Educational Research and Reviews Vol. 5(8), pp. 446-454, August 2010
Available online at http://www.academicjournals.org/ERR2
ISSN 1990-3839 © 2010 Academic Journals

Full Length Research Paper

Correlations between the mathematics teaching anxieties of pre-service primary education mathematics teachers and their beliefs about mathematics

Erhan Ertekin

Department of Elementary Mathematics Education, Education Faculty of Selçuk University, Konya, Turkey.
E-mail: eertekin@selcuk.edu.tr. Tel: + (90) 332-323 82 20 / 5657.

Accepted 23 June, 2010

This study investigates the correlation between the mathematical beliefs and mathematics teaching anxieties of prospective primary education mathematics teachers. The investigation, which could be classified as a correlation study, has been conducted on 299 prospective teachers studying at the 1st, 2nd, 3rd and 4th grades of one of the state universities in Turkey. As data gathering tools, "mathematics teaching anxiety scale (MATAS)" and "beliefs about mathematics scale (BMS)" have been used. As a result of the study, meaningful correlations were found between the "field training based teaching anxiety" and "attitude towards anxiety directed at teaching mathematics" sub-categories of the mathematics teaching anxiety scale (MATAS) and all sub-categories of the beliefs about mathematics scale.

Key words: Mathematics teaching anxiety, beliefs about mathematics, preservice teachers.

INTRODUCTION

There is no universal agreement on what constitutes good mathematics teaching. The opening quote indicates that what one considers to be desirable ways of teaching and learning mathematics is influenced by one's conception of mathematics (Thompson, 1992). As stated, although there is no universal agreement on good mathematics teaching, it is possible to say that subject knowledge is essential. However, numerous studies have shown that, besides the field knowledge of mathematics teachers, their belief about the nature of mathematics, learning and teaching mathematics have influence their in-class practices, which may be considered as one of the components of good teaching (Stipek et al., 2001; Cross, 2009; Wilkins, 2008; Beswick, 2007; Son and Crespo, 2009). In relation to how the teachers' concepts are about the nature of mathematics, Baki has shown that a teacher with an absolutist concept may present the stud- ent with routine mathematical tasks or problems that have no relation with the real world, while in contrast, a teacher who sees mathematics as a product of the human brain will believe that the student will set forth new solutions through intuition, there by taking them to completion through social interaction and present problems that will provide such opportunities.

In the same respect, Thompson (1984) found that a teacher who views mathematics as a collection of facts and rules to be memorized and applied is more likely to teach in a prescriptive manner, emphasizing rules and procedures conveyed by the teacher. On the other hand, a teacher who holds a problem solving view of mathematics is more likely to employ activities that allow students to construct mathematical ideas for themselves (Szydlik et al., 2003).

When it is considered that in-class practice includes factors such as the strategies and techniques used by the teacher in class, and even the communication established between the teacher and the students, its effect on the success of the students and its necessity for good teaching are clear. Therefore, as one of the components influencing these practices, the role of beliefs in teaching is too important to be underestimated.

Although, belief in general does not have a universally agreed upon definition, as Beswick (2007) and Ajzen and Fischbein (1980) defined beliefs as anything that an individual regards as true. Belief is viewed as knowledge of a sort, but Ernest (1989) suggested that knowledge is the

cognitive outcome of thought, while belief is the affective outcome of thought. Moreover, he acknowledged that beliefs also possess a slender but significant cognitive component (Cited in: Pajares, 1992). The stated cognitive dimension of belief brings to mind environmental factors that may specifically be important in the development of the cognitive characteristics of individuals, and Pajares (1992) has pointed out two sources influencing the formation of belief: Emotion-packed experiences and cultural transmission. For example, some prospective teachers give detailed accounts of crying, while they struggled to learn multiplication tables. They relate these experiences to their belief that they are incapable of learning mathematics (Ambrose, 2004).

The second source of beliefs, which is cultural transmission, creates beliefs that may be held at a subconscious level and can be thought of as resulting from the "hidden curricula" of humans' everyday lives. Culturally transmitted beliefs often take the form of assumptions and stereotypes. For example, because prospective teachers' mathematics works in schools that are consisted mostly of memorizing procedures, many assume that mathematics always requires memorization even though they have never heard a statement to that effect. People tend to be unaware of the culturally transmitted beliefs they hold (Ambrose, 2004). Also, beliefs shape individuals' perceptions of what they experience (Schoenfeld, 2000).

One of the fields where belief is in the foreground of teaching is mathematics. Mathematical beliefs are considered as personal philosophies or conceptions about the nature of mathematics as well as about teaching and learning mathematics (Thompson, 1992). According to what Thompson (1992) states about the nature of mathematics, many educated persons see mathematics as a discipline characterized by accurate results and infallible procedures, whose basic elements are arithmetic operations, algebraic procedures and geometric terms and theorems. For them, knowing mathematics is equivalent to being skillful in performing procedures and being able to identify the basic concepts of the discipline.

