



COMPARING TEACHERS' BELIEFS ABOUT MATHEMATICS IN TERMS OF THEIR BRANCHES AND GENDER

ÖĞRETMENLERİN MATEMATİK HAKKINDAKİ İNANÇLARININ BRANŞ VE CİNSİYET BAKIMIDAN KARŞILAŞTIRILMASI

Asuman DUATEPE PAKSU*

ABSTRACT: The aims of the study reported in this paper were to identify teachers' beliefs about mathematics and to analyze possible significant differences in mathematics beliefs in terms of teachers' branches and gender. Teachers' mathematics beliefs were investigated by use of a 20-item self-report questionnaire; related to beliefs about process of learning mathematics, use of mathematics, and nature of mathematics. Data of the study were collected from 324 teachers (195 primary school teachers, 52 science teachers, 40 mathematics teachers, and 37 preschool teachers). Findings revealed that (a) whereas the teachers appeared to have beliefs consistent with problem-solving view in few items; they held more traditional beliefs that could be classified as instrumentalist, (b) beliefs of the teacher on mathematics are similar regardless of gender, (c) mathematics teachers have the most instrumentalist view in for some items.

Keywords: teacher, beliefs about mathematics, teachers' branches, gender

ÖZET: Bu makalede anlatılan çalışmanın amacı öğretmenlerin matematik hakkındaki inançlarını belirlemek ve matematik inançlarının branş ve cinsiyete göre olası değişimlerini analiz etmektir. Öğretmenlerin matematik inançları 20 maddelik bir ölçek kullanılarak; matematik öğrenme süreci, matematiği kullanma ve matematiğin doğasıyla ilgili inançlar açısından incelenmiştir. Veriler 195 sınıf öğretmeni, 52 fen öğretmeni, 40 matematik öğretmeni ve 37 okul öncesi öğretmeni olmak üzere 324 öğretmenden toplanmıştır. Çalışmanın sonunda şu sonuçlara ulaşılmıştır: (a) her ne kadar öğretmenler birkaç maddede problem çözme olarak adlandırılan bakış açısıyla tutarlı inançlara sahip olsalar da genel olarak enstrümantalist olarak sınıflanan geleneksel bir bakış açısına sahiptirler. (b) öğretmenlerin inançları cinsiyete göre değişmemektedir. (c) matematik öğretmenleri diğer branşlara göre daha geleneksel bir bakış açısına sahiptirler.

Anahtar sözcükler: öğretmen, matematik hakkındaki inançlar, öğretmen branşları, cinsiyet

1. INTRODUCTION

Since it is broadly accepted that teachers' beliefs influence their teaching, the role of beliefs in teaching and learning continues to interest many researchers. The research about subject-specific beliefs, like mathematics, reading, or the science is feasible and useful in education (Pajares, 1992), as the ideas of content area teachers about what to teach and how to teach may be largely influenced by their beliefs (Buchmann, 1987). Some researches revealed that there are remarkable consistencies between teachers' beliefs about the ways in which they present the subject matter, the kinds of task they set, and assessment methods they use (Clark & Peterson, 1986; Kaplan, 1991; Kloosterman & Stage, 1992; Nisbet & Warren, 2000; Pehkonen & Torner, 1996; Peterson, Fennema, Carpenter, & Loef, 1989; Thompson, 1992). On the other hand, others have identified inconsistencies between beliefs and those classroom actions (Brown, 1986; Cooney, 1985; Shaw, 1990; Shield, 1999; Thompson, 1984).

Schoenfeld (1985) defined mathematical belief system as one's mathematics world view that means the perspective with which he/she approaches mathematics and mathematical tasks. Similarly, Lester, Garofalo, and Kroll (1989) claimed that mathematical belief systems comprise one's subjective knowledge about the self as a doer of mathematics, the nature of mathematics, the environment of mathematics, and mathematical tasks. Gorman (1991) divided mathematics beliefs into three parts: beliefs about mathematics as a discipline, beliefs that individuals hold about themselves and how they learn mathematics, and beliefs about what an individual do to learn mathematics. Raymond (1997) defined mathematics beliefs as personal judgments about mathematics formulated from experiences in mathematics, including beliefs about the nature of mathematics, learning mathematics, and teaching mathematics. McLeod (1989) characterized mathematics beliefs as being mainly cognitive in nature

* Yard. Doç. Dr., Pamukkale Üniversitesi, asumanduatepe@gmail.com

and as being developed over the time. He divided beliefs about mathematics into two major types: beliefs that individuals develop about mathematics as a discipline, and individuals' beliefs about themselves and their relationships to mathematics which include beliefs related to confidence, self concept, and casual attribution of success or failure.

