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Investigation of Teacher Candidates' Teaching Maths Anxiety and Teaching Maths Competencies

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Abstract

Considering the fact that teacher candidates' maths teaching anxiety levels and maths teaching competency levels will affect their maths teaching in future, the desired beliefs should be tried to gain teacher candidates. Therefore, a positive contribution will be made to achieve the desired gains in maths education. In the study, it is aimed to examine the competency levels of pre-school teacher candidates in maths teaching and their maths teaching anxiety levels in terms of various variables and to determine whether there is a relationship between the maths teaching anxiety of the candidates and their level of competency for teaching maths. The research is in relational scanning model. The "Maths Teaching Anxiety Scale" and "Maths Teaching Competencies Scale" were implemented to 104 pre-school pre-service teacher candidates studying in 2019-2020 academic year, which constitutes the sample of the study. As a result of the analysis, it has been found that while teacher candidates' maths teaching anxiety levels do not change by gender, female teacher candidates consider themselves more competent than male teacher candidates in maths teaching and 4th-grade teacher candidates have significantly less anxiety of maths teaching compared to 3rd grades. Besides, it has been determined that there is a statistically significant negative correlation between the maths teaching anxiety scores of the candidates and the average of the maths teaching efficacy scores.

Keywords: Maths Teaching Anxiety, Maths Teaching Competency, Teacher Candidates

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INTRODUCTION

The level of maths achievement of students is effective in guiding their education life and career choices alike (Patkin & Yoram Greenstein, 2020). Maths anxiety has been recognized as an obstacle to maths achievement. Studies have been carried out to reveal how maths anxiety occurs in students and been found that many factors cause maths anxiety (Norwood, 1994; Steinberg& at. all. 1995; May, 2009; Uusimaki & Nason, 2004; Geist, 2010; Vinson, 2001; Puteh & Khalin, 2016). Teachers, one of these factors, have a significant effect on students' mathematical anxiety. Teachers, who fail in math class during their student years or are anxious, may pass their anxiety to the student(Norwood, 1994). Beilock, Gunderson, Ramirez. & Levine (2010) concluded in their study that the higher the teacher has math anxiety, the lower the success level of the students. Studies have revealed that there is a positive relationship between maths anxiety and maths teaching anxiety. In this context, maths anxiety in teachers may cause maths teaching anxiety(Unlu, Ertekin & Dilmac, 2017; Haciomeroglu, 2014). If maths anxiety turns into maths teaching anxiety, it may have a negative effect on students' ability to learn maths correctly (Hadley & Dorward, 2011). Serin (2017) states that anxiety towards teaching maths is effective in determining learning situations such as time planning, method-technique selection, activity selection, and application. It has been found that teachers having maths teaching anxiety spend less time in maths lessons, apply more traditional teaching methods, and allow for less for the activities such as group work (Swars et al., 2006). Such methods are insufficient to reach the level of students, to meet their expectations, to motivate them, to undertake teaching practices according to their interests and needs. Some teachers may even exclude some subjects from their curriculum because it causes them anxiety (Amato, 2004). Thus, teachers having higher maths teaching anxiety cause low achievement of students (Hadley & Dorward, 2011).

