question related with those new topics on the ÖSYS, so students were not interested in learning those topics. Therefore, most of the teachers thought that such topics were unnecessary. However, there were two questions related to new topics on the 2012 YGS, which was administered after the data collection for this study was completed. Therefore, teachers’ perceptions may change on such issues as the university entrance examinations evolve over time.

Another concern about the content changes was the intensity of the mathematics curriculum. The majority of teachers from Anatolian and general high schools and some of the science high school teachers had difficulty addressing all of the mathematics topics of Grade 9 in time. All of the participants, except the science high school teachers interviewed, found that the mathematics curriculum of Grade 9 was too intense. In the Turkish secondary education, there is a common curriculum for all 9th graders. Beginning in Grade 10, students choose divisions in accordance with their interest. Such divisions include Turkish language and art-mathematics; social sciences; or natural sciences. Their choices on the ÖSYS show differences based on their divisions. However, all students have to take the first stage of the examination, which consists of Grade 9 content. For the schools that have low achieving students, addressing all of the topics in
the curriculum is a problem. For a majority of the science high schools, time is not an issue of concern because students already have basic knowledge of the Grade 9 content.

There were two additional concerns of teachers about the changes in content. Some of the Anatolian and general high school teachers indicated that topics in Grade 12 should be simplified and should be taught at the university instead of the high school. In their view, if this were done, there would be ample time to teach the rest of the topics in 4 years. On the other hand, some of the Anatolian and science high school teachers stated that the topics in Grade 12 should not be simplified. They claimed that understanding of some topics would be impossible within a simplified curriculum, and it would cause students to memorize such topics without making connections and reasoning. It is important to emphasize that the teachers who suggested simplifying the topics in Grade 12 taught students who they perceived to low achieving students. On the other hand, teachers who favored teaching in detail in Grade 12 taught students who they perceived to high achieving students. These teachers stated that the unity of content was interrupted in some parts of the curriculum dividing the fluency of topic by the introduction of another one.

**Pedagogy.** Changes in pedagogy in the 2005 reform were significant. As is stated above, constructivist approach was adopted for the Turkish educational system. So, instruction was expected to become student centered. This approach emphasizes learning by activities and building new knowledge based on prior knowledge (Fowler & Poetter, 2004). All of the participants favor the idea of such an approach. Based on the survey results, the attitude of the teachers, regardless of their teaching experience and types of
schools, toward the curriculum reform was almost neutral. Gömlekşiz and Bulut’s (2007) study supports this result. However, in the literature, some studies found that the attitudes of the less experienced teachers toward the primary education mathematics curriculum reform more positive than the experienced teachers. Erbaş and Ulubay (2008) reported that the attitudes toward the new curriculum of teachers with less experience were more positive than those of teachers with greater experience. Yapıç and Leblebicier (2007) found the similar result with Erbaş and Ulubay for teachers with 1–10 years of teaching experience and teachers with 11 or more years of teaching experience regarding the same issue.

The majority of the science high school teachers already were implementing student-centered teaching. According to them, because they have high achieving students, implementation of constructivist teaching and learning is suitable. On the other hand, a majority of the teachers at Anatolian and general high schools have some difficulties with its implementation. Although some of them tried to adopt it, they had to leave it when they faced some obstacles.

There are three major obstacles against the implementation of the student-centered teaching and learning by most of the teachers at Anatolian and general high schools. The first one is time and class size, the second one is the university entrance examination, and the third one is the lack of training for inservice teachers.

**Time and class size.** Student-centered teaching and learning is time consuming approach. Teachers agree that such a program cannot be applied in crowded classes within an intense curriculum. This result is supported by the literature (Bikmaz, 2006;
These studies indicated that class size was an important issue for implementation of the student-centered approach.

**The university entrance examination.** All of the participants agreed that students, in Grade 11 and 12, resist learning mathematics in a student-centered environment because they will take ÖSYS in order to be admitted to higher education programs. Teachers, too, prefer to teach heavily relying on the teacher-centered teaching and learning although they favor the idea of the student-centered teaching and learning. This is consistent with the result of Haser and Star’s (2009) study. According to their study, the teachers were under pressure to address all of the topics in the curriculum and prepare students for the ÖSYS in a limited time. Therefore, teachers taught based on a more teacher-centered approach. In addition, teachers claimed that students would blame them if they did not teach mathematics toward the exam.

**Professional development.** Participants agreed that workshops or seminars were not offered to present to them the new educational approach. Although some of the participants had had the opportunity to attend some programs, all of them found those programs as insufficient and unbeneﬁcial. They thought that there was lack of sincerity and competence. These findings are supported by the literature; Bıkmaz (2006) indicated that teacher education and training were two of the neglected issues during the curriculum implementation; Aksit (2007) stated that because of the lack of information regarding the curriculum changes, university faculties could not make sufﬁcient preparation programs for inservice and preservice teachers; Birgin, Tutak, and Türkdoğan (2009) indicated that although the teachers were knowledgeable about the changes, they
could not implement those changes because of the insufficient inservice training. Boston and Smith’s (2009) study from the U.S. also supports this result. They found that teachers who participated in the inservice training programs selected and implemented high-level tasks frequently.

**Computer-aided teaching and learning.** In the Turkish secondary school mathematics curriculum, it is emphasized that computer use should be integrated with student-centered teaching and learning. Some participants could not support their teaching using a computer because of the lack of those tools in their schools. This result is supported by the studies of Bıkmaç (2006) and Birgin, Tutak, and Türkdoğan (2009). Some of the participants use computers to project both static and dynamic images of geometric figures in order to gain some time and to solve more problems. Some of the participants resist computer-aided teaching and learning because they believe that blackboard and chalk are more effective for learning than technological tools. However, analysis of the data revealed that the science high school teachers integrate technology use with their teaching. Among the interview participants, one of the science high school teachers with 37 years of teaching experience was especially devoted to computer-aided mathematics teaching and learning. He has used computer not only for projecting the figures and problems on the board, but also for writing various computer programs to solve or aid the solution of problems. He also has encouraged his colleagues to integrate the computer in their teaching. Therefore, even one teacher can change his colleagues’ attitudes toward the use of computer if he or she is willing to do so without getting any support from government. Erbaş and Ulubay (2008) found that teachers with 21 or more
years of teaching experience used tools in mathematics more efficiently than teachers with fewer years of teaching experience.

**The textbooks and activities provided by MEB.** Another significant aspect of the curriculum changes is the activities and textbooks, provided by MEB. Majority of the teachers found the activities and textbooks insufficient and extremely easy. All of the interviewed teachers and some of those surveyed agreed that the activities and textbooks should be prepared based on the students achievement levels in each type of school. This is because, activities and textbooks are just right or difficult for some students at general high schools, whereas they are extremely easy and insufficient for students in most of the Anatolian and science high schools. Therefore, all of the participants supported the idea of different curricula to different types of schools. This is supported by the study of Henningsen and Stein (1997). They indicated that mathematical tasks are the key tools for a students’ learning, and they should be selected and implemented wisely. Moreover, the activities and textbooks do not meet the demands of preparation for the ÖSYS. For preparation to the ÖSYS, students attend to private tutoring institutions.

**Impact on the proficiency.** Based on the survey result, teachers’ attitudes regardless their type of school and years of teaching experience toward the impact of the curriculum reform on students’ mathematical proficiency are negatively close to neutral. Interview results support this finding. Some of the participants indicate that students prefer to memorize types of questions and procedures in order to be more practical in solving problems on the exams. This affects students’ mathematical thinking negatively. Some participants claim that students do not want to think; that they do not even know
how to think because the system encourages memorization to attain success on the multiple-choice exams. Despite the benefits of the student-centered teaching and learning, students focus on the demands of the current examination system. Some participants claim that students do not question anymore, and they will likely not question anything in their future academic lives or jobs. Some participants at Anatolian and general high schools indicate that students’ ability to make connections between the topics is weak. Their conceptual understanding, reasoning, and strategic competence are not strong. Because they do not know how to use their knowledge, their attitude toward mathematics is negative. Some participants encourage such students to be involved in the lessons in order to improve their self-confidence and change their negative attitudes toward mathematics in their own way. A majority of the science high school teachers agree that mathematical proficiency of their students is strong. They have mathematical thinking skills in reasoning, abstract thinking, and connection ability, as well as the discovery ability. Therefore, science high school students are highly successful on the ÖSYS.

However, all of the participants, regardless type of school and years of teaching experience, observe that general student quality has decreased over years. Some participants stated that student quality has been too low especially in the last 4–5 years. Some participants indicate that the new system has not affected positively the students’ mathematical proficiency because students’ quality is too low. Some others blame the system that is currently implemented at the primary school level because students come to high schools without knowing basic mathematical knowledge. According to some of
the Anatolian high school teachers, one of the reasons of low quality of students in Anatolian high schools is that the mandatory education increased to 8 years. When the elementary and middle schools were combined, Anatolia high schools began to admit students after the middle school. Previously, they had admitted students when students became 6th graders. It had allowed them to educate students from an earlier age.

According to some of the Anatolian and science high school teachers, another reason is the SBS. This relatively new examination causes students to prepare for this exam at the primary school level and to neglect the topics which are not asked on the SBS.