Ernest (1989) differentiated three views of mathematics, that is, problem solving, 'platonist', and instrumentalist. The problem solving view sees mathematics as a dynamic, continually expanding field of human creation and invention and a cultural product. Mathematics is a process of enquiry and is not a completed product, for its results remain open to revision. The second view is the 'platonist' view of mathematics which sees mathematics as a static but unified body of certain knowledge. From this point of view, mathematics is discovered and not created. Lastly, there is the instrumentalist view in which mathematics is pictured as an accumulation of unrelated facts, rules and skills to be used by the trained expert in the search of some desired end. In other words, mathematics is a set of unrelated but useful rules and facts (Duatepe-Paksu, 2008).

Mathematics is at the top of the list of subjects that will develop the student's ability to reason, and efforts. Through curriculum changes and studies in the field of mathematics teaching are carried out in order to realize this mission. As an example to these efforts, an endeavor has been made to train prospective teachers that have adopted the constructivist philosophy instead of the traditional teaching methods in order to realize the defined mission of mathematics. However, studies on beliefs show that this process is not going to be very easy, because prospective teachers do not arrive at formal teacher education "emptyheaded"; instead they bring with them a host of ideas and ways of thinking which they feel is related to math and the teaching of math that is drawn largely from their personal experiences of schooling. For many of the prospective teachers, knowing math had always meant being able to produce the answer the teacher wanted, paying only scant attention to why the algorithms worked (Ball, 1988). Some believe that teaching will be relatively straightforward, consisting primarily of offering clear explanations to children (Richardson, 1996; cited in Ambrose, 2004). Therefore, it is necessary to reemphasize that changing the hardened beliefs of prospective teachers who have arrived at undergraduate education from class environments where the traditional teaching model prevails will be a time and effort consuming job, as supported by the teachers' experiences. In fact, according to Pajares (1992), "beliefs are static and represent eternal truths that remain unchanged in a teacher's mind regardless of the situation". Robust beliefs are difficult to change (Rolka et al., 2006). However, some studies (Szydlik et al. 2003; Ambrose, 2004) have shown that beliefs can be developed with some effort.

In the development of the beliefs as well as knowledge bases of prospective teachers, who will play a key role in the bringing up of generations that are willing to discover the mysterious world of mathematics with well developed thinking skills and reasoning ability, large responsibilities rest on institutions that educate teachers. Crespo (2003) defines this responsibility of teacher training institutions by saying, "Teacher education courses must be designed to not only extend prospective teachers' knowledge base of mathematics, but to also provide opportunities to change and revise unexamined knowledge and beliefs about the subject matter and about teaching and learning." Schuck (1997) stated "views held by student teachers about the nature of mathematics need to be challenged and more accessible views of mathematics should be promoted by teacher educators". On the other hand, Davis (1999) has stated that one of the most problematic things he has seen in his professional life as both a mathematics and teacher educator is the lack of thoughts of teachers and prospective teachers on the nature of mathematics and on the role of mathematics in their lives. As a result, he has expressed the need for the development and changing of these beliefs.

One of the most important issues in math education is

the irregularity arising from the view of the nature of math knowledge. The teaching of mathematics in primary, secondary and higher education levels is based on absolutism (Baki, 2008). In this respect, the fact that prospective teachers receive training in environments based on such perspectives, especially during their undergraduate years, and the relationship of the teaching style of teachers with that of their own teachers is remembered. A teaching environment based on this perspective and lasting through generations is brought to mind. However, the effects of such teaching environments on the affective characteristics of the student, such as an adverse attitude towards math or anxiety, are well known, and it is highly probable that an individual who has been educated with such an approach will also develop similar beliefs.

If the continuation of this issue in math education is not wanted, it must first be ensured that the teacher sees math in the correct perspective (Baki, 2008). To this end, it is believed that it is important to change and develop the beliefs of teacher candidates in teacher educating institutes before their professional lives start.

It can be said that such environments contributing to the prospective teachers' belief that math is a conglomeration of rules that have to be memorized, will cause anxiety about teaching math in their professional lives and even before they start their professional lives. For instance, even when a prospective teacher who does not know any other method but invert and multiply in dividing fractions thinks about his/her helplessness, should a student ask why this algorithm is used, it would be enough to cause anxiety in teaching math. Therefore, determining such anxieties of the prospective teachers and to take the necessary precautions to alleviate these fears must be one of the duties of teacher training institutions.

