

## WHAT ARE THE PRESERVICE MATHEMATICS TEACHERS' ATTITUDES TOWARDS MATHEMATICS AND BELIEFS ABOUT TEACHING MATHEMATICS, AND THEIR TEACHER PREPARATION PROGRAMS?

### HİZMET ÖNCESİ MATEMATİK ÖĞRETMENLERİNİN MATEMATİĞE KARŞI TUTUMLARI VE MATEMATİĞİN ÖĞRETİLMESİNE VE KENDİ ÖĞRETMEN YETİŞTİRME PROGRAMLARINA İLİŞKİN İNANÇLARI NELERDİR?

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**ABSTRACT:** This study investigated Turkish preservice mathematics teachers' attitudes towards mathematics and their beliefs about teaching mathematics and their teacher preparation programs with the aim of helping preservice teacher educators understand the perceptions of future teachers and structure of teacher preparation program better. In this study, 49 mathematics education preservice teachers in two universities in Turkey responded to the questionnaire that consists of 35 questions. Responses to the questionnaire were analyzed by using SPSS and findings included detailed attitudes and beliefs of preservice teachers and a summary of the results from the original study which emphasizes the differences in attitudes and beliefs of preservice teachers from three countries, namely Korea, Turkey and the US.

**KEY WORDS:** Attitudes, Preservice mathematics teachers, Teacher preparation programs

**ÖZET:** Bu çalışma, öğretmen eğitimcilerine, Türk öğretmen adaylarının anlayışlarını ve öğretmen yetiştirme programlarının yapısını daha iyi anlamada yardımcı olmak amacı ile, hizmet öncesi matematik öğretmenlerinin matematiğe karşı tutumlarını ve matematiğin öğretilmesine ve öğretmen yetiştirme programlarına ilişkin inançlarını incelemiştir. Bu çalışmada Türkiye'de iki üniversiteden 49 hizmet öncesi matematik öğretmeni 35 soruluk anketi cevaplandırmışlardır. Ankete verilen cevaplar SPSS programı kullanılarak analiz edilmiştir ve sonuçlar hizmet öncesi öğretmenlerin detaylı tutumlarını ve inançlarını ve Kore, Türkiye ve Amerika'lı hizmet öncesi öğretmenlerin tutumlarını ve inançlarını karşılaştıran orjinal çalışmanın sonuçlarından bir özet içermektedir.

**ANAHTAR SÖZCÜKLER:** Tutumlar, Hizmet öncesi matematik öğretmenleri, Öğretmen yetiştirme programları

## 1. INTRODUCTION

Teachers' and preservice teachers' affective characteristics such as beliefs and attitudes are believed to determine not only what they think of their subject area but also how they teach (Doğan, 2001). Those beliefs and attitudes are crucial in establishing their teaching practices since their attitudes towards mathematics and instructional techniques form their classroom procedures. Hence, there is a demand for research in determining Turkish mathematics preservice teachers' beliefs and attitudes towards mathematics, teaching mathematics, and their teacher preparation programs.

The extended version of this research was presented at the Association of Mathematics Teacher Educators (AMTE) conference in 2000 and published at internet site of AMTE and ERIC database (Wagner, Lee, & Özgün-Koca, 2000). The data of the original study were obtained from three different countries; Korea, Turkey, and the United States (US) with the aim of comparative educational research. However, the aim of this paper is to reveal the data collected from Turkey in more detail in order to provide an image of Turkish mathematics preservice teachers' attitudes towards mathematics and beliefs about mathematics teaching and especially their teacher preparation program at the period of reform. As we all know, this is the time that the faculties of

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education are being re-structured (Baskan, 2001; YÖK, 1998). So, this study will discuss the attitudes and beliefs of mathematics preservice teachers who were enrolled to the old program.

### 1.1 Research Questions

This research was designed to answer the following question: What are the attitudes and beliefs of Turkish preservice mathematics teachers towards mathematics, teaching mathematics, and their teacher preparation program?

The aim of this research is to find factors affecting student teachers' attitudes and beliefs, which may shape the future mathematics teachers. Their self-confidence in teaching mathematics was also investigated in order to observe if they feel ready for teaching after their education. The results of this study provide insight for teacher educators in executing teacher education programs as well as understanding the demands of the prospective mathematics teachers throughout their programs. Also, the results of the present study enable the educators to discuss if the restructured program may answer the preservice teachers' demands.