An additional result of this study was that the attitudes of the male teachers were more positive toward the effects of the curriculum reform on students’ mathematical proficiency than those of the female teachers. Gömleksiz and Bulut (2007) found a similar result about the gender attitudes toward the effectiveness of the primary education curriculum, whereas Türkyılmaz and Kuş (2010) found attitudes of female teachers to be more positive than male teachers.

**Impact of curriculum reform on students’ success on the ÖSYS.** The inclusion of the survey analysis addressing the third research question is that teachers perceive the impact of the curriculum reform on students’ success on the ÖSYS negatively, and the perceptions of some of the interviewed participants support it; the interviewed teachers at science high schools perceived no effect because of their high quality of students. Additionally, the 2012 YGS results support this finding. In particular, the results of the 2012 YGS show that the number of students who received a score of zero has doubled since 2011, and students’ average mathematics score in general declined; it was 6.92 in
2012, whereas it was 11.4 in 2010 and 7.5 in 2011 (ÖSYM, 2012). These results indicate a cause for concern regarding the curriculum and instruction.

All of the teachers, regardless of type of school and years of teaching experience, agree that the educational system and the examination system are in conflict with each other. Education system was changed toward the constructivist approach, whereas the examination system is still based on the behaviorist approach. Discovering, analyzing, and reasoning are emphasized in the student-centered teaching and learning (Argün et al., 2010), whereas practical solutions, memorization, and procedures without connections are expected to be able to answer a question in a minute in the exams.

Most of the participants observed that attendance in private tutoring institutes had increased in recent years. Because, students begin to think schools as a place that gives grades for their graduation, and private tutoring institutions are the place that they learn. Hence most of the participants complain about the 12th graders presenting excuses for not attending the schools in the middle of the academic year and attending the private tutoring institutions to prepare for the exams instead. So, most of the Anatolian and general high school teachers cannot address all of the topics at Grade 12 in time. Some of the participants claim that the student-centered teaching and learning causes the problem solving skills of students to slow down, so they attend to private tutoring institutions in order to improve their problem solving skills and to gain more experience in practice.

Additionally, teachers from science high schools with less than 16 years of teaching experience perceive this impact more negatively than teachers from Anatolian and general high schools with less than 16 years of experience. The reason for this result
could be related with the sample size of the science high school teachers with less than 16 years of teaching experience; it was less than those of the other groups (Table 4.1, p. 96).

**Recommendations**

This study explored the perceptions of high school mathematics teachers regarding the 2005 Turkish secondary education mathematics curriculum reform, and its impact on the students’ mathematical proficiency and success on the ÖSYS. The results of the study and following recommendations should be considered by MEB and researchers in Turkey in order to improve the Turkish secondary education mathematics program.

The ÖSYS, which require rapid responses to numerous items, and the secondary education system, which is based on the constructivist theory, are in conflict. Because of its high-stakes nature, students focus on the examination more than the education they receive in schools. The constructivist teaching and learning is a promising system that aims to strengthen understanding and thinking of students. The examination system should either be removed or be modified in accordance with the constructivist teaching and learning. Even adding a few open-ended questions to the exams would make a significant change in the attitudes of students, teachers, and parents toward the examinations. Private tutoring institutions also would modify their instructional system.

Different curricula should be implemented in different types of schools. In order to maintain their interest and involvement, high achieving students need an especially challenging curriculum. Textbooks also should be prepared based on the curricula for the
variety types of schools. Mathematics and geometry lesson hours should be increased, and the course load of the students should be reduced.

Teacher preparation and ongoing profession development should be considered seriously. Without convincing the teachers of the new system’s potential merits and training them to implement it, the system cannot be successful. Professional development programs should provide consultation, coaching, or mentoring for teachers who need to enhance their ability and knowledge to implement the new curriculum. Such programs should be designed and implemented throughout the country by well-prepared experts.

In order to increase mathematical proficiency of students in secondary schools, primary education, especially the upper grades, has a crucial role. Mandatory education should not allow students make progress in grade levels when they have not gained required knowledge. Students should have gained basic mathematical knowledge by the time they begin their secondary education because secondary education’s aim is to prepare the student for higher education rather than to teach basic knowledge.

One of the results in this study was that the science high school teachers with less than 16 years of teaching experience perceive the impact of the curriculum reform on students’ success on the ÖSYS more negatively than other teachers with less than 16 years of teaching experience at Anatolian and general high schools. Because the number of the science high school teachers with less than 16 years of teaching experience is relatively lower than the other groups in the present study, there is need for further investigation involving larger sample sizes from science high schools. Also, this study found that teacher’s gender is a factor in predicting the effects of curriculum reform on
students’ mathematical proficiency. Because literature provides some different results based on gender, there is a need to do more research concerning it.

Finally, the researcher would like to recall the question mentioned in Chapter 3, which she considers as a significant follow-up research question to the one investigated here: There were two categories of levels of teaching experience investigated in this study; namely teachers with 16 or more years of experience and those with less experience. Teachers in the former category normally received their university degrees before the 1991–1992 academic year and experienced the system that had been implemented before that academic year. This study does not include any information regarding the extent to which such experience affected their opinions on and perceptions of the 2005 curriculum reform. In summary, the researcher proposes the following question for future consideration: How do teachers who taught before the credit system was implemented view the current system, and does having experienced the credit system make teachers more or less prone to viewing the 2005 changes positively?

This dissertation has revealed some significant perceptions of teachers related to the secondary education mathematics curriculum and its effects on students’ mathematical proficiency and their success on the ÖSYS. Because the system is relatively new and changes are still ongoing, and because there are numerous obstacles in its implementation, there should be more research studies concerning secondary education. MEB and researchers may benefit from such studies for their ongoing studies to improve the Turkish secondary education.
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Appendix A: Permission From MEB

T.C.
MİLLİ EĞİTİM BAKANLIĞI
Yenilik ve Eğitim Teknolojileri Genel Müdürlüğü

Sayı : B.08.0.YET.00.00.00.00 70013633
Konu : Araştırma İzin

AVRUPA BİRLİĞİ VE DIŞ İLİŞKİLER GENEL MÜDÜRLÜĞÜNE

İlgi : a) 17.08.2011 tarih ve 3436 sayılı dilekçe
b) 28.02.2007 tarih ve B.08.0.EGD.D.03.33.05.311-311/1084 sayılı Makam Onayı ile
Uygulamaya Konulan "Milli Eğitim Bakanlığına Bağlı Okul ve Kurumlarda
Yapılacak Araştırma ve Araştırma Destekine Yönelik İzin ve Uygulama
Yönergesi".

Ohio Üniversitesi, Athens, Ohio ABD’de Matematik Eğitimi Bölümü Doktora
ögrencisi Sıdika Nihan ER’in “Türk Lise Öğrencilerinin Matematiksel Yeterlilikleri ve
Üniversite Sınavlarına Hazırlık Etkileri ile İlgi Alanları” konulu araştırmasında
kullandıracak veri toplama araçlarını ek listede belirtilen ilerideki ortaöğretim okullarında
görev yapmakta olan öğretmenlere uygulama izni talebi incelemiştir.

Onaylı bir örneği Bakanlığımızda muhafaza edilen 13 sayfa 64 sorudan oluşan veri
toplama araçlarının belirtilen ilerideki ek listede belirtilen ilerideki ortaöğretim okullarında
görev yapmakta olan öğretmenlere gönül altı esas olmak kaydıyla uygulanmasında bir
sakınca görülmemektedir.

İlgi (b) Yönergenin 5. Maddesinin (o) bendinde uyurınca teslim tutanağını imzalanan
arastırmının bitiminde sonuç raporunun iki örneğini Genel Müdürlüğümüzde gönderilmesi
gerekmektedir.

Bilgilerinizi ve gereğini arz ederim.

Mahmut TÜNCEL
Genel Müdürü

EK :
1- Veri Toplama Araç (1 Adet-13 Sayfa)
2- Okul Listesi (1 Adet-6 Sayfa)
Appendix B: Translation of the Permission Document From MEB

REPUBLIC OF TURKEY

MINISTRY OF NATIONAL EDUCATION

Directorate of the Innovation and Educational Technologies

No : B.08.0.YET.0.00.00.00700/3633 10/10/2011

Subject: Research Permission

TO DIRECTORATE OF EUROPEAN UNION AND FOREIGN AFFAIRS

The application of Südia Nihan Er, who is a doctoral student in Mathematics Education at Ohio University, Athens, Ohio, the U.S., to conduct her research on “Turkish secondary education curriculum reform, its effects on students’ mathematical proficiency, and their effects on their success on the university entrance examinations” by disseminating a survey tool to teachers who teach at secondary schools in provinces listed in the appendix has been examined.

The data collection tool, an approved copy is kept by our Ministry, that includes 13 pages and 64 items can be disseminated to volunteering teachers who teach at secondary schools in the provinces listed in the appendix.

Two copies of the report on your results should be sent to our Directorate along with other required documents signed.

Mahmut TÜNCEL

Director
Appendix C: Pilot Çalışma İçin Katılmcılara Elektronik Posta Daveti (Turkish Version of the Appendix D)

Değerli Öğretmenim:


Bu pilot çalışmanın amacı, katılımcıların, bu çalışma için hazırlanan anket aracının kullanışlılığı hakkındaki görüşlerini almaktır. Eğer bu çalışmaya katılmayı kabul ederseniz, her madde hakkındaki yorum ve önerilerinizi, yanındaki/altındaki kutuya yazmanızı rica ederim.