Belief about mathematics is often classified into two or three view points in the literature. Skemp (1976) suggested two kinds of view to mathematics: relational mathematics and instrumental mathematics. Relational mathematics involves knowing what to do and why, on the other hand instrumental mathematics involves rules without reason. Ernest (1989) differentiated three views of mathematics; problem solving, Platonist, and instrumentalist. The problem solving view sees mathematics as a dynamic, continually expanding field of human creation and invention, 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, 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.

A hierarchy can be formed among these three kinds of beliefs. At the lowest level is an instrumentalism which involves knowledge of mathematical facts, rules and methods as separate units. The Platonist view of mathematics is at the next level, involving a global understanding of mathematics as a consistent, connected and objective structure. At the highest level the problem solving view seeing mathematics as a dynamically organized structure located in a social and cultural context is (Ernest, 1989).

In Third International Mathematics and Science Study (TIMSS) (Beaton, Mullis, Martin, Gonzalez, Kelly, & Smith, 1996) some mathematics beliefs of teachers were revealed. As the report of the study shows most teachers that believe mathematics is an essential vehicle to model the real world, the ability in mathematics is innate. Furthermore teachers believe that more than one representation should be used in explaining a mathematical concept.

Anderson (1997) surveyed and interviewed 25 primary teachers about their mathematics beliefs. The result of this study revealed that the majority of the teachers believe in the value of class discussion, teacher's modeling, and the use of manipulative in the classroom. On the other hand, teachers thought that calculators should not be an important component in teaching mathematics in the primary school.

To reveal mathematics achievement; beliefs about mathematics, mathematics teaching and mathematics learning; and attitudes towards mathematics of pre-service primary teachers, White, Way, Perry and Southwell (2005) designed a study. Analyses of 83 preservice teachers' scores on these variables revealed that teacher candidates disagree with the idea of that mathematics learning is being able to get the right answers quickly and being able to memorize facts is critical in mathematics.

Beswick, Watson, and Brown (2006) carried out a project that involved profiling 42 middle school mathematics teachers. They studied that the teachers' confidence in relation to the mathematics topics that they teach, their beliefs about numeracy and effective teaching of mathematics. Of their findings, they revealed that teachers do not seem to believe the idea of mathematics makes everyday life easier and only % 29 of teachers agreed with the idea of mathematics is computation.

Beswick (2005) conducted a study to determine what beliefs secondary mathematics teachers hold regarding the nature of mathematics, mathematics teaching, and mathematics learning. The study involved 25 (17 male, 8 female) mathematics teachers. Many of the teachers expressed beliefs about pedagogies that were consistent with constructivist ideas and yet many also held beliefs that were counter to constructivist principles. One of the finding of this study showed that 15 out of 25 secondary mathematics teachers do not think that mathematics is calculation.

Briefly, the literature on teachers' beliefs about mathematics suggests that, teachers hold the following beliefs:

- Mathematics is to know how to do procedures and formulas and to memorize correct procedures (Ball, 1990; Benbow, 1993; Foss & Kleinsasser, 1996; Southwell & Khamis, 1992; White, Way, Perry & Southwell, 2005).
- Calculators are not an important component in teaching mathematics (Anderson, 1997)
- Only geniuses are capable of doing mathematics, that is, ability in mathematics is innate (Beaton, et al., 1996; Foss and Kleinsasser, 1996; Schoenfeld, 1985)
- Mathematics is not calculations (Beswick, 2005; Beswick, Watson, Brown, 2006).
- On the other hand there are some inconsistencies on some research findings as:
- Whereas some studies asserted that teachers believe that mathematics is not related with daily life and cannot make daily life easier (Ball, 1988; Beswick, Watson, Brown, 2006; Cooney; 1985), Beaton, Mullis, Martin, Gonzalez, Kelly, & Smith (1996) showed most teachers believe that mathematics is an essential vehicle to model the real world.
- While Shoenfeld (1985) found that teachers thought that mathematics is not problem solving, Cooney (1985) revealed that teachers believe that mathematics is problem solving.