### 1.2 Research on Beliefs and Attitudes of Mathematics Teachers

Many research findings demonstrated that teacher's beliefs and attitudes about teaching and learning mathematics have a significant effect on their students' attitudes (Aiken, 1972) and of course, their learning and achievement (Cross et al., 1985). Many researchers have also suggested that students come to teacher education programs with previously constructed knowledge, beliefs and thoughts which may be a help or a hindrance in the learning of new ideas (Adler, 1991; Britzman, 1986). Moreover, Archer (1999) mentioned that, the teachers' teacher preparation program has less influence on their teaching than their previously formed beliefs during their school years (Holt-

Reynolds, 1992) and the period of student teachers (NCTM, 1991). According to the Professional Standards for Teaching Mathematics by NCTM (1991), teachers are influenced by the teaching they go through and experience. In other words, teachers' own experiences have a profound impact on their knowledge of, beliefs about, and attitudes towards mathematics, students, and teaching, which implies the importance of student teachers' experiences in teacher education programs.

### 1.3 Teacher Preparation Program

In this section, it is intended to describe the nature of teacher preparation program in two participating universities with the aim of providing a picture of the program before the reform. To obtain a teacher certification, students must graduate from a four-year-degree program in a faculty of education or a teaching certificate program offered by a university. Two universities which are chosen for this study were among the top universities in Turkey and both provide education in English. Thus, the questionnaire was not translated into Turkish in order to be administered in Turkey. Secondary preservice mathematics teachers were required to take 12 –15 core and elective courses on mathematics at these universities. One of these universities had 3 general education courses in its curriculum whereas the other had 6 of them. A specific mathematics education methods course was offered in both universities. Students also enrolled in another course which includes field experience and teaching practice including class observation, adjusting to classroom conditions, planning and preparation for teaching and guided teaching practice in mathematics in secondary schools. Moreover, 2-3 science and elective science education courses, statistics, computer programming, courses specific to mathematics education but not necessarily methods course such as geometry for teachers, measurement of science achievement, and curriculum development in

mathematics education were among the courses that students need to take. Additionally, one of the universities offered project in mathematics education course in which the research project was carried out under the supervision of a staff member on school mathematics or mathematics education that aims to give the student the necessary skill and experience to carry out scientific research. On the other hand, the other university offered a course more related to the educational technology such as computer applications for the science teacher. With graduation, students gained the right to teach at secondary schools but their first year is under supervision and controlled by the local education systems.

## 2. DATA COLLECTION

### 2.1 Participants

Data were collected from 49 secondary mathematics education student teachers from two different universities in 1998. All participants had finished the field experience and student teaching by June 1998.

### 2.2 Instruments

The questionnaire consists of two parts: questions for demographic information and mixed questions on their attitudes towards mathematics and beliefs about teaching mathematics, and programs in their departments. The questions were modified according to Negangard's (1991) questionnaire and reorganized with the 6-point Likert scale ranging from strongly disagree to strongly agree. The types of information the questionnaire seeks can be classified into ten categories (See Table 1). Each item includes at least 2 and at the most 4 questions. The reliability tests resulted in 0.69 alpha value for the entire questionnaire.

**Table 1.** Classification of Items

Confidence in Teaching Mathematics	
Attitudes about Mathematics	
Methods of Teaching Mathematics	Traditional Teaching
	Manipulatives
	Cooperative Learning
	Communication among Teachers
	Communication among Students
	Technology Usage
Program	Mathematics Courses
	Mathematics Education Courses
	Field Experience Courses

## 3. RESULTS

In this section, demographic data about participants will be initially presented and it will be followed by data on preservice teachers' self-confidence in teaching mathematics and their attitudes towards mathematics. Then preservice teachers' beliefs about methods of teaching mathematics and their teacher preparation program will be analyzed.

### 3.1 Demographic Data

As Table 2 presents, there were more female students than male students in both universities. Almost all of them mentioned that they wanted to become teachers after they graduated.

**Table 2.** Demographic Information

		University	University
		A	B
Gender	Female	26	5
	Male	13	5
Want to become teacher after graduation	Yes	27	17
	No	2	1

When we asked the reasons to become a teacher, the first selected choice was the wish of helping other people as a teacher (see Figure 1).

Twelve percent of students mention that they had teacher relatives which affected their inclination to become a teacher. However, fifteen percent said that they had drifted into this profession. As we all know, students in Turkey are placed in universities through a national exam right after finishing a high school, and choose their undergraduate education mainly based on the exam score. So, sometimes students go to the university for the sake of becoming a university graduate.