Eğer herhangi bir endişeniz varsa ya da açığlazy kavuşturmak istediğiniz bir konu, lütfen tereddüt etmeden bana se102305@ohio.edu elektronik posta adresinden ya da 001-740-591-9774 telefon numarasından ulaşabilirsiniz. Eğer isterseniz, danışmanızım Dr. Gregory D. Foley’e foleyg@ohio.edu elektronik posta adresinden ya da 001-740-593-4430 telefon numarasından ulaşabilirsiniz. Değerli yardımı ve işbirliğiniz için teşekkür ederim.
Appendix D: E-Mail Invitation to Participants in the Pilot Study

Dear Professor:

My name is S. Nihan Er. I am a doctoral student at Ohio University in Athens, Ohio, the United States of America. This e-mail is an invitation to participate in a pilot study of a research for doctoral dissertation. The aim of the study is to investigate the perceptions of Turkish high school mathematics teachers regarding Turkish high school mathematics curricular changes that made in 2005, their effects on students’ mathematical proficiency and success on the university entrance examinations. Moreover, the differences among these perceptions will be investigated across the types of schools and years of teaching experiences.

The goal of the pilot study is to receive participants’ feedback concerning the usefulness of the survey instrument which has been developed for this study. If you choose to participate, then I kindly request you to write your comments or suggestions about each item in a box that is next to/below them.

I appreciate your participation in advance. The survey will not take more than 15 minutes of your time. If you change your mind while you are answering the survey questions, you may quit or you may stop and return to complete it at a later time. I assure you that your personal information will be kept completely confidential.

If you have any concerns or need any further clarifications, please do not hesitate to contact me by mail at se102305@ohio.edu or by phone at 001-740-591-9774, or contact my adviser Dr. Gregory D. Foley by e-mail at foleyg@ohio.edu or by phone at 001-740-593-4430. Thank you for your valued assistance and cooperation.
Appendix E: Anket İçin Katılmılara Elektronik Posta Daveti (Turkish Version of Appendix F)

Değerli Öğretmenim:


Eğer herhangi bir endişeniz varsa ya da açıklığa kavuşturmak istediğiniz bir konu, lütfen tereddüt etmeden bana se102305@ohio.edu elektronik posta adresinden ya da 001-740-591-9774 telefon numarasından ulaşabilirsiniz. Eğer isterseniz, danışmanızım Dr. Gregory D. Foley’e foleyg@ohio.edu elektronik posta adresinden ya da 001-740-593-4430 telefon numarasından ulaşabilirsiniz. Değerli yardım ve işbirliğiniz için teşekkür ederim.
Appendix F: E-Mail Invitation for Participants in Survey

Dear Professor:

My name is S. Nihan Er. I am a doctoral student at Ohio University in Athens, Ohio, the United States of America. This e-mail is an invitation to participate in a research study for doctoral dissertation. The aim of the study is to investigate the perceptions of Turkish high school mathematics teachers regarding Turkish high school mathematics curricular changes that made in 2005, their effects on students’ mathematical proficiency and success on the university entrance examinations. Moreover, the differences among these perceptions will be investigated across the types of schools and years of teaching experiences.

I highly appreciate your participation in advance. The survey will not take more than 15 minutes of your time. If you change your mind while you are answering the survey questions, you may quit or you may stop and return to complete it at a later time. I assure you that your personal information will be kept completely confidential. If you have any concerns or need any further clarifications, please do not hesitate to contact me by mail at se102305@ohio.edu or by phone at 001-740-591-9774, or contact my adviser Dr. Gregory D. Foley by e-mail at foleyg@ohio.edu or by phone at 001-740-593-4430. Thank you for your valued assistance and cooperation.
Appendix G: Mülakat Soruları (Turkish version of Appendix H)

Gerektiği zaman tamamlayıcı sorular sorulacaktır.

1. Kaç yıllık öğretmensiniz?
2. Hangi okullardan mezun oldunuz?
3. Hangi okullarda çalıştımınız?
4. Kaçüncü sınıfları okutuyorsunuz?
5. Sınıflarınızda hangi öğretim tekniğini uyguluyorsunuz?
6. Üniversitede okurken yapılandırıcı yaklaşımla eğitim ile ilgili ders aldınız mı?
7. Eğer almadıysanız, onunla ilgili seminer veya workshoplara katıldınız mı? Eğer katıldıysanız ne kadar sürdü? Faydaları oldu mu?
9. Siz sınıflarınızda yapılandırıcı eğitim sistemini uyguluyor musunuz? Ne derece uyguluyorsunuz?
10. Eğer uygulamıyorsanız nedenleri neler?
11. Size göre yapılandırıcı eğitim sistemine geçiş iyi oldu mu? Neden?
12. Millî Eğitim Bakanlığı’nın, ortaöğretim matematik dersi programında belirttiği öğrencilerin kazanımları konusunda neler diyebilirsiniz? Yeni programın matematiksel yeterliliğe nasıl etkisi oluyor?
13. Sizce yeni eğitim programlarının üniversite sınavlarına etkileri nelerdir?
14. Siz derslerinizde üniversite sınavları doğrultusunda özel bir çalışma yapıyor musunuz? (Test çözme teknikleri veya problemleri kısa yoldan çözme teknikleri vs.)

15. Ders müfredatları ile üniversite sınav soruları arasında nasıl bir ilişki var?

16. Sizce yapılandırıcı yaklaşım öğrencilerinizin sınavdaki başarısını etkiledi mi? Nasıl?

17. Yeni müfredat uygulamaya başladığınız zamandan öncesi ve sonrasında, üniversite sınavları açısdan karşılaştırabilir misiniz? Hangi tip eğitimde başarı nasıl?
Appendix H: Interview Questions

Follow-up questions will be asked when it is needed.

1. How long have you been a teacher?
2. From which schools did you graduated?
3. In which schools have you worked so far?
4. What grades are you currently teaching?
5. What pedagogical approach do you use in your teaching, and why?
6. Did you take classes about the constructivist theory when you were in college?
7. If you did not, did you attend to seminars or workshops about the constructivist approach? If you attended, how long was the seminar or workshop? And was it beneficial?
8. In 2005, the Ministry of National Education made major changes in the curriculum. Please tell us about your knowledge of these changes? What has changed?
9. Are you implementing constructivist approach in your classrooms? To what degree have you implemented this approach?
10. If you are not, why?
11. In your opinion, was the shift to the constructivist approach a good move? Why?
12. What can you say about the students’ mathematical proficiency that is stated in the secondary school mathematics curricula by the Ministry of National Education? How does the new curricula affect on students’ mathematical proficiency?
13. What do you think about the effects of the curricular changes on students’ success on the university entrance examinations?

14. Do you do any special study for preparation to the university entrance examinations in your classes? (e.g., techniques for solving multiple choices questions or shortcut of the solutions.)

15. How are the curriculum and university entrance exam questions related?

16. In your opinion, did the constructivist approach for teaching and learning affect the success of your students on the university entrance examinations? How?

17. Could you please compare to time periods before and after your implementation of the new approach? How was student success in which approach?
Appendix I: Ön Anket Soruları (Turkish Version of Appendix J)

Kısım I


Demografik Sorular

1. Cinsiyet
   (A) Erkek   (B) Kadın
2. Yaşınız: __________________
3. Öğretmenlik tecrübeniz:___________ yıl. (Lütfen en yakın tamsayıya tamамlayın)
4. Liseden mezun olduğunuz okul türü: ______________________________________
5. Mezun olduğunuz fakülte veya yüksek okul:________________________________
6. Mezun olduğunuz bölüm:__________________________________________________
7. Fakülte veya yüksek okulundan mezun olduğunuz yıl:________________________
8. Öğrenim dereceniz
   (A)Ön lisans   (B) Lisans   (C) Mastır   (D) Doktora   (E) Diğer
9. Daha önce öğretmenlik yaptığınız okul türleri
   (A)Anadolu Lisesi   (B) Fen Lisesi   (C) Genel Lise   (D) Diğer:___________
10. Şu anda öğretmenlik yaptığınız okul türü
    (A)Anadolu Lisesi   (B) Fen Lisesi   (C) Genel Lise   (D) Diğer:___________
11. Şu anda okuttuğunuz sınıflar
    (A)9. Sınıf    (B) 10. Sınıf     (C) 11. Sınıf    (D) 12. Sınıf
12. Üniversitede okurken, eğitim ve öğretimde yapılandırıcı yaklaşımla ilgili hiç ders aldınız mı?
   (A) Evet   (B) Hayır   (C) Emin değilim

13. Eğitim ve öğretimde yapılandırıcı yaklaşımla ilgili seminer veya çalışmalara hiç katıldınız mı?
   (A) Evet (Eğer evet ise, __________ kere katıldım ve __________ gün/hafta sürdü)
   (B) Hayır

14. Hangi ifade matematik derslerindeki pedagojik yaklaşımınızı en iyi şekilde tanımlıyor?
   (A) Öğrenci merkezli   (B) Öğretmen merkezli

Kısım II


Lise Matematik Öğretmenlerinin, ‘2005 Yılında Yapılan Eğitim Programındaki Değişiklikler’ Hakkındaki Görüșleri

1. Öğretim programındaki değişiklikler, öğrencilerin matematiksel kavram ve sistemleri anlayabilmelerini sağlamaktadır.
   (A) KESİNLİKLE KATILIYORUM   (B) KATILIYORUM   (C) KARARSIZIM
   (D) KATILMIYORUM   (E) KESİNLİKLE KATILMIYORUM

2. Öğretim programındaki değişiklikler, öğrencileri ezbercilikten uzaklaştırırmaktadır.
3. Öğretim programındaki değişiklikler, öğrencilerin sistemli, dikkatli ve sabırlı olma özelliklerini geliştirmektedir.