Mathematics teaching anxiety may be defined as "the stress and anxiety experienced by teachers in teaching mathematical concepts, theories, formulas or problem solving" (Peker, 2006). Levine (1996) has stated that the anxiety of prospective teachers who experience high levels of math teaching anxiety are related to unpleasant experiences that have a relation with insufficient math knowledge and teaching math. Therefore, the close relationship of beliefs about the nature, learning and teaching of math with the in class practices of the teachers brings to mind the anxiety in teaching math that might be experienced by teachers who come from class environments where traditional teaching models are in the foreground, and who have developed algorithmic based beliefs about math. In fact, in a study carried out on prospective teachers by Peker (2009b), the teaching anxiety of the group who had been trained using problem solving strategies was considerably lower than the group trained by traditional methods. Again, in another study realized by Peker (2009a), the math teaching anxiety of a group trained by micro-teaching methods was significantly lower than the group trained by the traditional teaching model.

On the other hand, research indicated that abstract discussions regarding mathematical concepts increased the teaching anxiety of the preservice elementary school teachers who had high levels of anxiety for teaching mathematics. Moreover, using manipulative materials, getting familiar with developing creative teaching strategies for teaching mathematics and learning to design lesson plans in mathematical concepts reduced the teaching anxiety level of the pre-service elementary school teachers (Levine 1996; Akt. Peker and Halat, 2009). Similarly, Peker (2008) has stated that as the need to concretize the subject to be taught increases, so does the mathematics teaching anxiety of the prospective teachers. As a result, the abstract discussions mentioned before and the use of concrete tools in utilized in-class practices, and the results of investigations into the possible influence of these practices on the mathematics teaching anxiety show possible correlations between the two variables. For the fact that the studies lack investigating relation between these two variables in literature and because of the possible correlation mentioned, this study aims to determine if there is a correlation between the math beliefs of prospective mathematics teachers and their mathematics teaching anxieties. To this end, answers to the following questions have been sought:

1. How are the mathematics beliefs of prospective teachers?
2. Do the mathematical beliefs of prospective teachers change according to grade level?
3. What kind of a correlation is there between the mathematics beliefs of prospective teachers and their math teaching anxieties?

METHODOLOGY

The model of the research

Much of social research in general and educational research more particularly, is concerned with establishing interrelationships among variables (Cohen et al., 2000). Such research, carried out with the aim of establishing the relationship between two or more variables and to obtain some clues about the cause and effect, is correlational research (Büyüköztürk et al., 2008). Correlation techniques are generally intended to answer three questions about two variables or two sets of data. First, 'is there a relationship between the two variables (or sets of data)?' If the answer to this question is 'yes', then two other questions follow: 'What is the direction of the relationship?' and 'What is the magnitude?' (Cohen et al., 2000). As this study is concerned, the examination of the relationship between the mathematics teaching anxiety of prospective teachers and their mathematics beliefs, and if there is a relationship with its magnitude, is considered as a correlational research.

Participants

The participants of the research are made up of prospective primary education mathematics teachers studying in the 1st, 2nd, 3rd and 4th grades of one of the state universities in Turkey. At the mentioned university, there are four sections for each of the 1st, 2nd, 3rd and 4th grades, and for each grade, two sections were selected randomly and the participants selected from these

sections. A number of 35 persons from the first grade, 93 from the second, 88 from the third and 83 from the fourth participated in the research, making up a total of 299. A number of 216 persons were females and 83 were males. The age range of the participants was 17 – 25 and the mean was 20.78.

Data collecting tools

Mathematics teaching anxiety scale

'Mathematics teaching anxiety scale' is a 5-fold Likert-type scale comprising 23 queries. The queries making up the scale can be answered as the person agrees absolutely, the person agrees, the person is undecided, the person does not agree, and the person absolutely does not agree. Negative answers are valued from 5 to 1 and the positive responses from 1 to 5. Thus the total points will show the mathematics teaching anxiety points of the prospective teacher.

The 'mathematics teaching anxiety scale' developed by Peker (2006), is a 4-factor scale. These factors are: anxiety arising from field knowledge, made up of 10 queries having factor weights between 0.53 and 0.86; anxiety arising from self-confidence, made up of 6 queries with factor weights between 0.57 and 0.76; anxiety arising from the attitude towards teaching mathematics, made up of 4 queries having factor weights between 0.61 and 0.70; and anxiety arising from field teaching knowledge, comprising 3 queries with factor weights between 0.68 and 0.78. The reliability quotient of the scale is 0.91 and the reliability quotient for the four factors is 0.90 for the anxiety arising from field knowledge factor, 0.83 for the anxiety ari- sing from self-confidence factor, 0.71 for the anxiety arising from the attitude towards teaching mathematics factor and 0.61 for the anxiety arising from field teaching knowledge factor.