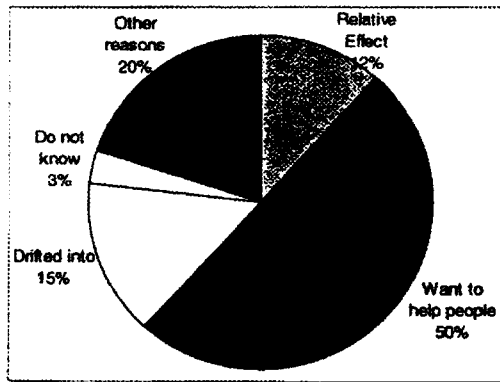


Figure 1. Reasons to Become a Teacher

Figure 2 displays preservice teachers' concerns as a teacher. Classroom management was the greatest concern of student teachers. Then not being able to answer students' questions was another concern selected by many students.

### 3.2 Attitudes towards Mathematics and Self-Confidence in Teaching Mathematics

The items evaluating participants' attitudes towards mathematics and self-confidence in teaching mathematics in the survey were 6-point Likert type questions, so they were scored from 1 (strongly disagree) through 6 (strongly agree).

All preservice mathematics teachers from both universities have very strong positive attitudes towards mathematics. They think that mathematics helps people think logically and is enjoyable for them but they did not think strongly that mathematics is a worthwhile subject for everyone (see Table 3).

There were some questions asking student teachers' self-confidence in teaching mathematics. Since all the participants of this study completed their student teaching, they

Figure 2. Concerns as a Teacher

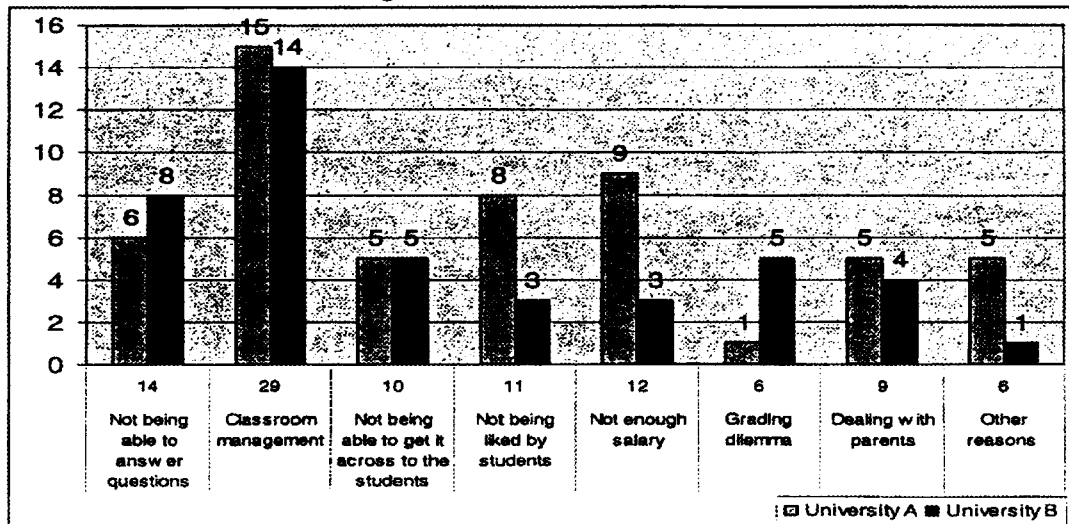


Figure 2. Concerns as a Teacher

**Table 3.** Attitudes towards Mathematics and Self-Confidence in Teaching Mathematics

Items	College	Mean	Std. Dev.
Mathematics helps people think logically.	Univ. A	5.65	0.61
	Univ. B	5.67	0.59
Mathematics is enjoyable to me.	Univ. A	5.67	0.55
	Univ. B	5.06	1.43
Mathematics is a very worthwhile subject for every person.	Univ. A	4.54	1.43
	Univ. B	4.61	1.72
Mathematics makes me feel confused.	Univ. A	2.27	1.51
	Univ. B	2.22	1.48
I enjoy teaching mathematics	Univ. A	5.68	0.60
	Univ. B	5.61	0.61
I have a lot of self-confidence in teaching mathematics.	Univ. A	5.68	0.54
	Univ. B	5.11	0.68
I feel insecure about teaching mathematics.	Univ. A	1.96	1.40
	Univ. B	3.00	1.46
I am concerned about my ability to teach mathematics.	Univ. A	4.60	1.57
	Univ. B	4.78	1.22

were aware of their abilities. Although they all mentioned that they had confidence in teaching