A few studies investigated on teachers' beliefs in terms of gender (Baydar, 2000; Li, 1996). Baydar (2000) carried out a study on preservice mathematics teachers from two universities. The result of this study showed no significant difference between the male and female teacher candidates in terms of beliefs about the nature of mathematics and teaching of mathematics. Li (1996) conducted a study on mathematics teachers hypothesizing that male and female teachers differ in beliefs about the importance and difficulty of selected mathematics topics. The results showed that, in general, male and female teachers were similar with respect to their beliefs regarding the importance and difficulty of certain mathematics topics. However, minor differences appeared. Numbers and operations was the only topic in which male and female teachers differed significantly. Male teachers believed that numbers and operations were more important than female teachers.

Approaching from a different perspective, Grossman and Stodolsky (1995) investigated on 399 teachers of mathematics, science, social studies, and foreign languages by survey and interview. It was revealed that the mathematics teachers, compared with those of the other subjects, consider their subject highly sequential, static, and have stronger consultation within their faculty for coordinating course content and common exams.

Gender differences have been considered as an important factor in educational studies. Furthermore teachers' branches are also a significant factor since it can affect many characteristics in educational settings. As seen above, research on the relationship between mathematics beliefs with gender and branch is limited.

From this point of view, the aims of the study reported in this paper were to identify teachers' beliefs about mathematics and to analyze possible significant differences in mathematics beliefs in terms of teachers' branches and gender. In this study, the term teachers' beliefs about mathematics is used as that what constitutes their subjective knowledge about how mathematics is learned, what is needed to be done to be successful in mathematics, the use of mathematics, and their opinions about mathematics.

More specifically, this research study aims to answer the following research questions:

1. What is the mathematics belief of the teachers?
2. Does teachers' mathematics belief differ in terms of their gender?
3. Does teachers' mathematics belief differ in terms of their branches?

This research study was important for a number of reasons. First, the results of the study will yield a better understanding for teachers' beliefs about mathematics. Second the study will provide a clear picture of possible significant relation between mathematics beliefs with teachers' branches and gender.

2. METHOD

2.1. Participants

Data of the study was collected from 324 teachers. The sample involves 195 primary school teachers, 52 science teachers, 40 mathematics teachers, and 37 preschool teachers. Totally 50.3% of the sample was male and 49.7 % was female. The number of participants in terms of their branches and genders is given in the Table 1.

Table 1: The participants of the study in terms of their genders and branches

	Primary school teacher	Science teacher	Mathematics teacher	Preschool teacher	Total
female	93	21	12	37	163
male	102	31	28	0	161
Total	195	52	40	37	324

2.2. Instrument

2.2.1. Beliefs about Mathematics Survey

This 20- item survey was developed by Aksu, Demir, and Sümer (2002). It is a four point Likert type scale with the alternatives of "completely disagree, disagree, agree, and completely agree". There are three dimensions; beliefs about process of learning mathematics (BPLM) with 10 items, beliefs about use of mathematics (BUM) with seven items, beliefs about nature of mathematics (BNM) with three items. Item in the BPLM dimension generally related to how mathematics is learned, and what is needed to be done to be successful in mathematics; BUM dimension was related to the importance and use of mathematics, and BNM dimension consisted of items related to the opinions about the characteristics of the mathematics. Aksu, Demir, and Sümer (2002) reported the overall reliability coefficient as .75 and internal consistencies of the scales as .75, .71, .66, for the BPLM, BUM, and BNM, respectively.

3. FINDINGS

The findings related with each question will be given in an order.

3.1. What is the mathematics belief of the teachers?

The means and the standard deviations of the teachers' scores for the each item of the survey are displayed in Table 2. Items are given in terms of the dimensions of the survey. The mean scores changes between 1.17 and 3.63 out of 4 for the items of the survey.