Belief about mathematics scale

In order to determine the beliefs of prospective teachers about mathematics, the 20-query, "beliefs about mathematics survey" developed by Aksu et al. (2002), has been used. The survey is a 4-fold Likert type graded from 'the person agrees absolutely' to 'the person absolutely does not agree' and has three sub-categories, namely: "beliefs about the process of learning mathematics" made up of 10 queries, "beliefs about the use of mathematics" consisting of 7 queries and "beliefs about the nature of mathematics", containing 3 queries. Aksu et al. (2002) have determined the reliability quotients of the sub-categories as 0.75, 0.71 and 0.66, respectively and for the entire survey itself as 0.75.

Data analysis

Descriptive statistics such as arithmetic means and standard deviation have been utilized in order to determine the beliefs of prospective teachers about mathematics, one-way variance analysis to determine whether beliefs showed differences according to the grade variable and Scheffe test (one of the multiple comparison tests) in order to determine from which group the difference arises, should there be one. 'Pearson multiplication of moments correlation quotient' analysis was used for the determination of the relationship between mathematical beliefs and mathematics teaching anxiety and determination quotient was used in determining the level to which mathematical beliefs explain the mathematics teaching anxiety.

FINDINGS

Prospective mathematics teachers' beliefs about mathematics

The means and standard deviations obtained by prospective teachers for each query of the beliefs about mathematics scale have been classified on the basis of the "beliefs about the process of learning mathematics", "beliefs about the use of mathematics" and "beliefs about the nature of mathematics" sub-categories and are presented in Table 1.

When the sub-categories are studied in order, it can be seen that the answers of the prospective teachers for most of the "beliefs about the process of learning math" sub-category queries lies in the "person absolutely does not agree" range. For example, the mean for the query, "you need to be good at memorizing in order to be successful in math" reflects the negative attitude of prospective teachers towards memorizing. In other words, prospective teachers do not see math as a subject that needs to be memorized. Their tendency not to agree with statements such as, "math problems must be solved in the way shown by the teacher" and "math can only be learnt from teachers," support this view. As a matter of fact, it has been determined through many studies (Duatepe-Paksu, 2008; Ball, 1990; Schuck, 1996) that individuals with an instrumentalist outlook see math as a whole to be made up of rules that need to be memorized, and that it can only be learnt if passed on by some experts. In this context, it can be said that the prospective teachers making up the sampling for this study do not have an instrumentalist outlook.

The means for the queries, "it is necessary to solve problems correctly and quickly to be successful in math" and "it is important to find the correct answer to be successful in math," seem to be more agreeable to prospective teachers compared to the others. In other words, prospective teachers have a tendency to focus on the result more than the process in problem solving and being successful in math. However, when it is considered that most of the queries in the learning process sub-category are those that the prospective teachers have the tendency not to agree with, it can be said that prospective teachers are in a transition period. Furthermore, the mean about the query "math is just for geniuses," shows that prospective teachers do not see math as a field where only a selected few can be successful. This can be taken as a sign that prospective teachers have the belief that individuals can learn mathematics through effort (Aksu et al., 2002).

When the queries about the use of mathematics are examined, it is seen that the prospective teachers have the tendency to agree with most of the statements. This indicates that prospective teachers see mathematics as a discipline used in daily life, which individuals need to know in order to succeed in many walks of life, in other words, that their beliefs about the use of mathematics are

Table 1. Means and standard deviations for the beliefs about mathematics scale queries.

Items	Mean	SD
Beliefs about the process of learning mathematics		
1. What is learnt in the classroom is enough to be successful in math.	1.62	0.69
2. You need to be good at memorizing to be successful in math.	1.44	0.63
3. Math is just for geniuses.	1.30	0.58
4. It is important to find the correct answer to be successful in math.	1.99	0.77
5. Math can only be learnt from teachers.	1.66	0.76
6. It is necessary to solve problems correctly and quickly to be successful in math.	2.04	0.80
7. Math problems must be solved in the way shown by the teacher.	1.43	0.62
8. The exercises in the math book can only be solved with the methods shown in the book.	1.12	0.43
9. In a mathematics course, it is sufficient to know the topics that will be asked in the exam.	1.24	0.57
10. Using a calculator makes learning math easier.	1.56	0.75
Beliefs about the use of mathematics		
1. Math is a universal language.	3.70	0.58
2. Mathematics is necessary to be successful in other courses.	2.91	0.74
3. Knowing math is important in all professions.	3.20	0.69
4. Math enhances practical intelligence.	3.61	0.54
5. Math makes daily life easier.	3.36	0.66
6. Math is a mental practice.	3.62	0.54
7. Math is used in each course.	3.14	0.77
Beliefs about the nature of mathematics		
1. Math is calculations.	2.07	0.65
2. Math is problem solving.	2.25	0.76
3. Math is numbers.	2.62	0.72

high. This finding supports the findings that were obtained from the research related to the math learning process. It was stated that, according to the findings about the math learning process, the prospective teachers do not have an instrumentalist outlook. An individual with an instrumentalist outlook sees math, independent of daily life, as a lesson where some rules are applied. However, as it was determined as a result of the research, the fact that prospective teachers see mathematics as a discipline used in daily life may be an indication that they are distanced from such an outlook. From this aspect, it can be said that both findings are consistent.