Teacher competency is another obstacle to maths achievement (Deringöl, 2018). According to social learning theorists, self-efficacy is a feeling of confidence regarding the fulfillment of certain tasks (Tran et al., 2012). Self-efficacy is defined by Bandura as the belief of individuals in their own abilities to do a certain job. These beliefs affect individuals' effort and the level of existence in their work thanks to struggles, the resilience shown when failed, and adapting to changes (Tran et al., 2012). Maths self-efficacy expresses beliefs in one's ability to do maths and often involves solving certain math problems, performing maths-related tasks, and evaluating one's own judgments about abilities to succeed in maths-related courses (Bates & at. all, 2011). Maths teaching competency refers to one's belief in the ability to teach maths effectively (Enochs, Smith & Huinker, 2000; Holzberger, Philipp & Kunter 2013 ; Tschannen-Moran & Hoy 2007). Teachers should have sufficient knowledge about the development and training of students' maths skills, as well as having high competencies that they can apply. When the teacher has different efficacy beliefs, s/he can produce different results. For instance, it has been found out that among teachers who have the same content knowledge, those who see themselves as effective in teaching maths are more successful than those who see themselves as ineffective in teaching maths (Tran et al., 2012). Çelik (2017), in the study with preschool teachers, concluded that there is a significant relationship between teachers' self-efficacy levels in early maths education and teachers' self-efficacy when planning and applying maths activities. In this context, teachers' efficacy beliefs about teaching maths affect their efforts in preparing lesson plans, setting goals, choosing methods and techniques, and designing teaching practices and evaluations (Tschannen-Moran & Hoy 2007). Compared to teachers with low teaching self-efficacy, teachers with higher teaching competency use more advanced and flexible teaching methods, handle the subjects at a high level in-depth. They are less emotionally stressed, since they have lower levels of burnout, and more professional satisfaction, they continue their teaching profession for longer (Holzberger, Philipp & Kunter 2013; Granziera & Perera2019). Besides, they encourage independent learning, improve their attitude towards learning increasing their students' achievement and motivation (Caprara et al. 2006; Holzberger, Philipp & Kunter 2013 ; Tschannen-Moran & Hoy 2007).

There is a strong negative relationship between maths anxiety and maths self-efficacy. Low self-efficacy in individuals is one of the strongest determinants of maths anxiety (Gonzalez-DeHass et al.2013). Bates, Latham, & Kim (2011) claim that teacher candidates with maths anxiety can develop

maths teaching anxiety associated with their low teaching self-efficacy. In the interview with the 2008 primary-school teacher-candidate, Gresham concluded that teacher candidates with less maths anxiety are more qualified as a "maths teacher", and found that maths anxiety is the basis of teaching efficacy beliefs.

Although there are many studies examining teacher candidates' maths anxieties and maths teaching competencies, most studies focus on teacher candidates in primary and secondary education (Deringöl, 2018; Başpınar & Peker 2016; Ural, 2015; Swars, Daane & Giesen, 2006; Uusimaki & Nason, 2004). Therefore, it is important to examine pre-school teacher candidates' maths teaching anxiety and maths teaching competencies. In this context, it has been considered that the results of this study will contribute to teacher training programs in terms of eliminating this deficiency in the literature.

Aim

In the study, it was aimed to examine the pre-school teacher candidates' competency levels regarding maths teaching and their maths teaching anxiety levels in terms of various variables, and to determine whether there is a relationship between the maths teaching anxiety of the candidates and their maths teaching competency levels. In line with this general-aim, answers were sought for the following sub-problems.

Is there a significant difference between the maths teaching competency and maths teaching anxiety levels of pre-school teacher candidates according to the variables of gender, grade level, academic mark average, the reason for choosing the program, order of choice and type of high school graduated from?

Is there a relationship between pre-school teacher candidates' maths teaching anxiety and maths teaching competency levels?

METHOD

The research is in a descriptive relational survey model being quantitative research. Among quantitative research, relational scanning models are research models aiming to determine the existence and/or degree of covariance between two or more variables. (Karasar, 2008).

Population- Sample

The teacher candidates studying in the pre-school education program of a state university in the Western Black Sea Region constitute the study group of this research. Convenience sampling, one of the purposive sampling methods, was preferred for the research. The sample consists of a total of 104 teacher candidates studying in the 2nd, 3rd and 4th grades of the pre-school education department of a state university in the Western Black Sea Region.

Data Collection Tools

In the research, a personal information form prepared by the researcher was used to obtain information about gender, grade level, and general academic grade point average of pre-school teacher candidates. In order to collect data related to the problems and sub-problems of the study, the "Maths Teaching Anxiety Scale" developed by Peker (2006) and the "Maths Teaching Competencies Scale" developed by Esendemir, Çırak, and Samancıoğlu (2015) were used.