When the scores for the first dimension are examined, it can be said that teachers agreed with the items of 1, 2, 5, 7 and 9. Particularly, teachers believed that finding the correct answer is important to be successful in mathematics, questions should be solved by the way taught by the teacher, the mathematics can only be learned from teacher, and exercises in a book can only be done by using the methods given in the book. Other than this, teacher believed that usage of calculator provides mathematics learning easier.

Table 2: The means and the standard deviations of the teachers' scores for the each item of the survey

Items	Mean	SD
Beliefs about the process of learning mathematics		
1. To be successful in mathematics, it is important to find correct answer.	3.37	.66
2. Mathematics questions should be solved by the methods taught by the teacher.	3.63	.50
3. To be successful in mathematics, it is necessary to solve the problems quickly and correctly.	2.37	.98
4. To be successful in mathematics, what is learned in the classroom is sufficient.	1.94	.91
5. Mathematics can only be learned from teacher.	3.34	.77
6. To be successful in mathematics, you need to be good at memorizing.	2.76	.89
7. The exercises in a mathematics book can only be done by using the methods given in the book.	3.52	.62
8. In a mathematics course, it is sufficient to know the topics that will be asked in the exam.	1.70	.82
9. Using a calculator makes it easier to learn mathematics.	3.51	.68
10. Mathematics is the work of genius.	2.31	.98
Beliefs about the use of mathematics		
11. Mathematics facilitates practical intelligence.	1.71	.85
12. Knowing mathematics is important for all professions.	3.42	.64
13. Mathematics is a mental practice.	1.60	.78
14. Mathematics is a universal language.	2.83	.92
15. Mathematics makes everyday life easier.	1.49	1.30
16. Mathematics is necessary to be successful in other courses.	2.11	.87
17. Mathematics is used in each course.	1.23	.60
Beliefs about the nature of mathematics		
18. Mathematics is numbers.	3.16	.87
19. Mathematics is problem solving.	1.47	.74
20. Mathematics is doing calculations.	1.17	.52

Teachers certainly disagreed with idea given in the item number 4 and 8. In other words they thought that what is learned in the classroom is not enough to be successful in mathematics and knowing the topics that will be asked in the exam is not sufficient. For the item 3, 6 and 10, the teachers' mean score was around 2.5 that is between disagreement and agreement. Mainly teacher in a transition with the idea of in order to be successful in mathematics, it is necessary to solve the problems quickly and correctly and you need to be good at memorizing. Besides, it is seemed that they have no definite idea of "mathematics is the work of genius".

For the beliefs about the use of mathematics, teachers agreed with the item of knowing mathematics is important for all professions. On the other hand they disagreed with idea given in the item number 11, 13, 15, and 17. They did not seem to believe that mathematics facilitates practical intelligence and is a mental practice. Besides they did not believe the idea of mathematics is used in each course and makes everyday life easier. Their mean score is between 2 and 3 for the items of "Mathematics is a universal language" and "Mathematics is necessary to be successful in other courses". Related with the beliefs about the nature of mathematics, teachers believe that mathematics is neither problem solving nor calculations. They thought that mathematics is numbers.

3.2. Does the mathematics belief differ in terms of teachers' gender?

The analysis revealed that female teachers and male teachers got fairly similar results except for the fourth item. The differences are not significant at $\alpha = .05$, apart from this item. In other words, there is no significant difference between belief scores of female and male teachers. For the item of "To be successful in mathematics, what is learned in the classroom is sufficient", male teachers ($M = 3.04$, $SD=.95$) got higher scores than female teachers ($M = 1.86$, $SD= .85$). This difference is significant at $\alpha = .05$, [$t(322) = 3.465$, $p < .05$]. In other words, there is a significant difference between the scores of female and male teachers for this item. The calculated large effect sizes ($d=1.35$) claims the practical significance of this findings.