The means for querying the sub-category of belief about the nature of math are around 2.3 and prospective teachers seem to be in the process of establishing their beliefs about math. However, the fact that the mean for the query “math is calculations” is lower than the mean for the query, “math is problem solving” and the findings about the other sub-categories indicate that prospective teachers developing beliefs show that math is problem solving. On the other hand, while a higher mean for “math is numbers” seem to be a contradiction at this point, teacher candidates seem more directed towards a definition of math in the author’s opinion. However, in general, their beliefs about the nature of mathematics are not clearcut.

Teacher candidates’ beliefs in respect to grade level

In order to determine whether the mathematical beliefs of prospective teachers changed according to the grade level in the sub-categories of the scale, one-way variance analysis was applied to the sub-category points and the results have been presented in Table 2. The table shows that the F value calculated on the basis of their grade levels for the sub-category of “beliefs about the process of learning mathematics” is 0.523 ($p > 0.05$), for the sub-category of “beliefs about the use of mathematics” is 7.105 ($p < 0.01$) and for the sub-category of “beliefs about the nature of mathematics” is 1.517 ($p > 0.05$). Based on these results, while a meaningful difference at the level of 0.01 can be seen for the sub-category of “beliefs about the use of mathematics”, no difference has been determined for the other two sub-categories.

The results of the Scheffe test, carried out in order to determine at which grade levels the source of the difference is, are given in Table 3. The outcome of this

Table 2. ANOVA results for the mathematical belief points of teacher candidates according to the grade levels they are currently studying.

Sub-categories	Source of the variance	Sum of squares	df	Avg. Square	F	p
Beliefs about the process of learning math.	Between groups	17.275	3	5.758	0.523	0.667
	Within groups	3250.946	295	11.020		
Beliefs about the use of math.	Between groups	188.553	3	62.851	7.105	0.000
	Within groups	2609.494	295	8.846		
Beliefs about the nature of math.	Between groups	10.529	3	3.510	1.517	0.210
	Within groups	682.615	295	2.314		

Table 3. Scheffe test results about the mathematics belief points of teacher candidates according to their grade levels (sub-category of belief about the use of mathematics).

Grades		Beliefs about the use of mathematics		
		t	Std. error	P
1	2.00	-2.141	0.590	0.005
	3.00	-2.606	0.594	0.000
	4.00	-2.475	0.599	0.001
2	1.00	2.141	0.590	0.005
	3.00	-0.464	0.442	0.777
	4.00	-0.334	0.449	0.907
3	1.00	2.606	0.594	0.000
	2.00	0.464	0.442	0.777
	4.00	0.130	0.455	0.994
4	1.00	2.475	0.599	0.001
	2.00	0.334	0.449	0.907
	3.00	-0.130	0.455	0.994

test shows that there is a difference in the sub-category of “beliefs about the use of mathematics” between the 1st grade and the 2nd, 3rd and 4th grades to the advantage of the 2nd, 3rd and 4th grades. In other words, 2nd, 3rd and 4th grades have stronger beliefs about the use of mathematics. This finding may be interpreted as showing that the education that the prospective teachers making up the study’s sampling are receiving at the university is at least effective in developing beliefs about the use of mathematics. Furthermore, the fact that the belief level of the 1st grade students about the use of mathematics is lower than the other grades brings to mind the fact that the mathematics teaching at the intermediate education system of the country is carried out with no consideration of relationships with daily life.

Relation between beliefs about mathematics and teaching mathematics anxiety

The ‘Pearson multiplication of moments correlation quotients’ calculated between the points they have received from the beliefs about mathematics scale subcategories and the points accumulated from the subcategories of the mathematics teaching anxiety scale have been presented in Table 4.

When the correlation quotients for the mathematical beliefs and mathematics teaching anxieties of prospective teachers, shown in Table 4, are examined, it is seen that the values change between -0.211 and 0.129. When a detailed study is carried out, it can be seen that there are meaningful associations between the “attitude towards anxiety about teaching mathematics” (which is the third sub-category of the teaching anxiety scale) and the “beliefs about the process of learning mathematics” and “beliefs about the use of mathematics” sub-categories. Also, there are meaningful associations between the “field teaching knowledge in anxiety about teaching mathematics” sub-category of the teaching anxiety scale and all sub-categories of the mathematical belief scale. No meaningful association is determined between the first two subcategories of the mathematics

Table 4. Correlations between the beliefs about mathematics and the anxiety about teaching mathematics points of prospective teachers.

