

Self-efficacy beliefs of students of primary school teaching department regarding mathematics and teaching mathematics

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ABSTRACT

Prospective teachers' attitudes and beliefs regarding self-efficacy beliefs become the basis of their attitudes in their professional lives, as they affect their students' attitudes and self-efficacy. The aim of this study is to determine the primary teacher training students' attitudes towards mathematics and self-efficacy beliefs regarding teaching math and the relationship among them. The "Relational Scanning Model" is used in the study. Data is collected from 290 students who were studying in the Primary Education Department of 9 Eylül University, Buca Faculty of Education. Mathematics Attitude Scale and Self-efficacy Belief Scale towards Teaching Mathematics are used to gather data. SPSS 22 was used for data analyses. T-test used for identifying significance of differences, and the Pearson correlation coefficient by means of different aspects. Results showed no differences by gender in attitudes towards math and self-efficacy beliefs regarding teaching math of the students who completed the survey. However, although Primary Education prospective teachers scores were higher in their attitude points and self-efficacy towards math teaching, a significant difference between pre-school and primary school prospective teachers. Besides, results revealed a relationship between attitude and self-efficacy beliefs regarding math. To further research, it is recommended that the same surveys should be done with different groups and the larger sample sizes.

Keywords: Attitude towards math, self-efficacy beliefs, prospective teachers.

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INTRODUCTION

When examining the discussions related to education these days, it is clear that one of the most discussed problems is the education of teachers and the teachers' attributes. Besides, the most important topics at the level the teachers' attitude and their self-efficacy beliefs regard teaching. The education of primary school teachers is done in education faculties in Turkey. A 4-years education program, which includes pre-school education and primary education is applied to prospective teachers (Başkan et al., 2006). This program includes the professional instruction lessons, which include the required knowledge and skills for effectively and efficiently being able to understand, change, and learn by critically analyzing the teacher's teaching environment, the institution, and the lessons that the teacher will teach

(Coşkun and Sezen-Yüksel, 2018). There are common lessons in sciences on specific lessons regarding different subjects, including math (YÖK, 2018).

Mathematics is the stepping-stone to science and technology. Altun (2002) describes mathematics as a mental activity, which is developed through the pursuit of understanding the truth. This mental activity, which involves abstraction, analysis, and application, is a spiral cycle. Each activity once completed brings forth a new outlook, and this outlook also has a new mode of analysis (Sevgen, 2002). Consequently, mathematics has been applied in every area of life. Thus, mathematics is widely applied as it affects the ways education is delivered in mathematics education area (Çoban, 2002). It is important that math educators are those who are able to

improve self-efficacy, foster a positive attitude towards math, adapt to knowledge and technology of the age, work with others in cooperation, improve new strategies to solve problems can describe the problems in their own lives (MEB, 2018).

An attitude is "a relatively enduring organization of beliefs, feelings, and behavioral tendencies towards socially significant objects, groups, events or symbols" (Hogg and Vaughan 2005, cited in McLeod, 2018).

The person's manner that he/she puts forth as mental, emotion, and behavior about an object, a position, or a person reflects the person's attitude (Inceoğlu, 2004). Zan and Di Martino (2007) emphasized that the attitude towards math is based on the beliefs, feelings, and behaviors that shape the positive or negative tendencies.

The feelings and behaviors related to math that primary school prospective teachers' also affect their self-efficacy beliefs (Aksu, 2008). To Bandura (1997), self-efficacy is a trait that affects forming of behaviors, and it has been described as the outlook related to oneself regarding the capacity for successful application, by organizing the required behaviors to show a specific performance. To Aston (cited in Ekici, 2008), teacher self-efficacy belief is the teachers' capacities regarding orienting the students' performances or their beliefs about doing their tasks successfully.

Teaching self-efficacy beliefs often related with positive teaching behaviors, classroom management, and active learning environments etc. It is revealed that there is a relationship between teacher self-efficacy and students' achievements (Siegle, 2003).

Teacher self-efficacy belief is a significant variable in increasing the quality of education, in classroom management, in increasing student achievement, in the use of method and strategy and in increasing student motivation and success (Woolfolk et al., 1990; Al-Alwan and Mahasneh, 2014; Tschannen-Moran and Hoy, 2007).