3.3. Does the mathematics belief differ in terms of teachers branches?

For the first dimension there was a difference between branches for five items. The ANOVA revealed significant differences, $F(3,320) = 3.075$, $F(3,320) = 6.172$, $F(3,320) = 4.749$, $F(3,320) = 2.783$, and $F(3,320) = 5.813$, $p < .05$, for the items of 1, 2, 6, 7, and 8, respectively. The effect sizes were calculated as .72, .104, .87, .68, .93 for these five items respectively. As for these items there was a significant difference between mean scores, a post hoc analysis of Tukey test was used to decide mean scores of which branch/branches differ(s) significantly from others. The result of the post hoc analyses for the first item indicated that the mathematics teachers ($M=3.62$, $SD=.68$) got significantly higher score than primary school teachers ($M=3.32$, $SD=.64$). There was no significant difference detected among the mean scores of primary school teachers, science teachers ($M=3.49$, $SD=.71$) and preschool teachers ($M=3.38$, $SD=.76$). In other words, mathematics teachers more agree that the idea of finding correct answer is important to be successful in mathematics than primary school teachers. No significant difference was seen among the opinion of primary school teachers, science teachers and preschool teachers.

The result of the post hoc analyses for the second item indicated that mathematics teachers ($M=3.85$, $SD=.35$) got significantly higher score than science teachers ($M=3.48$, $SD=.41$) and primary school teachers ($M=3.57$, $SD=.54$). There was no significant difference detected between the mean scores preschool teachers ($M=3.69$, $SD=.48$) and other branches. No significant difference was detected between the mean scores of primary school teachers and science teachers. Namely mathematics teachers more agree with the thought of “mathematics questions should be solved by the methods taught by the teacher” than the science teachers and primary school teachers. No significant differences detected between the beliefs of preschool teachers with other branches and the views of primary school teachers and science teachers did not differ.

The analyses revealed that the mathematics teachers ($M=3.11$, $SD=.39$) got significantly higher score than primary school teachers ($M=2.61$, $SD=.96$) for the sixth item. No significant difference was detected among the mean scores of primary school teachers, science teachers ($M=3.00$, $SD=.75$) and preschool teachers ($M=2.63$, $SD=.95$). Also no significant difference was detected among the mean scores of mathematics teachers, science teachers and preschool teachers. Particularly, mathematics teachers more agree that the idea of “it is necessary to be good at memorizing in order to be successful in mathematics” than primary school teachers. No significant difference was seen the opinions of primary school teachers, science teachers and preschool teachers. Likewise, no significant difference was detected among the mathematics teachers, science teachers and preschool teachers’ beliefs.

For the seventh item, the result of the post hoc analyses indicated that the mathematics teachers ($M=3.71$, $SD=.45$) got significantly higher score than primary school teachers ($M=3.48$, $SD=.67$). There was no significant difference among the mean scores of primary school teachers, science teachers ($M=3.61$, $SD=.71$) and preschool teachers ($M=3.53$, $SD=.51$). In other words, mathematics teachers more believe that the idea of “the exercises in a mathematics book can only be done by using the methods given in the book” than primary school teachers. No significant difference was seen the opinions of primary school teachers, science teachers and preschool teachers.

The result of the post hoc analyses for the eighth item indicated the mathematics teachers ($M=2.14$, $SD=.15$) got significantly higher score than preschool teachers ($M=1.69$, $SD=.26$) and primary school teachers ($M=1.60$, $SD=.05$). There was no significant difference between the mean scores of science teachers ($M=1.82$, $SD=.11$) and other branches. The mean score of preschool and primary school teachers did not differ. Mainly, mathematics teachers more agree that the idea of “it is sufficient to know the topics that will be asked in the mathematics exam” than preschool and primary school teachers. No significant difference was seen between opinions of science teachers and other branches for this statement. The views of preschool and primary school teachers seemed similar.

For the second dimension the only significant difference was seen for the item number 14 as a result of ANOVA [$F(3,320) = 10.390$, $p < .05$]. In other words, a significant difference among the mean scores of different branches teachers was detected for the item of “Mathematics is a universal

language". The effect size was calculated as .138 for this item. The result of the post hoc analyses indicated the mathematics teachers ($M=3.45$, $SD=.61$) got significantly higher score than the primary school teachers ($M=2.70$, $SD=.92$) and preschool teachers ($M=2.30$, $SD=1.18$). The science teachers ($M=3.12$, $SD=.79$) also got significantly higher score than primary school teachers and preschool teachers. No statistically significant difference was found between the mean scores of primary school and preschool teachers. In other words, mathematics and science teachers more believe the opinion of mathematics is a universal language than primary school and preschool teachers. No significant difference was seen the opinions of primary school teachers and preschool teachers. The beliefs of preschool and primary school teachers did not differ. For the third dimension no significant difference was detected.