4. Öğretim programındaki değişiklikler, öğrencilerin keşfederek öğrenmelerini sağlamaktadır.

5. Öğretim programındaki değişiklikler, öğrencilerin daha az konu öğrenmelerine sebep olmaktadır.

6. Öğretim programlarında önerilen yüksek seviyeli aktivite ve projeler vakit kaybettirmektedir.

7. Öğretim programlarında önerilen yüksek seviyeli aktivite ve projeler, öğrencilerin konuları daha iyi anlayıp kavrayabilmelerine yardımcı olmaktadır.

8. Öğretim programındaki değişiklikleri uygulamada sorun yaşamıyorum.
9. Öğretim programlarında sadece müfredat değişmeliydi, yapılandırıcı yaklaşımla eğitime geçilmemeliydi.

(A) KESİNLIKLE KATILMIYORUM (B) KATILMIYORUM (C) KARARSIZIM
(D) KATILIYORUM (E) KESİNLIKLE KATILIYORUM

10. Öğretim programındaki değişiklikler, genel olarak olumludur.

(A) KESİNLIKLE KATILMIYORUM (B) KATILMIYORUM (C) KARARSIZIM
(D) KATILMIYORUM (E) KESİNLIKLE KATILMIYORUM

Lise Matematik Öğretmenlerinin, ‘2005 Yılında Yapılan Eğitim Programındaki Değişikliklerin Öğrencilerin Matematik Öğrenimi Üzerindeki Etkileri’ Hakkındaki Görüşleri

11. Öğretim programındaki değişiklikler, öğrencilerin daha bağımsız olarak öğrenmelerini sağlamaktadır.

(A) KESİNLIKLE KATILMIYORUM (B) KATILMIYORUM (C) KARARSIZIM
(D) KATILMIYORUM (E) KESİNLIKLE KATILMIYORUM

12. Öğretim programındaki değişiklikler, öğrencilerin yüksek öğretim kurumlarında okumaya daha hazırlıklı olmalarında etkili olmamaktadır.

(A) KESİNLIKLE KATILMIYORUM (B) KATILMIYORUM (C) KARARSIZIM
(D) KATILMIYORUM (E) KESİNLIKLE KATILMIYORUM

13. Öğretim programındaki değişiklikler, öğrencilerin matematiği günlük hayatta daha etkili bir şekilde kullanabilmelerini sağlamaktadır.

(A) KESİNLIKLE KATILMIYORUM (B) KATILMIYORUM (C) KARARSIZIM
(D) KATILMIYORUM (E) KESİNLIKLE KATILMIYORUM
14. Öğretim programındaki değişiklikler, öğrencilerin problem çözme kabiliyetleri üzerinde etkili olmamaktadır.
   
   (A) KESİNLİKLE KATILMIYORUM  (B) KATILMIYORUM  (C) KARARSIZIM
   (D) KATILMIYORUM  (E) KESİNLİKLE KATILMIYORUM

15. Öğretim programındaki değişiklikler, öğrencilerin tümevarım ve tümöngelim ile çıkarımlar yapabilmelerini sağlamaktadır.
   
   (A) KESİNLİKLE KATILMIYORUM  (B) KATILMIYORUM  (C) KARARSIZIM
   (D) KATILMIYORUM  (E) KESİNLİKLE KATILMIYORUM

16. Öğretim programındaki değişiklikler, öğrencilerin model kurup, modelleri sözel ve matematiksel olarak ifade edebilmelerini etkilememektedir.
   
   (A) KESİNLİKLE KATILMIYORUM  (B) KATILMIYORUM  (C) KARARSIZIM
   (D) KATILMIYORUM  (E) KESİNLİKLE KATILMIYORUM

17. Öğretim programındaki değişikler, öğrencilerin araştırma yapma, bilgi üretme ve kullanma güçlerini geliştirmelerine yardımcı olmaktadır.
   
   (A) KESİNLİKLE KATILMIYORUM  (B) KATILMIYORUM  (C) KARARSIZIM
   (D) KATILMIYORUM  (E) KESİNLİKLE KATILMIYORUM

18. Öğretim programındaki değişiklikler, öğrencilerin matematiksel düşüncelerini açıklamak için, matematiksel terminoloji ve dilini doğru kullanabilmelerini sağlamaktadır.
   
   (A) KESİNLİKLE KATILMIYORUM  (B) KATILMIYORUM  (C) KARARSIZIM
   (D) KATILMIYORUM  (E) KESİNLİKLE KATILMIYORUM

19. Öğretim programındaki değişiklikler, öğrencilerin gözünde matematik öğrenmenin kıymetinin artmasına etki etmemektedir.
   
   (A) KESİNLİKLE KATILMIYORUM  (B) KATILMIYORUM  (C) KARARSIZIM
(D) KATILIYORUM    (E) KESİNLİKLE KATILIYORUM

20. Öğretim programındaki değişiklikler, öğrencilerin matematik öğrenimi üzerinde genel olarak olumlu etki yapmaktadır.

(A) KESİNLİKLE KATILIYORUM    (B) KATILIYORUM    (C) KARARSIZIM
(D) KATILMIYORUM    (E) KESİNLİKLE KATILMIYORUM


21. Öğretim programındaki değişiklikler, üniversiteyi kazanan öğrencilerin sayısını artırmaktadır.

(A) KESİNLİKLE KATILIYORUM    (B) KATILIYORUM    (C) KARARSIZIM
(D) KATILMIYORUM    (E) KESİNLİKLE KATILMIYORUM

22. Öğretim programındaki değişiklikler, üniversite sınavlarında, sınıflarının puan ortalamalarını artırmaktadır.

(A) KESİNLİKLE KATILIYORUM    (B) KATILIYORUM    (C) KARARSIZIM
(D) KATILMIYORUM    (E) KESİNLİKLE KATILMIYORUM

23. Öğretim programındaki değişiklikler, öğrencilerin üniversite sınavlarında pratik düşünceye yeteneklerinin azamasına sebep olmaktadır.

(A) KESİNLİKLE KATILMIYORUM    (B) KATILMIYORUM    (C) KARARSIZIM
(D) KATILIYORUM    (E) KESİNLİKLE KATILIYORUM

24. Öğretim programındaki değişiklikler, üniversite sınavlarında sayısal bölümleri tercih eden öğrencilerin sayısını artırmaktadır.

(A) KESİNLİKLE KATILIYORUM    (B) KATILIYORUM    (C) KARARSIZIM
(D) KATILMIYORUM    (E) KESİNLIKLE KATILMIYORUM

25. Öğretim programındaki değişiklikler, üniversite sınavlarında başarılı olmak için dershanelere giden öğrenci sayısını artırmaktadır.

(A) KESİNLIKLE KATILMIYORUM   (B) KATILMIYORUM   (C) KARARSIZIM
(D) KATILIYORUM    (E) KESİNLIKLE KATILIYORUM  

26. Öğretim programındaki değişiklikler, sayısal ağırlık yüksek öğretim programlarına giren öğrencilerin sayısını artırmaktadır.

(A) KESİNLIKLE KATILMIYORUM   (B) KATILMIYORUM   (C) KARARSIZIM
(D) KATILIYORUM    (E) KESİNLIKLE KATILIYORUM  

27. Öğretim programındaki değişiklikler, öğrencilerin üniversite sınavlarındaki soru çözme hızlarının azalmasına sebep olmaktadır.

(A) KESİNLIKLE KATILMIYORUM   (B) KATILMIYORUM   (C) KARARSIZIM
(D) KATILIYORUM    (E) KESİNLIKLE KATILIYORUM  

28. Öğretim programındaki değişiklikler, öğrencilerin üniversite sınavları karşısında öz güvenlerinin azalmasına sebep olmaktadır.

(A) KESİNLIKLE KATILMIYORUM   (B) KATILMIYORUM   (C) KARARSIZIM
(D) KATILIYORUM    (E) KESİNLIKLE KATILIYORUM  

29. Öğretim programındaki değişiklikler, öğrencilerin üniversite sınavlarında konuları ilişkinendirme yeteneklerini artırmaktadır.

(A) KESİNLIKLE KATILMIYORUM   (B) KATILMIYORUM   (C) KARARSIZIM
(D) KATILIYORUM    (E) KESİNLIKLE KATILIYORUM  

30. Öğretim programındaki değişiklikler, genel olarak, öğrencilerin üniversite sınavlarındaki başarılarını olumlu etkilemektedir.