Research has shown that enjoyment of mathematics can lead to higher perceived ability to do math (Pinxten et al., 2014). Briley (2012) in his study revealed that beliefs and feelings toward mathematics had a significant effect on teachers' self-efficacy for teaching mathematics. If a higher enjoyment of mathematics could lead to higher self-efficacy for teaching mathematics, then it becomes important for math methods courses to not only teach the theoretical practices for teaching math, but to also help foster positive attitudes towards math (McGuire, 2016).

LITERATURE REVIEW

Recent study have been done on the attitudes towards math and examined the primary school, high school, and university students' attitudes towards math based on different variables (gender, school type, class level, parents' education level, success, etc.). Özlü (2001) explores secondary school students' attitude towards

math and its relationship with the different variables. Alcı (2001) intended to elucidate how grade-4 teachers' math attitude affected the students' successes. Peker and Mirasyedioğlu (2003) studied senior students in high schools to define the students' attitude to their successes on math and the relationship between their attitude points and success. Alkan et al. (2004) attempts to determine the factors that influence the attitudes of high school students' attitude towards math depend on and how the students are affected by their teacher's behaviors. Bayturan (2004) studied secondary school students to identify if the students' successes in math and relationship between their attitudes towards math and psychosocial and social-demographic properties. Akdemir (2006) studied primary school students' attitude towards math and their success motivation, and Yenilmez (2007) examined primary school students' attitude toward math. Ekizoğlu and Tezer (2007) examined the relationship between the primary school students' attitude towards math and their math success points. Taşdemir and Taşdemir (2008) performed a survey to define grades 6–8 students' attitude towards math in relation to some variables. Göç (2010) examined primary school students' attitude towards math, their success motivations by gender, their parents' education level, and class levels, and what kind of relationship their success motivations show with their gender, class level, and their parents' education level. Yağmur (2012) researched the relationship between the students' attitude towards math and their self-efficacy in teacher high schools. Elkonca (2013) examined secondary school students' attitude towards math with chaid analysis. Yaşar et al. (2014) made a survey on the attitudes towards math of high school students in Turkey and the factors that affect these attitudes. Tuncer and Yılmaz (2016) studied the evaluation of secondary school students' attitudes and anxieties regarding math. The surveys regarding prospective teachers include the following: Doğan (2000) with the students in Educational Faculties; Kızıloğlu and İpek (2001) and Başer and Yavuz (2003) with prospective teachers; Duru et al. (2005), Kandemir (2007) with prospective primary teachers; Çelik and Bindak (2005) with the students in primary education departments, Tarım and Bulut (2007) with prospective pre-school teachers; Gökçek and Güneş (2011) and Göloğlu Demir (2011) with primary school math teachers; and Tabuk and Tabuk (2018) with prospective teachers. These studies had been done examining the prospective teachers' attitudes about different variables. Apart from all these studies, there have been a lot of surveys on students' attitudes towards math that affect their success (Minato and Yanese, 1984; Ethington and Wolfle, 1986; Cheung, 1988; Ma and Kishor, 1997; Tapia and Marsh, 2000; Yee, 2010; Baydar, 2000; Ekici, 2008; Duatepe-Paksu, 2008, and Özsoy-Güneş et al., 2015) studied on the teachers' and prospective teachers' self-efficacy beliefs in teaching math and their professions. Based on

this literature, the aim of our survey is to determine primary school prospective teachers' attitudes towards math, their self-efficacy beliefs, and the relationship between them.

In this frame the survey presented the following questions for prospective teachers attending the primary school teaching department:

1. How are their attitudes towards math and their self-efficacy beliefs related to teaching math?
2. Is there any difference in attitudes towards math with regards to gender and the department in which they were educated?
3. Is there any difference in their self-efficacy beliefs with regards to gender and the department in which they were educated?
4. Is there any relationship between attitudes towards math and self-efficacy beliefs towards teaching math?

METHODOLOGY

The research was designed in accordance with the correlational survey methods. Relational scanning is one of the research models that aim to define the degree of correlation through time among two or more variables (Cohen et al., 2008; Karasar, 2009).

Study group

The study group consists of 321 4th grade primary school prospective teachers who took lessons in Dokuz Eylül University, Buca Faculty of Education in İzmir, Turkey. 270 of the participants were female and 51 of them are male. The participation to the study was on a voluntary basis.

Data collection instruments

In order to determine the teacher candidates' attitudes towards math, 'The Math Attitude Scale' was used. The scale was developed by Duatepe and Çilesiz (1999).