4. DISCUSSIONS, CONCLUSIONS, AND RECOMMENDATIONS

Findings of the study confirm that teachers believed that finding the correct answer is very important to be successful in mathematics and the mathematics can only be learned from teacher. This is not surprising when school settings are considered. Typical classroom activities are generally motivated by finding the correct answer of the university entrance exam or the high school entrance exam. Parallel with this belief, teachers did not believe the idea of mathematics makes everyday life easier, since their motivation is finding the correct answer rather than understanding mathematical thinking and its everyday application. This finding of the study related with everyday usage of mathematics supports the findings of previous studies of Beswick, Watson, and Brown (2006), who provided evidence to show teachers do not seem to believe the idea of mathematics makes everyday life easier; Ball (1988) who revealed that preservice teachers found mathematics was mostly abstract and symbolic, having little to do with the real world and Cooney (1985) who found that beginning high school teachers believed that some mathematics may not have real life applications.

While this study implicated that teachers believe that questions should be solved by the way taught by the teacher and exercises in a book can only be done by using the methods given in the book, they are in a transition with the idea of in order to be successful in mathematics, you need to be good at memorizing. On the other hand literature showed that preservice teachers (Benbow, 1993; Foss & Kleinsasser, 1996; White, Way, Perry & Southwell, 2005) and inservice teachers (Ball, 1990; Southwell & Khamis, 1992) believe that mathematics is simply knowing how to do it or remembering proper procedures.

Findings also appear to suggest that teachers believed that usage of calculator makes learning mathematics easier which is inconsistent with the result of Anderson (1997) who found primary teachers were of the opinion that calculators should not be an important component in teaching mathematics in the primary school. This finding can be interpreted as the teachers' awareness of usage of the technology. As both Turkish primary and elementary mathematics curriculums (MEB, 2005a; 2005b; 2005c) and NCTM (2000) emphasized that technology influences the mathematics that is taught and enhances students' learning, this finding can be interpreted as very positive.

Different from the Schoenfeld (1985) argument that preservice teachers believe that only geniuses are capable of discovering or creating mathematics, teachers are unsure on the item of mathematics is the work of genius. It is seemed that they not have a definite idea about this sentence. On the other hand some previous research findings suggest that preservice teachers agree with the item of "Some people have a mathematical mind and some don't" (Frank, 1990) and teachers believe that ability in mathematics is innate (Beaton, et al., 1996; Foss and Kleinsasser, 1996).

Related with the beliefs about the nature of mathematics, teachers do not believe that mathematics is problem solving. This result is similar with Schoenfeld (1985) argument that preservice teachers believe that formal mathematics has little or nothing to do with real thinking or problem solving and contradicts with the result of Cooney (1985) who found that beginning high school teachers believed that mathematics was primarily problem solving. Beside that they do not think that mathematics is doing calculations which is consistent with the result of Beswick (2005) who

found secondary mathematics teachers equates mathematics with calculation and Beswick, Watson, & Brown, (2006) who found only % 29 of the middle school mathematics teachers agreed with the idea of mathematics is computation. Another finding which gives the evidence that teachers' beliefs can be categorized as instrumentalist that they thought that mathematics is numbers. Contrary to teachers believes, mathematics is more than numbers, calculations, strict algorithms and correct answers (NCTM, 2000).

Beliefs of the teachers on mathematics are amazingly similar regardless of gender except for only one item. This finding is parallel with the result of Li (1996), who revealed that no substantial gender differences have been noticed in mathematics teachers' beliefs regarding the importance and difficulty of certain mathematics topics and Baydar (2000) who asserted that no significant difference exists between the male and female teacher candidates in terms of beliefs about the nature of mathematics and teaching of mathematics. On the other hand teachers' beliefs are different on the item of "To be successful in mathematics, what is learned in the classroom is sufficient." Male teachers more agree about this idea than female teachers.