(A) KESİNLIKLE KATILMIYORUM   (B) KATILMIYORUM   (C) KARARSIZIM
(D) KATILIYORUM    (E) KESİNLIKLE KATILIYORUM
Kısım III

Ölçeğin bu bölümü, ortaöğretim eğitim programlarındaki değişiklikler, bu değişikliklerin öğrencilerin matematik öğrenimi üzerindeki ve üniversite sınavlarındaki başarıları üzerindeki etkileri hakkındaki düşüncelerinizi özgürce ifade edebileceğiniz üç açık uçlu soru içermektedir. Lütfen bütün soruları yantlayınız.

Açık Uçlu Soru1:
2005 yılında ortaöğretim matematik öğretim programında yapılan değişikler ile ilgili, olumlu ve olumsuz görüşleriniz nelerdir?

Açık Uçlu Soru2:
2005 yılında ortaöğretim matematik öğretim programında yapılan değişikliklerin, öğrencilerin matematiğin yeterlilikleri üzerindeki etkileri ile ilgili olumlu ve olumsuz düşünceleriniz nelerdir?

Açık Uçlu Soru 3:
2005 yılında ortaöğretim matematik öğretim programında yapılan değişikliklerin, öğrencilerin üniversite sınavlarındaki başarısına etkileri ile ilgili olumlu ve olumsuz görüşleriniz nelerdir?
Appendix J: Pilot Survey Questions

Part I

This instrument consists of three parts. The first part includes demographic questions aimed to gain basic information about participants. Please answer each question. Your thoughts on the subject are highly appreciated and the success of the research relies on your candid and complete responses. Your personal information will be kept completely confidential.

Demographic Information

1. Gender
   (A) Male       (B) Female

2. Age range: ______________________

3. Years of teaching experience: ________ yrs (Please indicate to the nearest year)

4. Type of the high school graduated from: __________________________

5. Name of the university you graduated from: __________________________

6. Name of the department you graduated from: _________________________

7. Year of graduation from the university: _____________________________

8. Level of highest degree earned
   (A) Associate’s   (B) Bachelor’s   (C) Master’s   (D) Doctoral   (E) Other: ________

9. Types of schools at which you have been employed in the past
   (A) Anatolian    (B) Science     (C) General     (D) Other: ________

10. Type of school at which you are currently teaching
    (A) Anatolian   (B) Science     (C) General     (D) Other: ________

11. Grade level you are currently teaching (Choose all that apply)
    (A) 9          (B) 10          (C) 11          (D) 12
12. When studying at the university, did you ever take a course involving the constructivist approach to teaching and learning?
   (A) Yes             (B) No             (C) Not sure

13. Have you ever attended workshops or seminars that including the constructivist approach to teaching and learning?
   (A) Yes  (If yes, I joint_____ times and it continued _____day(s)/week(s))
   (B) No

14. Which word best describes your pedagogical approach to school mathematics?
   (A) Student-centered     (B) Teacher-centered

Part II

In 2005, the Turkish high school mathematics curriculum was changed by the Ministry of National Education. This part of the survey consists of three categories. The first one will measure high school mathematics teachers’ attitudes toward the curricular changes, the second one will measure high schools mathematics teachers’ attitudes toward the effects of these changes on students’ mathematical proficiency, and the third one will measure high school mathematics teachers’ attitudes toward the effects of these changes on students’ success on the university entrance examinations. Please answer all of the questions.

Perceptions of High School Mathematics Teachers Regarding the 2005 Curricular Changes

1. The curricular changes enable students to understand mathematical concepts and systems.
   (A) STRONGLY AGREE   (B) AGREE   (C) NEUTRAL   (D) DISAGREE   (E) STRONGLY DISAGREE

2. The curricular changes fail to deter students from memorization.
   (A) STRONGLY DISAGREE  (B) DISAGREE  (C) NEUTRAL  (D) AGREE  (E) STRONGLY AGREE
3. The curricular changes improve students’ ability to be systematic, careful, and patient.
   (A) STRONGLY AGREE (B) AGREE (C) NEUTRAL (D) DISAGREE (E) STRONGLY DISAGREE

4. The curricular changes enable students to learn by discovering.
   (A) STRONGLY AGREE (B) AGREE (C) NEUTRAL (D) DISAGREE (E) STRONGLY DISAGREE

5. The curricular changes cause students to learn less content.
   (A) STRONGLY DISAGREE (B) DISAGREE (C) NEUTRAL (D) AGREE (E) STRONGLY AGREE

6. Time is wasted with high-level activities and projects proposed by the curricular changes.
   (A) STRONGLY DISAGREE (B) DISAGREE (C) NEUTRAL (D) AGREE (E) STRONGLY AGREE

7. Students understand concepts better than before via the high-level activities and projects proposed by curricular changes.
   (A) STRONGLY AGREE (B) AGREE (C) NEUTRAL (D) DISAGREE (E) STRONGLY DISAGREE

8. I have difficulty applying the curricular changes.
   (A) STRONGLY DISAGREE (B) DISAGREE (C) NEUTRAL (D) AGREE (E) STRONGLY AGREE

9. Only content should have been changed in the curriculum, and constructivist approach should not have been adopted.
   (A) STRONGLY DISAGREE (B) DISAGREE (C) NEUTRAL (D) AGREE (E) STRONGLY AGREE

10. In general, the curricular changes are positive.
    (A) STRONGLY AGREE (B) AGREE (C) NEUTRAL (D) DISAGREE (E) STRONGLY DISAGREE

Perceptions of High School Mathematics Teachers Regarding the Impact of the 2005 Curricular Changes on Students Mathematical Proficiency

11. The curricular changes enable students to learn more independently.
    (A) STRONGLY AGREE (B) AGREE (C) NEUTRAL (D) DISAGREE (E) STRONGLY DISAGREE
12. The curricular changes have had no effect on student readiness to study at higher education institutes.
   (A) STRONGLY DISAGREE  (B) DISAGREE  (C) NEUTRAL  (D) AGREE  (E) STRONGLY AGREE

13. The curricular changes enable students to be able to use mathematics more effectively in daily life.
   (A) STRONGLY AGREE  (B) AGREE  (C) NEUTRAL  (D) DISAGREE  (E) STRONGLY DISAGREE

14. The curricular changes have had no effect on students’ abilities to solve problems.
   (A) STRONGLY DISAGREE  (B) DISAGREE  (C) NEUTRAL  (D) AGREE  (E) STRONGLY AGREE

15. The curricular changes enable students to be able to reason inductively and deductively.
   (A) STRONGLY AGREE  (B) AGREE  (C) NEUTRAL  (D) DISAGREE  (E) STRONGLY DISAGREE

16. The curricular changes have had no effect on student abilities to do modeling and express those models in verbally and mathematically.
   (A) STRONGLY DISAGREE  (B) DISAGREE  (C) NEUTRAL  (D) AGREE  (E) STRONGLY AGREE

17. The curricular changes have helped students developed their capabilities to do research, and to produce and use knowledge.
   (A) STRONGLY AGREE  (B) AGREE  (C) NEUTRAL  (D) DISAGREE  (E) STRONGLY DISAGREE

18. The curricular changes enable students to be able to use mathematical terminology and language correctly in order to express their mathematical thoughts.
   (A) STRONGLY AGREE  (B) AGREE  (C) NEUTRAL  (D) DISAGREE  (E) STRONGLY DISAGREE

19. The curricular changes have had no effect on students’ appreciation of learning mathematics.
   (A) STRONGLY DISAGREE  (B) DISAGREE  (C) NEUTRAL  (D) AGREE  (E) STRONGLY AGREE
20. In general, the curricular changes have had positive effect on students’ mathematical proficiency.

(A) STRONGLY AGREE   (B) AGREE   (C) NEUTRAL   (D) DISAGREE   (E) STRONGLY DISAGREE

Perceptions of High School Mathematics Teachers Regarding the Impact of the 2005 Curricular Changes on Students’ Success on the University Entrance Exams

21. The curricular changes have increased the number of my students admitted to higher education institutions.

(A) STRONGLY AGREE   (B) AGREE   (C) NEUTRAL   (D) DISAGREE   (E) STRONGLY DISAGREE

22. The curricular changes have increased the average score of my classes on the university entrance exams.

(A) STRONGLY AGREE   (B) AGREE   (C) NEUTRAL   (D) DISAGREE   (E) STRONGLY DISAGREE

23. The curricular changes have diminished students’ ability to think practically on the university entrance exams.

(A) STRONGLY DISAGREE   (B) DISAGREE   (C) NEUTRAL   (D) AGREE   (E) STRONGLY AGREE

24. The curricular changes have increased the number of students choosing STEM majors.

(A) STRONGLY AGREE   (B) AGREE   (C) NEUTRAL   (D) DISAGREE   (E) STRONGLY DISAGREE

25. The curricular changes have increased the number of students attending private tutoring institutions to become successful on the university entrance exams.

(A) STRONGLY DISAGREE   (B) DISAGREE   (C) NEUTRAL   (D) AGREE   (E) STRONGLY AGREE

26. The curricular changes have increased the number of students admitted to higher education programs to become STEM major.