The Maths Teaching Anxiety Scale

The scale developed by Peker (2006) consists of 23 items and is in a 5-point Likert type. Each item was scored from "very adequate = 5" to "very inadequate = 1". In other words, it can be seen that

as the score increases, the maths teaching anxiety of the teacher candidates increases(Peker, 2006). In addition, the total scores to be obtained from the scale range between 23 and 115. For the content validity, it was examined by 1 teacher candidate, 1 teacher, and 2 faculty members from the subject area and field education experts and the necessary arrangements were made. Cronbach's alpha internal consistency coefficient for the scale was found .91. This value indicates that the scale is a reliable measurement tool.

The Maths Teaching Competencies Scale

The scale developed by Esendemir & others(2015) consists of 20 items and is in a 5-point Likert type. For each item in the scale, there are "1 = Strongly Disagree", "2 = Disagree", "3 = Unsure", "4 = Agree", "5 = Strongly Agree" options. Therefore, the total scores to be obtained from the scale vary between 20 and 100. Confirmatory factor analysis was used for the construct validity of the measuring tool. It was determined that the fit index values ($\chi 2$ / df = 2.51; NFI = 0.97; NNFI = 0.98; CFI = 0.98; RMSEA = 0.071; GFI = 0.88; RMR = 0.033; SRMR = 0.046) obtained as a result of Structural Equation Modeling were found to be at acceptable levels. Cronbach's alpha internal consistency coefficient for the scale was found to be .96. These values show that the scale is highly reliable.

Data Collection

"General Information Form", "Maths Teaching Competencies Scale" and "Maths Teaching Anxiety Scale" were implemented to the teacher candidates in the sample group on a voluntary basis in January 2020.

Analysis of Data

The scales from which the data were obtained, were checked before starting the analysis process. After the control, scales filled incorrectly or incompletely were not taken into consideration and 104 participant data were enumerated. After enumeration, the data was entered into the SPSS (IBM SPSS Statistics 22) program. Percentage, frequency, and arithmetic average analyzes of the data entered into the SPSS program were carried out. At the beginning of the statistical analysis in the study, the appropriate analysis type needs to be determined. Since the sample size is larger than 30, it has been predicted to use parametric methods for this study. The prerequisite for using parametric tests is to determine whether each factor has a normal distribution. The normal distribution of data has been determined using the single sample Kolmogorov Smirnov Test. As the results of the analysis, the data were found to be distributed normally, t-Test, Variance analysis, and Spearman Rank Difference Correlation test calculations were carried out.

FINDINGS

In this section, the findings obtained from the analysis of the data are included.

Table 1. Normality test results of pre-school teacher candidates' scores.

	N	X	Skewness	Kurtosis	Kolmogorov-Smirnov Test
MTAS*	104	57,21	,272	,213	,069
MTCS**	104	76,36	,-163	1,375	,20

*MTAS: Maths Teaching Anxiety Scale

**MTCS: Maths Teaching Competencies Scale

When Table 1 is examined, it has been found that both the "Maths Teaching Anxiety Scale" score distributions and the "Maths Teaching Competencies Scale" score distributions were higher than the Kolmogorov-Smirnov Test p> 0.05 as a result of the normality test and it was concluded that the data were distributed normally.

Table 2. T-test results of the pre-school teacher candidates' opinions about the nature of maths related to the gender variable.

Scale	Gender	N	$\bar{x}$	SD	t	p
MTAS	Female	87	56,1149	16,13347	-1,813	,081
	Male	17	62,8235	13,48256		
MTCS	Female	87	77,5287	12,54929	3,202	,003
	Male	17	70,3529	7,39038		

According to Table 2, while the maths teaching anxiety levels of pre-school teacher candidates do not differ significantly by the gender variable, their maths teaching competency levels differ significantly by the gender variable (MTAS) t (26) =-1,813, p>0,05, (MTCS) t (37) =3,202, p<0,05). The arithmetic averages of male teacher candidates obtained from MTAS and arithmetic average of female teacher candidates are higher. Male teacher candidates have higher anxiety levels than female teacher candidates. The arithmetic averages of female teacher candidates obtained from MTCS are higher than the arithmetic averages of male teacher candidates. Female teacher candidates consider themselves more efficient in teaching maths than male teacher candidates.