The "Math Attitude Scale" which was developed by Duatepe and Çilesiz (1999) was used for determining teacher candidates' attitudes towards math. The scale is based on four subscales (interest/ like; afraid/confidence; profession/ importance; pleasure) and 38 items using a 5-point, Likert-type scale. The first dimension of the scale included the items that measure "interest and like" (13 items); the second dimension included "afraid-confidence" (9 items); the third dimension included "Profession and importance" (8 items); the fourth dimension included "pleasure" (8 items). In order to get the reliability estimates of the scale, Cronbach's alpha measure was used and the total scale is obtained as

0.96.

The self-efficacy beliefs towards mathematics teaching scale was developed by Aksu (2008) five point likert type scale with 24 items. The scale consisted from two subscales as Self efficacy and Coping Behavior. In order to get the reliability estimates of the scale, Cronbach's alpha measure was used and the total scale is obtained as 0.89.

Data analysis

The descriptive statistics of the variables and correlation analysis were conducted through SPSS 22. During the data analysis process, firstly the Kolmogorov Smirnov test was conducted in order to determine whether or not the data showed normal distribution. According to the results; the scores of primary teacher candidates (Sig. = .08, $p > .05$) were above $p > .05$, which indicates a normal distribution. Tabachnick and Fidell (2013) underline that if the skewness and kurtosis values of these values are between +1.5 and -1.5, an analysis is considered to be made according to the normal distribution. Skewness and kurtosis values of the mean scores obtained from the scales used in this study were found to be within the specified ranges (Skewness = -.757, -.126; Kurtosis = 1.068, -.537). Then, in order to determine the relationship between attitudes towards mathematics and self-efficacy beliefs towards mathematics teaching, correlation analysis was used. And the parametric independent samples t-test was conducted in analyzing the data in order to compare with independent variables such as gender, department.

RESULTS

RQ1: The findings are displayed below as sub problems. The first sub problem of the study was "How are the prospective teachers' attitude towards math and their self-efficacy beliefs towards teaching math?" The mean and standard deviation values of the scores that the participants gave for the attitude scale are displayed on Table 1.

The mean of the prospective teachers' answers are ordered as follows: between 1.00 and 1.79 "I never agree," 1.80–2.59 "I don't agree," 2.60–3.39 "I have no idea," 3.40–4.19 "I partly agree," and 4.20–5.00 "I completely agree." Considering these degrees, the mean of the students' attitude levels towards math are "I partly agree" with 3.63; prospective teachers have willingly been studying math, spending time, and are interested in Math.

The mean and standard deviation values for the self-efficacy belief scale are displayed on Table 2. While the averages of prospective teachers' answers were

Table 1. Prospective teachers' attitude level towards mathematics.

Scale	Mean	SS
Mathematic attitude level	3.63	1.34

Table 2. Prospective teachers' self-efficacy beliefs towards mathematics

Scale	O	SS
Self-efficacy belief	3.84	3.24
Coping behavior	3.65	1.47
Total	3.79	4.02

evaluated, they were ordered as follows: Between 1.00 and 1.79 "I never agree," 1.80–2.59 "I don't agree," 2.60–3.39 "I have no idea," 3.40–4.19 "I partly agree," and 4.20–5.00 "I completely agree." Considering these degrees, the students' self-efficacy belief levels towards math are "I agree" in all sub dimensions and in total. We can thus say that prospective teachers have high self-efficacy beliefs towards teaching mathematics.

RQ 2: Is there any difference in their attitudes towards math with regards to gender and the department in which they were educated?

As the data distributed normally t-test for independent samples has been applied for examining the concerned difference (Table 3).

Although the female prospective teachers' attitude scores are higher than male, this difference is not statistically significant ($t(288) = 0.88$; $p > .05$).

The t-test results show that the difference amongst

prospective teachers' means according to department which they have been educated is significant [$t(288) = 2.93$, $p < 0.05$] (Table 4). Result show that primary education prospective teachers' attitudes towards math are higher than pre-school prospective teachers'.

RQ 3: Is there any difference in their self-efficacy beliefs with regard to gender and the department in which they were educated?

Results of the t-test analysis concerning teacher candidates' self-efficacy levels with regards to gender are given on Table 5.