(A) STRONGLY AGREE   (B) AGREE   (C) NEUTRAL   (D) DISAGREE   (E) STRONGLY DISAGREE
27. The curricular changes have decreased the computational fluency of students.
   (A) STRONGLY DISAGREE (B) DISAGREE (C) NEUTRAL (D) AGREE (E) STRONGLY AGREE

28. The curricular changes have decreased the self-confidence of students regarding their performance on the university entrance exams.
   (A) STRONGLY DISAGREE (B) DISAGREE (C) NEUTRAL (D) AGREE (E) STRONGLY AGREE

29. The curricular changes have increased the adaptive reasoning of students on the university entrance exams.
   (A) STRONGLY AGREE (B) AGREE (C) NEUTRAL (D) DISAGREE (E) STRONGLY DISAGREE

30. In general, the curricular changes have had positive effect on student success on the university entrance exams.
   (A) STRONGLY AGREE (B) AGREE (C) NEUTRAL (D) DISAGREE (E) STRONGLY DISAGREE

**Part III**

This part of the survey has three open-ended questions that allow you to explain your thoughts regarding the curricular changes, their effects on students’ proficiency, and their effects on students’ success on the university entrance examinations. Please answer all of the questions.

**QUESTION 1:** What are your opinions, both positive and negative, about the curricular changes that began in 2005?

**QUESTION 2:** What are your opinions, both positive and negative, about the effects of the 2005 curricular changes on students’ mathematical proficiency?

**QUESTION 3:** What are your opinions, both positive and negative, about the effects of the 2005 curricular changes on student success on the university entrance exams?
Appendix K: Anket Soruları (Turkish Version of Appendix L)

Kısım I


Demografik Sorular

1. Cinsiyet
   (A) Erkek   (B) Kadın

2. Yaşınız: ____________________

3. Öğretmenlik tecrübeniz: __________ yıl. (Lütfen en yakın tamsayıya tamamlayın)

4. Liseden mezun olduğunuz okul türü: ________________________________

5. Mezun olduğunuz fakülte veya yüksek okul: _________________________

6. Mezun olduğunuz bölüm: ________________________________

7. Fakülte veya yüksek okuldan mezun olduğunuz yıl: __________________

8. Öğrenim dereceniz
   (A) Ön lisans   (B) Lisans   (C) Master   (D) Doktora   (E) Diğer

9. Daha önce öğretmenlik yaptığınız okul türleri
   (A) Anadolu Lisesi   (B) Fen Lisesi   (C) Genel Lise   (D) Diğer: ________

10. Şu anda öğretmenlik yaptığınız okul türü
    (A) Anadolu Lisesi   (B) Fen Lisesi   (C) Genel Lise   (D) Diğer: ________

11. Şu anda okuttuğunuz sınıflar
    (A) 9. Sınıf   (B) 10. Sınıf   (C) 11. Sınıf   (D) 12. Sınıf
12. Üniversiteye okurken, eğitim ve öğretimde yapılandırıcı yaklaşım ile ilgili hiç ders aldınız mı?

(A) Evet   (B) Hayır  (C) Emin değilim

13. Eğitim ve öğretimde yapılandırıcı yaklaşım ile ilgili seminer veya çalışmalarla hiç katıldınız mı?

(A) Evet (Eğer evet ise, __________ kere katıldım ve __________ gün/hafta sürdü)
(B) Hayır

14. Hangi ifade matematik derslerindeki pedagojik yaklaşımınıza en iyi şekilde tanımlıyor?

(A) Öğrenci merkezli   (B) Öğretmen merkezli

Kısım II


Lise Matematik Öğretmenlerinin, ‘2005 Yılında Yapılan Eğitim Programındaki Değişiklikler’ Hakkındaki Görüşleri

1. Öğretim programındaki değişiklikler, öğrencilerin matematiksel kavram ve sistemleri anlayabilmelerini sağlamaktadır.

(A) KESİNLIKLE KATILIYORUM   (B) KATILIYORUM   (C) KARARSIZIM
(D) KATILMIYORUM   (E) KESİNLIKLE KATILMIYORUM
2. Öğretim programındaki değişikliklere rağmen, öğrenciler hala fazla ezbere dayanmaktadır.

(A) KESİNLİKLE KATILMIYORUM  (B) KATILMIYORUM  (C) KARARSIZIM
(D) KATILMIYORUM  (E) KESİNLİKLE KATILMIYORUM

3. Öğretim programındaki değişiklikler, öğrencilerin sistemli, dikkatli ve sabırlı olma özelliklerini geliştirmektedir.

(A) KESİNLİKLE KATILMIYORUM (B) KATILMIYORUM  (C) KARARSIZIM
(D) KATILMIYORUM  (E) KESİNLİKLE KATILMIYORUM

4. Öğretim programındaki değişiklikler, öğrencilerin keşfederek öğrenmelerini sağlamaktadır.

(A) KESİNLİKLE KATILMIYORUM (B) KATILMIYORUM  (C) KARARSIZIM
(D) KATILMIYORUM  (E) KESİNLİKLE KATILMIYORUM

5. Öğretim programındaki değişikliklerin bir sonucu olarak, öğrenciler daha az konu öğrenmektedir.

(A) KESİNLİKLE KATILMIYORUM (B) KATILMIYORUM  (C) KARARSIZIM
(D) KATILMIYORUM  (E) KESİNLİKLE KATILMIYORUM

6. Öğretim programlarında önerilen yüksek seviyeli aktivite ve projeler vakit kaybettirmektedir.

(A) KESİNLİKLE KATILMIYORUM (B) KATILMIYORUM  (C) KARARSIZIM
(D) KATILMIYORUM  (E) KESİNLİKLE KATILMIYORUM

7. Öğretim programlarında önerilen yüksek seviyeli aktivite ve projeler, öğrencilerin konuları daha iyi anlayıp kavrayabilmelerine yardımcı olmaktadır.

(A) KESİNLİKLE KATILMIYORUM (B) KATILMIYORUM  (C) KARARSIZIM
(D) KATILMIYORUM  (E) KESİNLİKLE KATILMIYORUM
8. Öğretim programındaki değişiklikleri uygulama sorun yaşadırm.
   (A) KESİNLIKLE KATILMIYORUM   (B) KATILMIYORUM   (C) KARARSIZIM
   (D) KATILIYORUM                (E) KESİNLIKLE KATILIYORUM

9. Öğretim programlarında sadece müfredat değişmeli, yapılandıranıı yaklaşımla
   eğitim geçilmemeliydi.
   (A) KESİNLIKLE KATILMIYORUM   (B) KATILMIYORUM   (C) KARARSIZIM
   (D) KATILIYORUM                (E) KESİNLIKLE KATILIYORUM

10. Öğretim programındaki değişiklikler, genel olarak olumlu.
    (A) KESİNLIKLE KATILMIYORUM   (B) KATILMIYORUM   (C) KARARSIZIM
    (D) KATILIYORUM                (E) KESİNLIKLE KATILIYORUM

Lise Matematik Öğretmenlerinin, ‘2005 Yılında Yapılan Eğitim Programındaki
Değişikliklerin Öğrencilerin Matematik Öğrenimi Üzerindeki Etkileri’ Hakkındaki
Görüşleri

11. Öğretim programındaki değişiklikler, öğrencilerin daha bağımsız olarak
    öğrenmelerini sağlamaktadır.
    (A) KESİNLIKLE KATILMIYORUM   (B) KATILMIYORUM   (C) KARARSIZIM
    (D) KATILIYORUM                (E) KESİNLIKLE KATILIYORUM

12. Öğretim programındaki değişiklikler, öğrencilerin yüksek öğretim kurumlarında
    okumaya daha hazırlanıı olmalarında etkili OLMAMAKTADIR.
    (A) KESİNLIKLE KATILMIYORUM   (B) KATILMIYORUM   (C) KARARSIZIM
    (D) KATILIYORUM                (E) KESİNLIKLE KATILIYORUM

13. Öğretim programındaki değişiklikler, öğrencilerin matematiği günlük hayatda daha
    etkili bir şekilde kullanabilmelerini sağlamaktadır.
14. Öğretim programındaki değişiklikler, öğrencilerin problem çözme kabiliyetleri üzerinde etkili OLMAMAKTADIR.

(A) KESİNLİKLE KATILIYORUM  (B) KATILIYORUM  (C) KARARSIZIM
(D) KATILMIYORUM  (E) KESİNLİKLE KATILMIYORUM

15. Öğretim programındaki değişiklikler, öğrencilerin tümevarım ve tümengelim ile çıkarımlar yapabilmelerini sağlamaktadır.

(A) KESİNLİKLE KATILMIYORUM  (B) KATILMIYORUM  (C) KARARSIZIM
(D) KATILIYORUM  (E) KESİNLİKLE KATILIYORUM

16. Öğretim programındaki değişiklikler, öğrencilerin model kurup, modelleri sözel ve matematiksel olarak ifade edebilmelerini ETKİLEMEMEKTEDİR.

(A) KESİNLİKLE KATILMIYORUM  (B) KATILMIYORUM  (C) KARARSIZIM
(D) KATILIYORUM  (E) KESİNLİKLE KATILMIYORUM

17. Öğretim programındaki değişikler, öğrencilerin araştırma yapma, bilgi üretme ve kullanma güçlerini geliştirmelerine yardımcı olmaktadır.

(A) KESİNLİKLE KATILIYORUM  (B) KATILIYORUM  (C) KARARSIZIM
(D) KATILMIYORUM  (E) KESİNLİKLE KATILMIYORUM

18. Öğretim programındaki değişiklikler, öğrencilerin matematiksel düşüncelerini açıklamak için, matematiksel terminoloji ve dilini doğru kullanabilmelerini sağlamaktadır.

