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# A COMPARISON OF PRE- AND IN-SERVICE PRESCHOOL TEACHERS' MATHEMATICAL ANXIETY AND BELIEFS ABOUT MATHEMATICS FOR YOUNG CHILDREN

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## ABSTRACT

*This study was conducted to investigate pre- and in-service preschool teachers' mathematical anxiety and beliefs about mathematics for young children. The sample included 100 pre-service preschool teachers (50 first grade and 50 last grade pre-service teachers) and 50 in-service preschool teachers. As data collection tools "Beliefs Survey" and "Math Anxiety Scale" were used. Findings indicate that in-service teachers had more mathematical anxiety score than pre-service teachers. Also in-service teachers had higher beliefs score than pre-service teachers. Indeed, last grade pre-service teacher who had taken the course about mathematics education in preschool had higher beliefs score than first grade pre-service teachers who had not taken that course.*

**Keywords:** Preschool education, teacher, mathematics anxiety, beliefs about mathematics education

## INTRODUCTION

Preschool years in which many basic mathematical concepts occur are very important years (Aktaş Arnas, 2009). When children are faced with formal mathematics education in primary school, not appearing mathematical anxiety, liking mathematics, being excited to learning mathematics and having a positive attitudes towards mathematics of children have direct relation with the experiences of mathematics in preschool years (Henniger, 1987). On the other hand, some children may have negative attitudes towards mathematics early in life, sometimes even before they enter kindergarten (Arnold, Fisher, Doctoroff and Dobbs, 2002).

In preschool years, teachers' attitudes towards mathematics have an important role in children's having a positive attitude towards mathematics and not feeling mathematical anxiety. Attitude to mathematics is a multi-dimensional construct. It includes confidence or anxiety, liking or disliking mathematics, a tendency to engage in or to avoid mathematics, beliefs about whether one is good or bad at mathematics, and beliefs that mathematics is important or not, useful or useless, easy or difficult (Beswick, Watson and Brown, 2006).

Studies have indicated that mathematics anxiety has implications for teacher practice in mathematics (Bush, 1981; Hembree, 1990; Swetman, Munday and Windham, 1993). Richardson and Suinn (1972) have defined mathematics anxiety as "feelings of tension and anxiety that interfere with the manipulation of numbers and the solving of mathematical problems". Mathematics anxiety is more than a dislike towards mathematics (Vinson, 2001). Mathematics anxiety has been characterized in various ways. For example, having difficulties everyday mathematical activities, avoiding math classes, feeling panic or nervous when ask to do math activities (Smith, 1997). Teachers having high mathematics anxiety use more traditional methods. For instance, they use lecture and concrete on teaching basic skills rather than concepts in mathematics. These teachers spend more time with seatwork and whole class

instruction and less time with playing games, problem-solving, small group instruction, individualized instruction (Gresham, 2008; Swars, Daane and Giesen, 2010). Moreover studies indicate that teachers with mathematics anxiety may cause the early anxiety in their students and their mathematics anxiety effects math success of students in a negative way (Martinez, 1987; Hembree, 1990).

Teachers' beliefs about mathematics and mathematics teaching have also an important role in shaping their instructional practice and influence their pupils' attitudes, interest and achievement (Philipou and Christou, 1998; Pajares, 1992; Leder, Pehkonen and Torner, 2002). Beliefs have a particular function as a filter for teaching experiences and actions of teachers (Platas, 2008). Some studies have determined that there are consistencies between beliefs and classroom actions (Ashton and Webb, 1986; Peterson, Fennema, Carpenter and Loef, 1989; Kaplan, 1991; Stipek, Givvin, Salmon and MacGyvers, 2001). Peterson et al. (1989), for instance, found that there was a significant positive relation among teachers' beliefs, teachers' knowledge, and students' problem-solving achievement. Stipek et al., (2001) found that there was a consistent association between teachers' beliefs and practices related to mathematics instruction.

## METHODS

### Participants

The samples of this study consisted of three groups: preschool teachers (N=50), pre-service preschool teachers who didn't have the class "mathematic education in preschool period" yet (N=50) and pre-service preschool teachers who had that class (N=50). Participants were selected via random sampling method. While the pre-service preschool teachers were having the preschool teachers program, the in-service teachers were working in public preschools.