	Beliefs about the process of learning math	Beliefs about the use of math	Beliefs about the nature of math
Field knowledge of teacher candidates in anxiety about teaching mathematics	r = 0.052 p = 0.366	r = -0.069 p = 0.236	r = -0.036 p = 0.537
The self-confidence of teacher candidates in anxiety about teaching mathematics	r = 0.021 p=0.721	r = -0.110 p =0.058	r = -0.005 p = 0.933
The attitudes of teacher candidates towards teaching mathematics in anxiety about teaching mathematics	r = 0.129 p = 0.025	r = -0.162 p = 0.005	r = -0.010 p = 0.859
Field teaching knowledge of teacher candidates in anxiety about teaching mathematics	r = 0.127 p = 0.028	r = -0.211 p = 0.000	r = 0,117 p = 0.044

teaching anxiety scale (MATAS) and all subcategories of the beliefs about mathematics scale (BMS), and between the third sub-category of MATAS and the third sub-category of BMS.

When the correlation quotients for the sub-categories of the mathematics teaching anxiety scale and the beliefs about mathematics scale, in which meaningful associations that have been determined, are examined, it can be seen that the associations between the third and fourth sub-categories of MATAS and first and third sub-categories of BMS are positively meaningful, while the associations between the same sub-categories of MATAS and the second sub-category of BMS are negatively meaningful.

However, in general, the low correlation quotients between two variables indicate a low degree of association. On the other hand, according to the determination quotients obtained by taking the squares of the correlation quotients, it can be said that approximately 1.5% of the variability of the teaching anxiety in prospective teachers in the “attitude towards anxiety about teaching mathematics” sub-category of the mathematics teaching anxiety scale arises from “beliefs about the process of learning mathematics” and approximately 2.5% from the “beliefs about the use of mathematics.” Approximately, 1.5% of the variability in their anxiety in “field teaching knowledge in anxiety about teaching mathematics” sub-category arises from “beliefs about the process of learning mathematics”, about 4.4% from “beliefs about the use of mathematics” and 1.3% from “beliefs about the nature of mathematics”.

DISCUSSION AND CONCLUSION

Literature shows that prospective teachers see math as a field comprising unrelated rules, knowledge and skills, that does not require reasoning, but needs to be memorized (Rolka et al., 2006; Schuck, 1997). The findings from the study show that the views of prospective teachers about the mathematics learning process is quite opposite, in that they nurture the belief that mathematics is not a field that requires memorizing. Furthermore, prospective teachers display the tendency to focus on results rather than processes in succeeding in mathematics and problem solving. However, the fact that prospective teachers have a tendency to disagree with most of the queries of the mathematical beliefs scale, having to do with the process of learning, may be indicative of being in a transition period, and the reason may be given as the emphasis placed by the exam system currently valid in Turkey on reaching the correct answer in the shortest time possible. Aksu et al. (2002) obtained similar findings in a study carried out with primary education students and put forth the current exam system in Turkey’s educational system as the reason. On the other hand, traditional teaching is associated with behavioral approaches. Behavioral applications argue that knowledge can be transferred from individual to individual (Handal, 2003). Moreover, prospective teachers start their undergraduate studies with set beliefs, in which the development of their class experiences in their previous lives and what they have observed from their good teachers play a large role. These observations may be defined as easily understandable explanations often used in the traditional teaching of mathematics and the following practical applications (Prescott and Cavanagh, 2006). Although, the assumptions of the behaviorist approach in teaching mathematics have been delegated to the background with the renewed curricula in the education system of Turkey, it can be said that the prospective teachers making up the study’s sampling have been, especially at the primary education level, brought up with the traditional model. Therefore, the fact that for years, prospective teachers have been coming from educational environments where the transfer of knowledge by the teachers is in the foreground may be considered a factor in the emergence of this belief.

According to the traditional concept of teaching, math is a field of occupation made up of unrelated, unchanging, absolute and abstract rules that are far from daily needs, and formulas that must be learnt individually (Baki, 2008). However, the findings of the study about the use of mathematics indicate that prospective teachers see math as something that is used in daily life and as a discipline that must be learnt in order to be successful in many fields; in other words, it indicates that their beliefs about the use of mathematics are high. This finding obtained as a result of this research parallels the findings of Prescott and Cavanagh (2006) and Macnab and Payne (2003). Presmeg (2002) has stated that it is important to associate the applications of school math with daily life. NCTM (2000, p.4), points out that there is a growing increase in the need to understand mathematics and use it in daily life. As the teachers of the future, the belief of prospective teachers in the association of mathematics with daily life is providing humans with clues about the more meaningful teaching of mathematics.