(A) KESİNLİKLE KATILIYORUM  (B) KATILIYORUM  (C) KARARSIZIM
(D) KATILMIYORUM  (E) KESİNLİKLE KATILMIYORUM
19. Öğretim programındaki değişiklikler, öğrencilerin gözünde matematik öğrenmenin kıymetinin artmasına etki ETMEMEKTEDİR.

(A) KESİNLIKLE KATILMIYORUM  (B) KATILMIYORUM  (C) KARARSIZIM
(D) KATILMIYORUM  (E) KESİNLIKLE KATILMIYORUM

20. Öğretim programındaki değişiklikler, öğrencilerin matematik öğrenimi üzerinde genel olarak olumlu etki yapmaktadır.

(A) KESİNLIKLE KATILMIYORUM  (B) KATILMIYORUM  (C) KARARSIZIM
(D) KATILMIYORUM  (E) KESİNLIKLE KATILMIYORUM


21. Öğretim programındaki değişiklikler, üniversiteyi kazanan öğrencilerin sayısını artırmaktadır.

(A) KESİNLIKLE KATILMIYORUM  (B) KATILMIYORUM  (C) KARARSIZIM
(D) KATILMIYORUM  (E) KESİNLIKLE KATILMIYORUM

22. Öğretim programındaki değişikliklerin, üniversite sınavlarında, sınavların puan ortalamalarını artırdığımı düşünüyorum.

(A) KESİNLIKLE KATILMIYORUM  (B) KATILMIYORUM  (C) KARARSIZIM
(D) KATILMIYORUM  (E) KESİNLIKLE KATILMIYORUM

23. Öğretim programındaki değişikliklerin, öğrencilerin üniversite sınavlarında pratik düşünme yeteneklerinin AZALMASINA sebep olduğunu düşünüyorum.

(A) KESİNLIKLE KATILMIYORUM  (B) KATILMIYORUM  (C) KARARSIZIM
(D) KATILMIYORUM  (E) KESİNLIKLE KATILMIYORUM
24. Öğretim programındaki değişikliklerin, üniversite sınavlarında sayısal bölümü tercih eden öğrencilerin sayısını artırdığını sanıyorum.

   (A) KESİNLİKLE KATILMIYORUM  (B) KATILMIYORUM  (C) KARARSIZIM
   (D) KATILMIYORUM  (E) KESİNLİKLE KATILMIYORUM

25. Öğretim programındaki değişiklikler, üniversite sınavlarında başarılı olmak için dershanelere giden öğrenci sayısını artırmaktadır.

   (A) KESİNLİKLE KATILMIYORUM  (B) KATILMIYORUM  (C) KARARSIZIM
   (D) KATILMIYORUM  (E) KESİNLİKLE KATILMIYORUM

26. Öğretim programındaki değişikliklerin, sayısal ağırlıklı yüksek öğretim programlarına giren öğrencilerin sayısını artırdığını DÜŞÜNMEYORUM.

   (A) KESİNLİKLE KATILMIYORUM  (B) KATILMIYORUM  (C) KARARSIZIM
   (D) KATILMIYORUM  (E) KESİNLİKLE KATILMIYORUM

27. Öğretim programındaki değişikliklerin, öğrencilerin üniversite sınavlarındaki başarılarına bir katkısının OLMADIĞINI düşünüyorum.

   (A) KESİNLİKLE KATILMIYORUM  (B) KATILMIYORUM  (C) KARARSIZIM
   (D) KATILMIYORUM  (E) KESİNLİKLE KATILMIYORUM

28. Öğretim programındaki değişiklikler, öğrencilerin üniversite sınavına hazırlık için çöktan seçmeli test çözme gerekсинimini azaltmıştır.

   (A) KESİNLİKLE KATILMIYORUM  (B) KATILMIYORUM  (C) KARARSIZIM
   (D) KATILMIYORUM  (E) KESİNLİKLE KATILMIYORUM

29. Öğretim programındaki değişikliklerin, öğrencilerin üniversite sınavlarındaki soru çözme becerilerinin azalmasına sebep olduğunu düşünüyorum.

   (A) KESİNLİKLE KATILMIYORUM  (B) KATILMIYORUM  (C) KARARSIZIM
   (D) KATILMIYORUM  (E) KESİNLİKLE KATILMIYORUM
30. Öğretim programındaki değişiklikler, öğrencilerin üniversite sınavları karşısında öz güvenlerinin azalmasına sebep olmaktadır.

(A) KESİNLIKLE KATILMIYORUM   (B) KATILMIYORUM   (C) KARARSIZIM
(D) KATILMIYORUM   (E) KESİNLIKLE KATILMIYORUM

31. Öğretim programındaki değişiklikler, öğrencilerin üniversite sınavlarında konuları ilişkilendirme yeteneklerini artırmaktadır.

(A) KESİNLIKLE KATILMIYORUM   (B) KATILMIYORUM   (C) KARARSIZIM
(D) KATILMIYORUM   (E) KESİNLIKLE KATILMIYORUM

32. Öğretim programındaki değişiklikler, genel olarak, öğrencilerin üniversite sınavlarındaki başarılarını olumlu etkilemektedir.

(A) KESİNLIKLE KATILMIYORUM   (B) KATILMIYORUM   (C) KARARSIZIM
(D) KATILMIYORUM   (E) KESİNLIKLE KATILMIYORUM

Kısım III

Ölçeğin bu bölümü, ortaöğretim eğitim programlarındaki değişiklikler, bu değişikliklerin öğrencilerin matematik öğrenimi üzerindeki ve üniversite sınavlarındaki başarıları üzerindeki etkileri hakkındaki düşüncelerinizi özgürlüçe ifade edebileceğiniz üç açık uçlu soru içermektedir. Lütfen bütün soruları yanıtlayınız.

Açık Uçlu Soru1:
2005 yılında ortaöğretim matematik öğretim programında yapılan değişikler ile ilgili, olumlu ve olumsuz görüşlerinizi nelerdir?

Açık Uçlu Soru2:
2005 yılında ortaöğretim matematik öğretim programında yapılan değişikliklerin, öğrencilerin matematiksel yeterlilikleri üzerindeki etkileri ile ilgili olumlu ve olumsuz düşünceleriniz nelerdir?
Açık Uçlu Soru 3:

2005 yılında ortaöğretim matematik öğretim programında yapılan değişikliklerin, öğrencilerin üniversite sınavlarındaki başarısına etkileri ile ilgili olumlu ve olumsuz görüşleriniz nelerdir?
Appendix L: Revised Survey Questions

Part I

This instrument consists of three parts. The first part includes demographic questions aimed to gain basic information about participants. Please answer each question. Your thoughts on the subject are highly appreciated and the success of the research relies on your candid and complete responses. Your personal information will be kept completely confidential.

Demographic Information

1. Gender
   (A) Male     (B) Female

2. Age range: __________________

3. Years of teaching experience: _________ yrs (Please indicate to the nearest year)

4. Type of the high school graduated from: ______________________________

5. Name of the university you graduated from: __________________________

6. Name of the department you graduated from: _________________________

7. Year of graduation from the university: ______________________________

8. Level of highest degree earned
   (A) Associate’s  (B) Bachelor’s  (C) Master’s  (D) Doctoral  (E) Other: ______

9. Types of schools at which you have been employed in the past
   (A) Anatolian     (B) Science     (C) General     (D) Other: ______

10. Type of school at which you are currently teaching
    (A) Anatolian     (B) Science     (C) General     (D) Other: ______

11. Grade level you are currently teaching (Choose all that apply)
    (A) 9          (B) 10          (C) 11          (D) 12
12. When studying at the university, did you ever take a course involving the constructivist approach to teaching and learning?
   (A) Yes      (B) No      (C) Not sure

13. Have you ever attended workshops or seminars that including the constructivist approach to teaching and learning?
   (A) Yes  (If yes, I joint_____ times and it continued _____day(s)/week(s))
   (B) No

14. Which word best describes your pedagogical approach to school mathematics?
   (A) Student-centered  (B) Teacher-centered

Part II

In 2005, the Turkish high school mathematics curriculum was changed by the Ministry of National Education. This part of the survey consists of three categories. The first one will measure high school mathematics teachers’ attitudes toward the curricular changes, the second one will measure high schools mathematics teachers’ attitudes toward the effects of these changes on students’ mathematical proficiency, and the third one will measure high school mathematics teachers’ attitudes toward the effects of these changes on students’ success on the university entrance examinations. Please answer all of the questions.