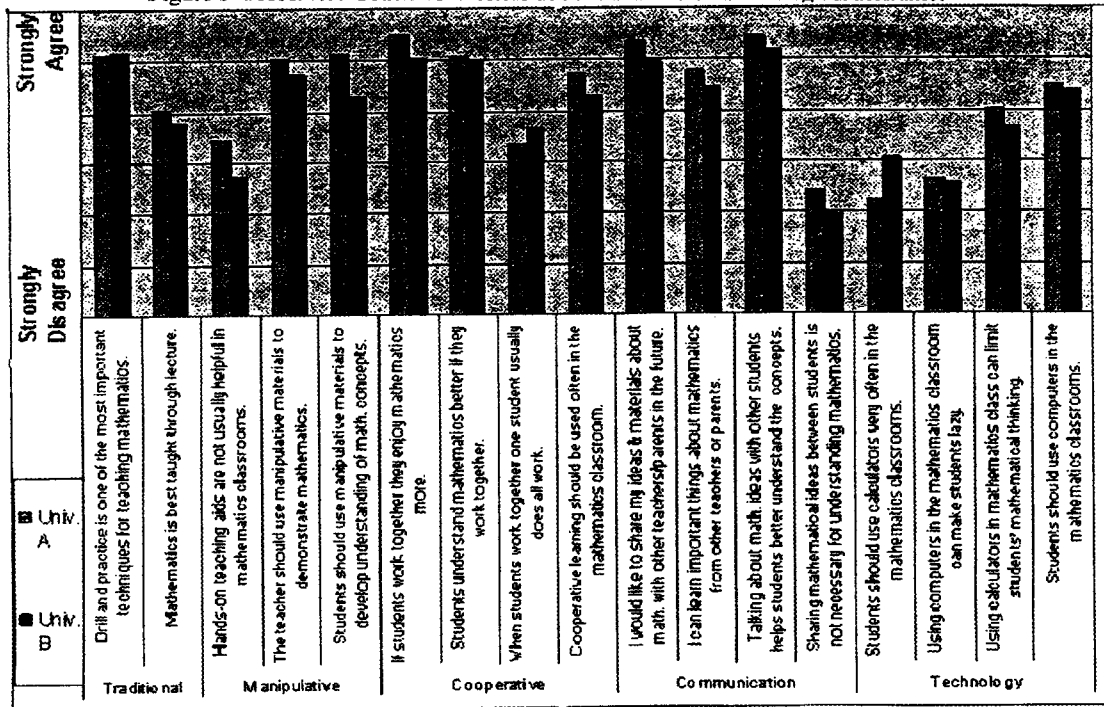
mathematics, preservice teachers in University B almost agreed that they also felt insecure about teaching the subject (see Table 3).

### 3.3 Beliefs about Methods of Teaching Mathematics

In this section, results are presented with a graph displaying the means of preservice teachers' answers to the questions on their beliefs about didactical methods of mathematics.

As it can be observed, preservice teachers strongly believe that drill and practice and lecture are among the most important techniques for teaching mathematics (see Figure 3). Public schools form the majority of institutes for grades 1 through 11 in Turkey. Because most of the classrooms in public schools are over 40-50 in number of students and lecturing is the most frequent method of teaching mathematics. Therefore, Turkish preservice teachers may think that this method is one of the main and useful methods in teaching mathematics.

Figure 3. Preservice Teachers' Beliefs about Methods of Teaching Mathematics



**Figure 3.** Preservice Teachers' Beliefs about Methods of Teaching Mathematics

They stated to believe that hands-on teaching materials are usually helpful in mathematics classrooms. They also advocated the use of cooperative learning in mathematics classrooms since they think that students understand mathematics better if they work together (See Figure 3). Participants in both universities would like to share their ideas and materials about mathematics with others. Moreover, they all strongly agreed that if students talk about mathematical ideas with other students, this would help them understand the concept better. (See Figure 3)

Computers are getting into schools in Turkey; however, we, as educators, are not that

ready to use computers in mathematics instruction more effectively. But preservice teachers agreed on the benefits of using the computers in mathematics classrooms unlike the use of calculators. Because they think that using calculators in mathematics classes can limit the students' mathematical thinking, thus they do not want students to use calculators often in the mathematics classrooms. For preservice mathematics teachers, calculators may mean the scientific calculators for computation and they may not be aware of the existence of graphing calculators and their capabilities in teaching and learning mathematics.