The means for the sub-categories of the belief about the nature of mathematics are in the region of 2.3, which indicates that the prospective teachers are in the process of developing their beliefs. The belief of teacher candidates that mathematics is solving problems is higher than the belief that mathematics is calculations. This finding, when considered with previous findings, shows that prospective teachers are at the stage of developing beliefs on the point of considering mathematics as problem solving. Furthermore, the belief of prospective teachers that mathematics is numbers is higher than their belief that math is problem solving. All these findings indicate that the beliefs of teacher candidates about the nature of math are not yet very clear. However, the findings from the sub-categories of beliefs about the mathematics learning process and the use of mathematics indicate that this transition may be towards the belief that mathematics is solving problems.

Another finding obtained as a result of this research is, while no difference according to grade levels of the prospective teachers could be found in the sub-categories of “beliefs about the mathematics learning process” and “beliefs about the nature of mathematics”, a meaningful difference to the degree of 0.01 was determined in the “beliefs about the use of mathematics” sub-category between the 1st grade and 2nd, 3rd and 4th grades. Accordingly, 2nd, 3rd and 4th grades have stronger beliefs than the 1st grade about the connection of mathematics with daily life. That the difference is between the 1st grade and the other grades may be considered a reflection of the traditional education, which the prospective teachers received before starting their undergraduate education. On the other hand, this finding shows that a change starts to take place after the 2nd grade of undergraduate education of the teacher candidates, thereby providing signs that after the 1st grade, at least for the prospective teachers of the study’s sampling, the undergraduate education can change their beliefs. Moreover, the fact that 1st grade students have lower beliefs than other grades about the use of mathematics is a reflection of the mathematics education given in intermediate schools according to the educational system of Turkey without considering its relationship to everyday life.

According to another finding of the study, while correlations can be observed between the sub-categories of both the variables of mathematics teaching anxieties and beliefs about mathematics of prospective teachers, these correlations are at a low level. The two sub-categories with the highest level of correlation according to the correlation quotients are the belief about the use of mathematics and the field teaching knowledge in the mathematics teaching anxiety, while the negative correlation can be explained as the decrease of the anxiety about teaching mathematics arising from field teaching knowledge as the beliefs in the use of mathematics increase.

In other words, as the belief that ‘math is a field that is often used in daily life’ increases, teaching anxiety arising from field knowledge decreases. This may be the result of the knowledge gleaned from field education lessons taken by the prospective teachers at undergraduate level. In other words, when the beliefs of the prospective teachers in the use of mathematics are bolstered, they are less anxious about teaching mathematics due to field teaching knowledge. This situation also indicates the necessity for mathematics educators to use teaching methods based on problem solving in field teaching classes and to encourage teacher candidates to use the same methods. In fact, research shows that class practices during the university education of prospective teachers contribute to their existing beliefs and the development of their practical knowledge (Potari and Georgiadou- Kabauridis, 2009).

In general, meaningful correlations have been found between the sub-categories of “teaching anxiety arising from field teaching knowledge” and “attitude in mathematics teaching anxiety” and all sub-categories of the beliefs about mathematics. Of these, the correlation between attitude based anxiety and mathematical beliefs is meaningful when it is considered that the attitude is created by a belief in a special situation or object (Ambrose, 2004). This situation clearly shows that, especially, the mathematical beliefs of the teacher candidates must be carefully considered during the field teaching lessons for prospective teachers.

REFERENCES

Aksu M, Demir C, ve Sümer Z. (2002). Students' Beliefs about Mathematics: A Descriptive Study. Eğitim ve Bilim, 27 (123): 72-77.

Ambrose R (2004). Initiating change in prospective elementary school teachers’ orientations to mathematics teaching by building on beliefs. J. Math. Teacher. Educ., 7: 91-119.

Baki A (2008). Kuramdan Uygulamaya Matematik Eğitimi. Harf Eğitim Yayıncılığı, Ankara.

Ball DL (1988). Unlearning to teach mathematics. (Issue). East Lansing:

Michigan State University, National Centre for Research on Teacher Education. pp. 1-88.
Ball DL (1990). The mathematical understandings that prospective teachers bring to teacher education. Elementary School J., 90(4): 449–466.
Beswick K (2007). Teachers' beliefs that matter in secondary mathematics classrooms. Educ. Stud. Math., 65, 95-120.
Büyüköztürk Ş, Kılıç-Çakmak, E.,Akgün ÖE, Karadeniz Ş, Demirel F (2008). Bilimsel Araştırma Yöntemleri. Pegem Yayıncılık, Ankara.
Cohen L, Manion L, Morrison K (2000). Research Methods in Education. Routledge, Falmer, New York.
Crespo S (2003). Learning to pose mathematical problems: exploring changes in preservice teachers' practices. Educ. Stud. Math., 52: 243-270.
Cross DI, (2009). Alignment, cohesion, and change: examining mathematics teachers' beliefs structures and their influence on instructional practices. J. Math. Teacher. Educ., 12, 325-346.
Davis B (1999). Basıc irony: examining the foundatıons of school mathematics with preservice teachers. J. Math. Teacher. Educ., 2: 25–48.
Duatepe-Paksu A (2008). Comparing Teachers' beliefs about mathematics in terms of their branches and gender. H.U. J. Educ., 35: 87-97.
Handal B (2003). Teachers' mathematical beliefs: A review. Math. Educ., 13(2): 47-57.
Levine G (1996). Variability in anxiety for teaching mathematics among pre-service elementary school teachers enrolled in a mathematics course. Paper presented at the Annual Meeting of the American Educational Research Assocation in New York. (ERIC Document Reproduction Service No. ED398067).
Macnab DS, Payne F (2003). Beliefs, attitudes and practices in mathematics teaching: perceptions of Scottish primary school student teachers. J. Educ. Teaching., 29(1): 55-68.
NCTM (2000). Principles and Standards for School Mathematics. Reston, VA: NCTM Publications.
Pajares MF (1992). Teachers' beliefs and educational research: cleaning up a messy construct. Rev. Educ. Res., 62(3): 307-332.
Peker M (2006). Matematik öğretmeye yönelik kaygı ölçeğinin geliştirilmesi. Eğitim Bilimleri ve Uygulama, 9: 73-92.
Peker M (2008). Eğitim programları ve öğretmen adaylarının matematik öğretme kaygısı. VIII. Ulusal Fen Bilimleri ve Matematik Eğitimi Kongresi, Ağustos, Bolu.pp. 27-29.
Peker M (2009a). The use of expanded microteaching for reducing pre-service teachers' teaching anxiety about mathematics. Sci. Res. Essays, 4(9): 872-880.
Peker M (2009b). The effects of an instruction using problem solving strategies in Mathematics on the teaching anxiety level of the pre-service primary school teachers. New Educ. Rev., 19: 3-4, 95-114.
Peker M, Halat E (2009). Teaching anxiety and the mathematical representations developed through webquest and spreadsheet activities. J. Appl. Sci., 9(7): 1301-1308.
Prescott,A, Cavanagh M (2006). An investigation of pre-service secondary mathematics teachers' beliefs as they begin their teacher training. In Grootenboer P, Zevenbergen R, Chinnappan M (Eds.), Identities, Cultures and Learning Spaces (Proceedings of the 29th annual conference of the Mathernatics Education Research Group of Austlalasia, Sydney: MERGA., 2: 424- 431.
Presmeg N (2002). Beliefs about the nature of mathematics in the bridging of everyday and school mathematical practices. In (Eds. Leder GC, Pehkonen E, Törner G) Beliefs: A Hidden Variable in Mathematics Education?, Kluwer Acade. Publishers.,pp. 293-312.
Potari D, Georgiadou-Kabouridis B (2009). A primary tecahers' mathematics teaching: the development of beliefs and practice in different "supportive" contexts. J. Math. Teacher. Educ., 12: 7-25.
Rolka K, Rösken B, Liljedahl P (2006). Challenging the mathematical beliefs of preservice elementary school teachers. Proceedings of 30th Conference of the International Group fort he Psychology of Mathematics Education, Prague.
Schoenfeld AH (2000). Models of the teaching process. J. Math. Behav., 18(3): 243-261.
Schuck S (1996). Chains in primary teacher mathematics education courses: An analysis of powerful constraints. Math. Educ. Res. J., 8(2): 119–136.
Schuck S (1997). Using a research simulation to challenge prospective teachers' beliefs about mathematics. Teaching and Teacher Education., 13(5): 529- 539.
Son JW, Crespo S (2009). Prospective teachers' reasoning and response to a student's non-traditional strategy when dividing fractions. J. Math. Teacher. Educ., 12: 235-261.
Stipek DJ, Givvin KB, Salmon JM, andMacGyvers VL (2001). Teachers' beliefs and practices related to mathematics instruction. Teaching and Teacher Education, 17: 213-226.
Szydlik JE, Szydlik SD, Benson SR (2003). Exploring changes in Pre-service elementary teachers' mathematical beliefs. J. Math. Teacher. Educ., 6: 253-279.
Thompson AG (1992). Teachers' beliefs and conceptions: A synthesis of the research. In D. A. Grouws (Ed.), Handbook of research on mathematics teaching and learning . New York: Macmillan.pp. 127–146.
Wilkins JLM (2008). The relationship among elementary teachers' content knowledge, attitudes, beliefs, and practices. J. Math. Teacher. Educ., 11: 139-164.