One of the interesting findings of this study indicated that mathematics teachers more agree with the following items than those other subjects' teachers:

- (a) finding correct answer is important to be successful in mathematics,
- (b) mathematics questions should be solved by the methods taught by the teacher,
- (c) it is necessary to be good at memorizing in order to be successful in mathematics ,
- (d) the exercises in a mathematics book can only be done by using the methods given in the book,
- (e) in a mathematics course, it is sufficient to know the topics that will be asked in the mathematics exam.

It is remarkable that while the mathematics teacher should know the structure of mathematics and pedagogical aspects of mathematics teaching, they have the most instrumentalist view in for these items. This result can be stemmed from the mathematics teachers rule based view and their exam oriented teaching style. This finding is similar with the findings of Grossman and Stodolsky (1995) who found that compared to teacher of other subjects, mathematics teachers consider mathematics highly sequential and static.

Briefly, whereas the teachers appeared to have beliefs consistent with Ernest's (1989) problem-solving view in few items, they held more traditional beliefs that could readily be classified as instrumentalist. Teachers still perceive mathematics as a discipline with rules and procedures that has to be memorized rather than a dynamic, continually expanding field of human creation and invention, a cultural product. Replication of this study on different branches of teacher is recommended to determine to see whether teachers of other branches show similar pattern or not. To prepare teachers held more sophisticated beliefs, pre-service teacher training programs should involve course(s) to inform teacher candidates about the nature, use and importance of mathematics.

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GENİŞLETİLMİŞ ÖZET

Öğretmenlerin inançlarının öğretimlerini etkilediği yaygın olarak kabul edildiğinden öğrenme ve öğretilmede inançların rolü pek çok araştırmacının ilgisini çekmeye devam etmektedir. Alan öğretmenlerinin neyin nasıl öğretilmesi gerektiği konusundaki düşünceleri inançlarından büyük ölçüde etkilendiği için (Buchmann, 1987), alana özgü inançlar örneğin matematik, okuma ya da bilim hakkındaki inançlar ile ilgili araştırmalar yapılması yararlı ve uygundur (Pajares, 1992).

Matematik hakkındaki inançlar kişinin matematik dünyasına bakışı yani matematiğe ve matematiksel çalışmalara yaklaşımındaki algısı olarak tanımlanabilir. Öğretmenlerin matematik hakkındaki inançlarına yönelik alanyazın onların aşağıda özetlenen gibi inançlara sahip olduğunu göstermiştir:

- Matematik, işlemleri nasıl yapacağını ve formülleri nasıl kullanacağını bilmek ve doğru işlem basamaklarını ezberlemektir (Ball, 1990; Benbow, 1993; Foss & Kleinsasser, 1996; Southwell & Khamis, 1992; White, Way, Perry & Southwell, 2005).
- Hesap makineleri matematik öğretiminde önemli bir unsur değildir (Anderson, 1997)
- Sadece dahiler matematiği yapabilirler yani matematik becerisi doğuştandır (Beaton, Mullis, Martin, Gonzalez, Kelly, & Smith, 1996; Foss and Kleinsasser, 1996; Schoenfeld, 1985)
- Matematik hesaplama değildir (Beswick, 2005; Beswick, Watson, Brown, 2006).
- Diğer taraftan bu konuyla ilgili bazı araştırmalardan tutarlı olmayan sonuçlar elde edilmiştir. Bu sonuçlar şu şekilde özetlenebilir:
- Beaton, et al., (1996) çoğu öğretmenin matematiği günlük hayatı modellemede gerekli bir araç olduğuna inandığını ortaya koymuştur. Bazı çalışmalarda öğretmenlerin matematiği günlük hayatla ilgili olmadığını ve günlük hayatı kolaylaşdırmadığına inandığını belirlemiştir (Ball, 1988; Beswick, Watson, Brown, 2006; Cooney, 1985).
- Shoenfeld (1985) öğretmenlerin matematiği problem çözme olarak görmediğini ortaya koymuş, Cooney (1985) ise öğretmenlerin matematiğin problem çözme olduğuna inandığını belirlemiştir.

Diğer bir açıdan bakarak Grossman and Stodolsky (1995) 399 matematik, fen, sosyal bilimler ve yabancı dil öğretmenin matematik hakkındaki inançlarını araştırmıştır. Çalışma matematik öğretmenlerinin diğer branş öğretmenlerine göre matematiği daha ardışık ve durağan olarak algıladıklarını ortaya koymuştur.