**Table 4.** Preservice Teachers' Beliefs about Their Teacher Preparation Program

<b>Mathematics Courses</b>	<b>COLLEGE</b>	<b>Mean</b>	<b>Std. Dev.</b>
The mathematics I learned at the university has prepared me to teach mathematics to students in the 21st century.	Univ. A	3.19	1.49
	Univ. B	3.22	1.40
The mathematics courses required in my program provided sufficient background in mathematics.	Univ. A	4.16	1.39
	Univ. B	3.56	1.29
The content of the required mathematics courses was unrelated to what I am going to teach.	Univ. A	3.76	1.61
	Univ. B	4.50	1.50
<b>Mathematics Education Courses</b>			
I can use learning theories learned in my program to help students understand mathematics.	Univ. A	4.74	1.09
	Univ. B	5.00	0.79
The pedagogical courses in my program were not very useful.	Univ. A	3.13	1.63
	Univ. B	3.33	1.24
The pedagogical courses in my program were helpful.	Univ. A	3.97	1.49
	Univ. B	3.83	1.38
<b>Field Experience Course</b>			
Observing experienced teachers is good preparation for teaching.	Univ. A	5.06	0.85
	Univ. B	5.56	0.70
I had more practical and useful experiences in field experience than I did in other courses.	Univ. A	4.33	1.52
	Univ. B	4.72	0.67
Student teachers should spend more time for teaching during field experience.	Univ. A	4.69	1.23
	Univ. B	4.78	0.88
<b>General</b>			
I learned everything that I need to know to be a good teacher in my teacher preparation program.	Univ. A	3.52	1.31
	Univ. B	3.72	1.56

### 3.4 Beliefs about the Program

Participating preservice teachers do not believe that mathematics they learned in their educational program would be helpful in their future teaching and the contents of the required mathematics courses were unrelated to what they were going to teach.

On the other hand, they did not have strong opinions about mathematics methods courses. They stated that they can use what they learned from mathematics method courses in their future classrooms but believed that the pedagogical courses were not very useful.

Although preservice teachers value observing experienced teachers as a good learning opportunity as a field experience, they agreed on the need for more time for teaching in field experience and they believe that they have more practical and useful experiences at the schools

## 4. RESULTS FROM THE COMPARATIVE STUDY

The followings are excerpts from Wagner, Lee, & Özgün-Koca (2000) in order to present a summary of the results from the comparative study. The aim is to provide a snapshot of differences in attitudes of preservice teachers from three different countries; Korea, Turkey, and the US.

*The amount of experience in the field:* There are considerable differences in student teaching time among US and Turkey. Preservice teachers from the US teach 5-6 courses for at least 5 weeks and they take full responsibility of a course for 7-8 weeks. Most student teachers develop/limit self-confidence based on success/failure of student teaching experience. So, US preservice mathematics teachers have more self-confidence in teaching mathematics and stronger beliefs towards mathematics than Turkish and Korean preservice mathematics teachers. Therefore, the more the student teaching may mean the more chance to adjust/improve themselves as teachers.

*Characteristics of students entering program:* Students in Turkey and Korea are placed in universities through a national exam right after finishing a high school, and choose their undergraduate education mainly based on the exam score. On contrast, students in U.S. apply for a faculty personally and start their program with more specific and determined aims. So the effects of different characteristics of students entering teacher preparation program have been observed in student teachers' commitment to the teaching job and their beliefs and attitudes towards mathematics.

*Beliefs towards pedagogical courses:* There are significant differences in beliefs about methods of teaching mathematics among preservice teachers from three countries. In Turkey and Korea, preservice teachers are less exposed to constructivist classroom environments than US preservice teachers. Strong dominance of traditional methods of teaching in Turkish and Korean students' experiences as students and students teachers brought forward the results favoring traditional methods (drill and practice and lecturing) more than US student teachers and favoring constructivist methods (cooperative learning and use of technology and manipulative materials) less than US preservice teachers.

Moreover, different amount of field experience provides different types and depth of opportunities to encounter teaching context. Throughout managing different teaching contexts, student teachers can develop criteria in determining effectiveness of teaching materials and techniques as US student teachers did more than Korean and Turkish student teachers.