Perceptions of High School Mathematics Teachers Regarding the 2005 Curricular Changes

1. The curricular changes enable students to understand mathematical concepts and systems.
   (A) STRONGLY AGREE   (B) AGREE   (C) NEUTRAL   (D) DISAGREE   (E) STRONGLY DISAGREE

2. After the curricular changes, students are still relying too much on memorization.
   (A) STRONGLY DISAGREE   (B) DISAGREE   (C) NEUTRAL   (D) AGREE   (E) STRONGLY AGREE
3. The curricular changes improve students’ ability to be systematic, careful, and patient.
   (A) STRONGLY AGREE  (B) AGREE  (C) NEUTRAL  (D) DISAGREE  (E) STRONGLY DISAGREE

4. The curricular changes enable students to learn by discovering.
   (A) STRONGLY AGREE  (B) AGREE  (C) NEUTRAL  (D) DISAGREE  (E) STRONGLY DISAGREE

5. The curricular changes have resulted in students learning less content.
   (A) STRONGLY DISAGREE  (B) DISAGREE  (C) NEUTRAL  (D) AGREE  (E) STRONGLY AGREE

6. Time is wasted with high-level activities and projects proposed by the curricular changes.
   (A) STRONGLY DISAGREE  (B) DISAGREE  (C) NEUTRAL  (D) AGREE  (E) STRONGLY AGREE

7. Students understand concepts better than before via the high-level activities and projects proposed by curricular changes.
   (A) STRONGLY AGREE  (B) AGREE  (C) NEUTRAL  (D) DISAGREE  (E) STRONGLY DISAGREE

8. I have difficulty applying the curricular changes.
   (A) STRONGLY DISAGREE  (B) DISAGREE  (C) NEUTRAL  (D) AGREE  (E) STRONGLY AGREE

9. Only content should have been changed in the curriculum, and constructivist approach should not have been adopted.
   (A) STRONGLY DISAGREE  (B) DISAGREE  (C) NEUTRAL  (D) AGREE  (E) STRONGLY AGREE

10. In general, the curricular changes are positive.
    (A) STRONGLY AGREE  (B) AGREE  (C) NEUTRAL  (D) DISAGREE  (E) STRONGLY DISAGREE

Perceptions of High School Mathematics Teachers Regarding the Impact of the 2005 Curricular Changes on Students Mathematical Proficiency

11. The curricular changes enable students to learn more independently.
    (A) STRONGLY AGREE  (B) AGREE  (C) NEUTRAL  (D) DISAGREE  (E) STRONGLY DISAGREE
12. The curricular changes have had no effect on student readiness to study at higher education institutes.

(A) STRONGLY DISAGREE  (B) DISAGREE  (C) NEUTRAL  (D) AGREE  (E) STRONGLY AGREE

13. The curricular changes enable students to be able to use mathematics more effectively in daily life.

(A) STRONGLY AGREE  (B) AGREE  (C) NEUTRAL  (D) DISAGREE  (E) STRONGLY DISAGREE

14. The curricular changes have had no effect on students’ abilities to solve problems.

(A) STRONGLY DISAGREE  (B) DISAGREE  (C) NEUTRAL  (D) AGREE  (E) STRONGLY AGREE

15. The curricular changes enable students to be able to reason inductively and deductively.

(A) STRONGLY AGREE  (B) AGREE  (C) NEUTRAL  (D) DISAGREE  (E) STRONGLY DISAGREE

16. The curricular changes have had no effect on student abilities to do modeling and express those models in verbally and mathematically.

(A) STRONGLY DISAGREE  (B) DISAGREE  (C) NEUTRAL  (D) AGREE  (E) STRONGLY AGREE

17. The curricular changes have helped students developed their capabilities to do research, and to produce and use knowledge.

(A) STRONGLY AGREE  (B) AGREE  (C) NEUTRAL  (D) DISAGREE  (E) STRONGLY DISAGREE

18. The curricular changes enable students to be able to use mathematical terminology and language correctly in order to express their mathematical thoughts.

(A) STRONGLY AGREE  (B) AGREE  (C) NEUTRAL  (D) DISAGREE  (E) STRONGLY DISAGREE

19. The curricular changes have had no effect on students’ appreciation of learning mathematics.

(A) STRONGLY DISAGREE  (B) DISAGREE  (C) NEUTRAL  (D) AGREE  (E) STRONGLY AGREE
20. In general, the curricular changes have had positive effect on students’ mathematical proficiency.

   (A) STRONGLY AGREE   (B) AGREE   (C) NEUTRAL   (D) DISAGREE   (E) STRONGLY DISAGREE

Perceptions of High School Mathematics Teachers Regarding the Impact of the
2005 Curricular Changes on Students’ Success on the University Entrance Exams

21. The curricular changes have increased the number of my students admitted to higher education institutions.

   (A) STRONGLY AGREE   (B) AGREE   (C) NEUTRAL   (D) DISAGREE   (E) STRONGLY DISAGREE

22. I think the curricular changes have increased the average score of my classes on the university entrance exams.

   (A) STRONGLY AGREE   (B) AGREE   (C) NEUTRAL   (D) DISAGREE   (E) STRONGLY DISAGREE

23. I think the curricular changes have diminished students’ ability to think practically on the university entrance exams.

   (A) STRONGLY DISAGREE   (B) DISAGREE   (C) NEUTRAL   (D) AGREE   (E) STRONGLY AGREE

24. I think the curricular changes have increased the number of students choosing STEM majors.

   (A) STRONGLY AGREE   (B) AGREE   (C) NEUTRAL   (D) DISAGREE   (E) STRONGLY DISAGREE

25. The curricular changes have increased the number of students attending private tutoring institutions to become successful on the university entrance exams.

   (A) STRONGLY DISAGREE   (B) DISAGREE   (C) NEUTRAL   (D) AGREE   (E) STRONGLY AGREE

26. I do not think the curricular changes have increased the number of students admitted to higher education programs to become STEM major.

   (A) STRONGLY AGREE   (B) AGREE   (C) NEUTRAL   (D) DISAGREE   (E) STRONGLY DISAGREE
27. I think the curricular changes have had no effect on student success on the university entrance exams.
   (A) STRONGLY DISAGREE  (B) DISAGREE  (C) NEUTRAL  (D) AGREE  (E) STRONGLY AGREE

28. The curricular changes have decreased the needs of solving multiple choice tests for university entrance exam preparation.
   (A) STRONGLY AGREE  (B) AGREE  (C) NEUTRAL  (D) DISAGREE  (E) STRONGLY DISAGREE

29. I think the curricular changes have lowered the computational skills of students on the university entrance exams.
   (A) STRONGLY DISAGREE  (B) DISAGREE  (C) NEUTRAL  (D) AGREE  (E) STRONGLY AGREE

30. The curricular changes have decreased the self-confidence of students regarding their performance on the university entrance exams.
   (A) STRONGLY DISAGREE  (B) DISAGREE  (C) NEUTRAL  (D) AGREE  (E) STRONGLY AGREE

31. The curricular changes have increased the adaptive reasoning of students on the university entrance exams.
   (A) STRONGLY AGREE  (B) AGREE  (C) NEUTRAL  (D) DISAGREE  (E) STRONGLY DISAGREE

32. In general, the curricular changes have had positive effect on student success on the university entrance exams.
   (A) STRONGLY AGREE  (B) AGREE  (C) NEUTRAL  (D) DISAGREE  (E) STRONGLY DISAGREE

Part III

This part of the survey has three open-ended questions that allow you to explain your thoughts regarding the curricular changes, their effects on students’ proficiency, and their effects on students’ success on the university entrance examinations. Please answer all of the questions.

QUESTION 1: What are your opinions, both positive and negative, about the curricular changes that began in 2
QUESTION 2: What are your opinions, both positive and negative, about the effects of the 2005 curricular changes on students’ mathematical proficiency?

QUESTION 3: What are your opinions, both positive and negative, about the effects of the 2005 curricular changes on student success on the university entrance exams?
Appendix M: IRB Approval

A determination has been made that the following research study is exempt from IRB review because it involves:

Category 2. research involving the use of educational tests, survey procedures, interview procedures or observation of public behavior

Project Title: Perceptions of Turkish High School Mathematics Teachers Regarding the 2005 Curricular Changes and Their Effects on Mathematical Proficiency and University Entrance Exam Preparation

Primary Investigator: Sirteka Nihan Fr

Co-Investigator(s):

Advisor: (if applicable)

Department: Teacher Education

Rebecca Cale, AAH, CIP
Office of Research Compliance

07/19/11 Date

The approval remains in effect provided the study is conducted exactly as described in your application for review. Any additions or modifications to the project must be approved (as an amendment) prior to implementation.
Appendix N: Anticipated Timeline

<table>
<thead>
<tr>
<th>Research Activity</th>
<th>Anticipated Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Addressing committee’s comments</td>
<td>June 28–August 31, 2011</td>
</tr>
<tr>
<td>Submitting IRB forms and IRB approval</td>
<td>July 15–30, 2011</td>
</tr>
<tr>
<td>Selecting the provinces and the schools for surveying*</td>
<td>July 15–30, 2011</td>
</tr>
<tr>
<td>Submitting proposal to Turkish Ministry of National Education</td>
<td>July 15–30, 2011</td>
</tr>
<tr>
<td>Piloting and revising the instrument</td>
<td>September 15–September 30, 2011</td>
</tr>
<tr>
<td>Disseminating the survey</td>
<td>October 1, 2011–November 1, 2011</td>
</tr>
<tr>
<td>Contacting with interviewees and arranging meeting times</td>
<td>October 15–November 1, 2011</td>
</tr>
<tr>
<td>Interviews</td>
<td>November 15–December 25, 2011</td>
</tr>
<tr>
<td>Analyzing data and writing results and discussion</td>
<td>January 5–March 15, 2012</td>
</tr>
<tr>
<td>Revision</td>
<td>March 15–30, 2012</td>
</tr>
</tbody>
</table>

*Turkish Ministry of National Education requires the names of the provinces and schools in which the survey will be sent to give permission.