Table 3. Variance analysis results of teacher candidates' opinions for the variable of grade levels of education

Scales	G. Lev.	n	$\bar{x}$	sd	Var. C.	SS	fd	MS	F	p	Sign Dif.
MTAS	2	40	55,53	13,07	Between Groups	1878,78	2	939,39	3,95	.022	3-4
	3	39	62,39	16,7	Within Groups	24054,57	101	238,16			
	4	25	51,84	16,83	Total	25933,35	103				
	Total	104	57,22	15,87							
MTCS	2	40	77,30	11,06	Between Groups	416,038	2	208,01	1,43	,25	-
	3	39	73,87	10,94	Within Groups	14733,80	101	145,88			
	4	25	78,72	15,03	Total	15149,84	103				
	Total	104	76,36	12,13							

When Table 3 is examined, pre-school teacher candidates' maths teaching anxiety scores differ significantly according to the grade level variable F(2,101)=3,95, p<.05. As a result of the Tukey carried out to determine the source of the difference, it can be seen that the difference was between 3rd and 4th grades. When the arithmetic averages of the classes are examined, it can be seen that the anxiety of teaching maths for the 4th grades is significantly less than the 3rd grades. Pre-school teacher candidates' maths teaching competency scores do not differ significantly by the grade level variable. F(2,101)=1,43, p>.05.

Table 4. Variance analysis results related to the variable grade point average of teacher candidates' opinions

Scale	Ava. Mark	n	$\bar{x}$	sd	Var. C.	SS	df.	MS	F	p	Sig. Dif.
MTAS	100-90	6	63	13,74	Between Groups	1012,690	5	202,53	,80	,56	-
	89-85	14	56,29	18,10	Within Groups	24920,66	98	254,29			
	84-75	38	54,45	17,69	Total	25933,35	103				
	74-70	26	57,88	13,25							
	69-60	16	62,38	10,26							
	59-55	4	53	26,92							
	Total	104	57,21	15,87							
MTCS	100-90	6	73,67	12,11	Between Groups	1029,933	5	205,98	1,43	,22	-
	89-85	14	80,36	7,239	Within Groups	14119,9	98	144,08			

84-75	38	78,55	15,26	Total	15149,84	103
74-70	26	72,04	9,59			
69-60	16	74,75	9,088			
59-55	4	80	13,49			
Total	104	76,36	12,13			

According to Table 4, the scores of teacher candidates obtained from both MTAS and MTCS do not differ significantly according to grade point averages variable F (5.98) = .80 p> .05, F (5.98) = 1.43 p>.05. Teacher candidates' maths teaching anxiety and maths teaching competency are not affected by their achievement levels.

Table 5. Scale Score Average of Pre-School Teacher Candidates

Variables	N	X	sd
MTAS	104	57,2115	15,86758
MTCS	104	76,3558	12,12789

The total scores to be obtained from the Maths Teaching Anxiety Scale vary between 23 and 115, and the total points to be obtained from the Maths Teaching Competencies Scale vary between 20 and 100. When Table 5 is analyzed, it can be said that teacher candidates' anxiety about teaching maths is low (57.2) and their maths teaching competencies (76.4) are medium level.

Table 6. Spearman's Rank Correlation Coefficient test results of the relationship between "Maths Teaching Anxiety Scale" and "Maths Teaching Competency Scale"

Variables	N	r	p
MTAS MTCS	104	,-658**	00

When Table 6 is examined, it can be seen that there is a negative and statistically significant relationship between pre-school teacher candidates' maths teaching anxiety levels and maths teaching competency levels. (r= ,-658, p<0,01). According to the finding, we can say that as the maths teaching anxiety levels of pre-school teacher candidates decrease, their maths teaching competency levels increase.