*Beliefs about the program:* US preservice mathematics teachers more strongly believe in the usefulness and necessity of mathematics courses required in their program than Turkish and Korean preservice teachers. The content of mathematics courses in the program differ among countries. There are specific mathematics courses in the US prepared for prospective mathematics teachers with specific

mathematics contents according to K-12 mathematics curriculum with mathematics education focus.

All three countries had the same attitude towards the amount of student teaching. Even though US preservice teachers have the opportunity to teach a lot more than other two countries, all of them agreed that there should be more student teaching in their teacher preparation program.

## 5. DISCUSSIONS

These kinds of research on preservice teachers' attitudes on their profession and their attitudes towards their program play a vital role for Turkey at the age of reform in teacher education programs. We need to be aware of the students' needs as prospective mathematics teachers. As you see, the old program, which is enrolled by the participants, pointed out the need for more student teaching time. Turkish preservice teacher education program has been restructured with more field experiences at schools and classroom observations and especially with more students teaching time.

Moreover, Turkish preservice teachers indicated that they did not find the content of their mathematics courses related to their future teaching. New reformed program limit the mathematics courses to 3,5 years. So, teacher educators revised some mathematics courses and some two-semester mathematics courses were reduced into one semester and so on.

Repeating this study with preservice teachers enrolled in the reformed program may show whether the new program will be able to meet the demands of the prospective teachers.

## BIBLIOGRAPHY

- Adler, S. (1991). Forming a critical pedagogy in the social studies methods class: The use of imaginative literature. In B.R. Tabachnick & K.M. Zeichner (Eds.), *Issues and practices in inquiry-oriented teacher education*. (pp. 77-90). London: Falmer.
- Archer, J. (1999). Teachers' beliefs about successful teaching and learning in mathematics.

- <<http://www.aare.edu.au/99pap/arc99491.htm>> (2001, December 20)
- Aiken, L. (1972). Research on Attitudes Mathematics. *The Arithmetic Teacher*, Mar. 1972.
- Baskan, G. A. (2001). Öğretmenlik mesleği ve öğretmen yetiştirmede yeniden yapılanma. *Hacettepe Eğitim Fakültesi Dergisi*, 20, 16-25.
- Borko, H., & Putnam, R. (1996). Learning to teach. In D. Berliner & R. Calfee (Eds.) *Handbook of educational psychology* (pp. 673-708). New York: Macmillan.
- Britzman, D.P. (1986). Cultural myths in the making a teacher: Biography and social structure in teacher education. *Harvard Education Review*, 56(4), 442-455.
- Cross, F.J., et al. (1985). Second study of mathematics: Summary report. Champaign, IL.; Stipes Publishing Co.
- Doğan, M. (2001). Eğitim fakülterinde okuyan aday öğretmenlerin matematiğe karşı tutumları. IV. Fen Bilimleri Eğitimi Kongresi, Ankara; 6-8 Eylül 2000, 551-555.
- Holt-Reynolds, D. (1992). Personal history-based beliefs as relevant prior knowledge in course work. *American Educational Research Journal*, 29(2), 325-347.
- National Council of Teachers of Mathematics. (1991). *Professional standards for teaching mathematics*. Reston, VA: National Council of Teachers of Mathematics, Inc.
- Negangard, A. (1991). The effects of the cooperative learning versus lecture-discussion on student attitude and achievement in mathematics methods course for preservice elementary teacher. Unpublished Ph.D. Diss., Ohio University.
- Pajares, F. (1992). Teachers' beliefs and educational research: Cleaning up a messy construct. *Review of Educational Research*, 62, 307-332.
- Richardson, V. (1996). The role of attitudes and beliefs in learning to teach. In J. Sikula (Ed), *Handbook of research on teacher education* (pp. 102-119) New York: Macmillan.
- Wagner, S.; Lee, H. & Özgün-Koca, S. A. (2000). A comparative study of mathematics teacher education programs in the United States, Turkey, and Korea. Association of Mathematics Teacher Educators (AMTE) Fourth Annual Conference, Charlotte, NC. (ERIC Documentation Number SE 445 907)
- Yüksek Öğretim Kurulu. (1998). Eğitim fakülteleri öğretmen yetiştirme programlarının yeniden düzenlenmesi. Ankara: Yüksek Öğretim Kurulu.