Table 5 shows the evaluation of the self-efficacy belief dimension. Male prospective teachers' mean is higher than females'. Regarding achievement behavior and total evaluation, females' averages are higher than males. It is evident on Table 5 that there are no significant difference amongst prospective teachers with regards to gender in both sub scales and total scores of self-efficacy belief scale.

Table 6 shows that primary school prospective teachers' scores are higher than pre-school prospective teachers' in self-efficacy beliefs, coping behavior, and total evaluations. But, there is no significant difference is shown in the result of the t-test ($t(288) = 0.94$, $p > 0.05$).

RQ 4: Is there any relationship between attitudes and self-efficacy beliefs towards teaching math?

In order to find the answer to this sub problem, the correlation between prospective teachers' math attitude and self-efficacy beliefs regarding teaching math are examined.

Table 7 shows a statistically significant positive relationship ($p < 0.05$) at moderate level ($r = 0.328$) between the points from the mathematics attitude scale and self-efficacy scale ($r = 0.328$; $p < 0.05$).

Table 3. T-test results of prospective teachers' attitudes towards mathematics by gender.

Gender	n	Mean	SD	Df	t	p
Female	255	3.35	0.98	288	0.88	0.658
Male	35	3.11	1.00			

Table 4. T-test Results of prospective teachers' attitudes regarding their department

Department	N	Mean	SD	Df	t	p
Pre-school	203	2.02	1.11	288	2.93	0.028*
Primary education	87	3.57	1.68			

Table 5. T-test results of prospective teachers' self-efficacy beliefs by gender.

Dimensions	Gender	N	Mean	SD	df	t	p
Self-efficacy belief	Female	255	3.25	0.43	288	0.33	0.531
	Male	35	3.32	0.94			

Table 5. Continues.

Coping behavior	Female	255	3.68	0.34	288	0.88	0.378
	Male	35	3.59	0.39			
Total	Female	255	3.63	0.84	288	0.78	0.618
	Male	35	3.57	0.92			

Table 6. T-test Results of Teachers' self-efficacy beliefs according to department.

Dimensions	Department	n	Mean	SD	DF	t	p
Self-efficacy belief	Pre-school	203	3.28	1.08	288	0.37	0.494
	Primary school	87	3.36	0.88			
Coping behavior	Pre-school	203	2.99	1.21	288	0.79	0.395
	Primary school	87	3.18	0.89			
Total	Pre-school	203	3.01	2.94	288	0.94	0.755
	Primary school	87	3.34	1.97			

Table 7. Pearson correlation analysis results for the mathematics attitude scale and self-efficacy scale.

Variable	n	r	p
Self-efficacy towards teaching math	290	0.328	0.042*

DISCUSSION

According to data, primary teacher candidates' attitudes towards math are positive and self-efficacy beliefs are high. Although, female prospective teachers' attitude levels towards math were higher than males, there was no significant difference. Findings showed that gender had no effect on attitude towards math in many surveys done before (Abalı Öztürk and Şahin, 2015; Sezen and Yanık, 2012; Ursini and Sanchez, 2008; Sırmacı, 2007). Besides, Tabuk and Tabuk (2018) observed that male prospective teachers' attitude points for both math and teaching math were higher than women's. It was found that prospective teachers' attitude levels had a difference due to the departments of the primary school teachers. This result aligns with that of Sırmacı's study (2017). Besides, primary school teachers' attitude points were higher than pre-school teachers' in the survey by Tabuk and Tabuk (2018). This demonstrated that prospective teachers' self-efficacy beliefs were similar by gender. Similarly, it can be seen that there is no significant difference in the self-efficacy beliefs of candidate maths teachers according to their gender on the results of the research conducted by Şallı (2012) and Hacıömeroğlu and Taşkın (2010) Aksu (2008), Duatepe-Paksu (2008) and Baydar (2000).

When the departments of the candidate teachers,

which they attend considered, it can be concluded that the teachers' self-efficacy beliefs towards maths showed no significant difference.

This result is similar with findings in related surveys (Aksu, 2018; Duatepe-Paksu, 2008).

RECOMMENDATIONS

In this study group, prospective primary teachers revealed limited data as the result of the study.

Further studies can be carried out by the prospective teachers of different universities and more data can be collected considering the limitations in the current study. These further studies may lead to the comparison of the results to get more accuracy.

In this study self-report instruments were used. Different research techniques can be used to triangulation for instance interviews, observations etc. can be benefited.

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