### Data Collection Tools

In this study as data collection tools Math Anxiety Scale-Revised (Bai, 2010) and Beliefs Survey (Platas, 2008) were used. Math Anxiety Scale is a likert type assessment tool and consists of 14 items about mathematics anxiety. It includes positive and negative affect as two dimensions of math anxiety. Belifs Servey is also a likert type assessment tool and consists of 40 items about teachers' beliefs concerning teaching mathematics for young children. Items in the Beliefs Survey were grouped into four domains: Age-appropriateness of mathematical instruction in the early childhood classroom, locus of generation of mathematical knowledge, social and emotional versus mathematical development as primary goals of preschool education and teacher comfort in mathematical instruction.

Cronbach's Alpha value was calculated in order to determine the reliability of the assessment tools. Cronbach's Alpha value was .92 for Math Anxiety Scale and .96 for Beliefs Survey.

### Data Collection

Data were collected in the first term of 2012-2013 academic year. Data collection tools were applied to pre-service preschool teachers in their university and to in-service teachers in their preschools where they worked.

### Data Analysis

Total scores that the participants got from "Beliefs Survey" and "Math Anxiety Scale" were calculated and Anova (variance) analysis was done in order to determine whether there was a significant difference among groups. When a significant difference was found, Tukey's Post Hoc analysis was done to specify the source of the difference.

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## FINDINGS

**Table 1. The results of variance analysis about pre-and in-service teachers' scores in the Math Anxiety Scale**

| *Source* | *Sum of Squares* | *df* | *Mean Square* | *F* | *P* |
|---|---|---|---|---|---|
| Between Groups | 7822.56 | 2 | 3911.28 | 37.669 | .001 |
| Within Groups | 15263.44 | 147 | 103.83 | | |
| Total | 23086.01 | 149 | | | |

Table 1 shows the results of variance analysis about the scores that the pre-and in-service teachers got from the Math Anxiety Scale. It was found out that there was a statistically significant difference among the pre-and in-service teachers' scores in the Math Anxiety Scale (F (2,147)=37.669, p=.001). The effect size for this analysis ($d$ = .33) was found to exceed Cohen's (1988) convention for a large effect ($d$ = .14). The results of Tukey analysis done in order to define the source of the difference expressed that there was a statistically significant difference among in-service teachers and first and last grade pre-service teachers in favour in-service teachers. These results indicate that in-service teachers had higher scores (M=39.04, SD=13.96) in the Math Anxiety Scale than first grade (M=25.66, SD=8.05) and last grade pre-service teachers (M=22.36, SD=7.18).

**Table 2. The results of variance analysis about pre-and in-service teachers' scores in the Beliefs Survey**

| *Source* | *Sum of Squares* | *df* | *Mean Square* | *F* | *P* |
|---|---|---|---|---|---|
| Between Groups | 97613.21 | 2 | 48806.6 | 113.189 | .001 |
| Within Groups | 63385.88 | 147 | 431.1 | | |
| Total | 160999.11 | 149 | | | |

Table 2 presents the results of the variance analysis about the scores that the pre-and in-service teachers got from the Beliefs Survey. It was determined that there was a statistically significant difference among the pre-and in-service teachers' scores in the Beliefs Survey (F (2,147)=113.189, p=.001). The effect size for this analysis was very high (d=.60). As a result of the Tukey Post Hoc analysis, it was defined that there was a statistically significant difference among in-service teachers and first and last grade pre-service teachers in favour in-service teachers. Also there was a statistically significant difference between first grade pre-service teachers and last grade pre-service teachers in favour of last grade pre-service teachers. These results indicate that in-service teachers had higher scores (M=208.74, SD=14.9) than first and last grades pre-service teachers. Indeed, last grade pre-service teachers had higher scores (M=182.62, SD=18.25) than first grade pre-service teachers (M=146.52, SD=27.16) in the Beliefs Survey.

## DISCUSSION AND COMMENTS

This study was conducted to investigate pre- and in-service preschool teachers' mathematical anxiety and beliefs about mathematics for preschool children. The results of study indicated that in-service teachers had higher mathematics anxiety than pre-service teachers. It was

thought that the difference was derived from pre- and in-service preschool teachers' different substructures about their formal mathematical knowledge. When the demographic information of participants were investigated, it was found that most of the in- service teachers had graduated from social-verbal area and had had less math classes in high school. On the other hand, most of the pre-service preschool teachers had graduated from science and math area and had had more math classes in high school. The differences in mathematical knowledge may have an impact on the differences about mathematical anxiety. Results also showed that in-service teachers had higher beliefs score than pre-service teachers. Moreover, last grade pre-service teacher who had taken the course about mathematics education in early years had higher beliefs score than first grade pre-service teachers who had not taken that course.