Baydar (2000) iki üniversiteden aday matematik öğretmenlerinin matematik hakkındaki inançları üzerine çalışmıştır. Çalışma sonucunda kadın ve erkek öğretmen adaylarının matematiğin doğası ve matematik öğretimi konusunda benzer inançlara sahip olduklarını bulmuştur.

Li (1996) kadın ve erkek matematik öğretmenlerinin seçilen matematik konularının önemi ve zorluğu konusunda farklı inançlara sahip olup olmadıklarını araştırmıştır. Sonuçlar küçük bir farklılık dışında genel olarak kadın ve erkek öğretmenlerin verilen konuların önemi ve zorluğuna ilişkin inançlarının benzer olduğunu ortaya koymuştur. Erkek öğretmenlerin kadın öğretmenlere göre sayılar ve işlemlerin daha önemli olduğuna inandıklarını belirlemiştir.

Bu makalede anlatılan çalışmanın amacı öğretmenlerin matematik hakkındaki inançlarını belirlemek ve matematik inançlarının branş ve cinsiyete göre olası değişimlerini analiz etmektir. Çalışmada matematik hakkındaki inanç terimi; matematiğin nasıl öğrenildiği, matematikte başarılı olmak için ne yapılması gerektiği, matematiği kullanma ve matematik hakkındaki fikirlerden oluşmaktadır.

Veriler 195 sınıf öğretmeni, 52 fen öğretmeni, 40 matematik öğretmeni ve 37 okul öncesi öğretmeni olmak üzere 324 öğretmenden (% 50.3 erkek ve % 49.7 kadın) toplanmıştır. Öğretmenlerin matematik inançları Aksu, Demir, and Sümer (2002) tarafından geliştirilen 20 maddelik matematik inançları ölçeği kullanılarak toplanmıştır. Üç boyutlu olan ölçekte matematik öğrenme sürecine yönelik inançlara ilişkin 10, matematiği kullanmaya yönelik inançlara ilişkin yedi ve matematiğin doğasıyla ilgili inançlara ilişkin üç adet madde bulunmaktadır.

Bulgular birkaç maddede öğretmenlerin Ernest'in problem çözme bakış açısı olarak isimlendirdiği inançlara sahip olsalar da genel olarak enstrümantalist olarak sınıflanan geleneksel bir bakış açısına sahip olduklarını ortaya koymuştur. Öğretmenler hala matematiği dinamik, sürekli gelişen bir insan icadı ve kültürel ürün yerine kuralları ve işlemleri ezberlenmesi gereken bir disiplin olarak görmektedirler.

Öğretmenlerin matematik hakkındaki inançları "Matematikte başarılı olmak için sınıfta öğrenilenler yeterlidir" maddesi dışında cinsiyete göre değişmemektedir. Erkek öğretmenler bu maddeye kadın öğretmenlerden daha çok katılmaktadır.

Şaşırtıcı bir şekilde araştırma matematik öğretmenlerinin aşağıdaki maddelere diğer branş öğretmenlerinden daha çok katıldıklarını ortaya koymuştur:

- (a) doğru cevabı bulmak matematikte başarı için önemlidir,
- (b) matematik soruları öğretmenin öğrettiği yöntemle çözülmelidir,
- (c) matematikte başarılı olmak için ezberlemede iyi olmak gerekir,
- (d) bir matematik kitabındaki alıştırmalar yalnızca o kitapta verilen yöntem kullanılarak yapılabilir,
- (e) matematik dersinde sınavda sorulacak konuları bilmek yeterlidir.

Matematik öğretmenlerinin matematiğin yapısını ve matematik öğretmenin farklı yönlerini bilmeleri gerekirken bu maddelerde enstrümantalist bakış açısına sahip olmaları dikkat çekicidir.

Çalışmanın benzeri daha farklı branştaki öğretmenler üzerine yapılarak diğer branş öğretmenlerinin de benzer sonuçlar gösterip göstermedikleri incelenebilir. Daha gelişmiş inançlara sahip öğretmenler yetiştirmek için öğretmen yetiştirme programları öğretmen adaylarını matematiğin doğası, kullanımı ve önemi konusunda bilgilendirecek dersler içermelidir.