DISCUSSION AND CONCLUSION

Since it has been considered that pre-service teachers' maths teaching anxiety levels and maths teaching competency levels will affect their maths teaching in future, it should be tried to gain the desired beliefs. In this way, a positive contribution will be made to achieving the goals targeted in maths education(Baydar & Bulut 2002). In this study, it is aimed to examine the competency levels of pre-school teacher candidates in maths teaching and their maths teaching anxiety levels by various variables and to determine whether there is a relationship between the maths teaching anxiety of the candidates and their level of competency in maths teaching. Based on the analysis, it was found that while the mean scores of the pre-school teacher candidates regarding their level of maths teaching anxiety were low and their mean scores for maths teaching competency levels were moderate. In many studies, it has been concluded that teacher candidates supporting this result have less anxiety about teaching maths(Bekdemir, 2007; Hacıömeroğlu; 2014; Tatar, Zengin, & Kağızmanlı, 2016; Ural, 2015). Bursal & Paz Nokas (2006) found that half of the 65 pre-service teacher candidates who enrolled in the maths methods course thought that they could not teach maths effectively. It has been found that students who define themselves as having high maths anxiety are less confident in their maths teaching abilities than students who describe themselves as having low or moderate maths anxiety. Maths teaching competency expresses one's belief in the ability to teach maths effectively(Bates, Latham & Kim, 2011). In this context, it can be said that pre-school teacher candidates participating in the study are confident in their maths teaching competency and have a positive opinion of their maths teaching competencies.

In the study, pre-school teacher candidates' scores on maths teaching anxiety and maths teaching competency levels were examined whether they differ by gender, grade level, and academic grade point averages. It has been concluded that pre-school teacher candidates' maths teaching anxiety levels did not differ significantly by the gender variable, while maths teaching competency levels differ significantly. By the grade level variable, it has been found that the maths teaching anxiety of the 4th-grade teacher candidates was found to be significantly less than the 3rd grades while the maths teaching efficacy scores did not differ significantly. By the grade averages variable, the scores of both scales do not differ significantly. Findings differ in the literature. Akinsola (2014), in the study with teacher candidates, has concluded that the gender of the candidates did not affect their maths teaching anxiety. Deringöl (2018), in the study examining the anxiety of classroom teacher candidates and their math teaching competencies, concluded that the anxiety of math teaching of female teachers was lower than that of male teachers and that there was no difference in their maths teaching competencies. Also, while the anxiety of teacher candidates for teaching maths did not change significantly by grade level, the change in maths teaching competencies was found to be statistically significant. Tatar, Zengin & Kağızmanlı (2016) and Başpınar (2015), in their study with teacher candidates, found that teacher candidates' anxiety for teaching maths did not differ by gender, however, there was a difference in their anxiety for teaching maths in terms of fieldwork education knowledge sub-dimension by grade level. In the study in which classroom teacher candidates' anxiety for maths and their anxiety for teaching maths were examined, Serin (2017) has found that 3rd-grades have more math anxiety and math teaching anxiety than 4th-grades. The source of the decrease in maths teaching anxiety of teacher candidates in the 4th-grades may be due to the teaching practice lesson and the increase in experiences of practical teaching. Göloğlu Demir (2011) and Hacıömeroğlu & Taşkın (2010) has found in their study that the self-efficacy beliefs of teacher candidates in teaching maths were not affected by their academic achievement scores.

Similarly, in the studies with classroom teacher candidates, Arseven, Arseven & Tepehan (2015) has concluded that their maths teaching self-efficacy beliefs were not affected by their academic achievement scores.

In the study, it has been determined that there is a statistically significant negative relationship between the pre-school teacher candidates' maths teaching anxiety scores and the average of maths teaching efficacy scores. According to this finding, as the maths teaching anxiety of pre-school teacher candidates decreases, their maths teaching competencies increase. The finding of the study is in parallel with other research findings.

Bursal & Paznokas, 2006; Gresham, 2008; Swars, Daane & Giesen (2006) has focused on maths anxiety related to maths teaching competency in their study and has found negative correlations between the two. Başpınar (2015) found a negative, moderate, and significant relationship between the anxiety levels of classroom teacher candidates for teaching maths and their beliefs in teaching and learning maths. In the study, Deringöl (2018) has concluded that as the classroom teacher candidates' competency in maths teaching increases, their maths teaching anxiety decrease.

Suggestions

- Qualitative research can be carried out to examine maths teaching competency and maths teaching anxiety in depth.

- Longitudinal studies can be carried out to compare teacher candidates' maths teaching competency and maths teaching anxiety levels with their level of competency and anxiety when they take up their positions.

- Studies can be carried out to compare teachers' opinions on their math teaching competency and anxiety levels with their in-class practices.

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