It has been thought that the differences of education and experiences effect the beliefs about teaching mathematics. First grade pre-service teachers, having the lowest belief score, hadn't had any courses or experiences about teaching mathematics yet. Although last grade pre-service teachers had course about teaching mathematics in preschool period, they had very few experiences about it. But in-service teachers both had course about teaching mathematics in preschools and had more experiences about it. It is possible that the differences in education and experience cause differences in beliefs about teaching mathematics.

When the related literature is examined, it is seen that studies about mathematics anxiety and beliefs about mathematics education have focused on either pre-service teachers (Vinson, 2001; Brady and Bowd, 2005; Gresham, 2007, 2008; Isıksal, Curran, Koc and Askun, 2009; Rayner, Pitsolantis and Osana, 2009; Sloan, 2010; Swars et al., 2010) or in-service teachers (Reymond, 1997; Beswick et al., 2006; Platas, 2008; Beilock, Gunderson, Ramirez and Levine, 2010; Gunderson, Ramirez, Levine and Beilock, 2011). The findings of this study that pre-service teachers and in-service teachers were compared, suggested that pre-service teachers had less mathematics anxiety than in-service teachers whereas in-service teachers had more positive beliefs about teaching mathematics to young children.

Previous studies suggest that teacher's mathematics anxiety may cause students' mathematics anxiety. Therefore mathematics anxiety of in-service teachers is required to be reduced. Besides, pre-service teachers' beliefs about teaching mathematics in preschool period should be improved.

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## REFERENCES

Aktaş Arnas, Y. (2009). Okul öncesinde matematik eğitimi, Mathematics education in preschool. Nobel: Adana.

Arnold, D. H., Fisher, P. H., Doctoroff, G. L., & Dobbs, J. (2002). Accelerating math development in head start classrooms. *Journal of Educational Psychology*, 94(4), 762-770.

Ashton, P. T. & Webb, R. B. (1986). Making a difference: *Teachers sense of efficacy and student achievement*. Longman: New York.

Bai, H. (2010). Cross-validating a bidimensional mathematics anxiety scale. *Assessment*, 1, 178-182.

Beilock, S. L., Gunderson, E. A., Ramirez, G., & Levine, S. C. (2010). Female teachers' math anxiety affect girls' math achievement. *PNAS*, 107(5), 1860-1863.

Beswick, K., Watson, J., & Brown, N. (2006). Teachers' confidence and beliefs and their students' attitudes to mathematics. In P. Grootenboer, R. Zevenbergen, & M. Chinnoppan (Eds.), Identities, cultures and learning spaces (Proceedings of the 29th annual conference of the *Mathematics Education Research Group of Australasia, Canberra*, Vol. 1, pp. 68-75). Sydney: MERGA.

Brady, P., & Bowd, A. (2005). Mathematics anxiety, prior experience and confidence to teach mathematics among pre-service education students. *Teacher and Teaching: Theory and Practice*, 11(1), 37-46.

Bush, L. (1981). Some thoughts for teachers on mathematics anxiety. *Arithmetic Teacher*, 29(4), 37–39.

Gresham, G. (2007). A study of mathematics anxiety in pre-service teachers. *Early Childhood Education Journal*, 35(2), 181-188.

Gresham, G. (2008). Mathematics anxiety and mathematics teacher efficacy in elementary pre-service teachers. *Teaching Education*, 19(3), 171-184.

Gunderson, E. A., Ramirez, G., Levine, S. C., & Beilock, S. L. (2011). The role of parents and teachers in the development of gender-related math attitudes. *Sex Roles*, 66, 153-166.

Hembree, R. (1990). The nature, effects, and relief of mathematics anxiety. *Journal of Research in Mathematics Education*, 21, 33–46.

Henniger, M. L. (1987). Learning mathematics and science through play. *Childhood Education*, 63(3), 167-171.

Isıksal, M., Curran, J. M., Koc, Y., & Askun, C. S. (2009). Mathematics anxiety and mathematical self-concept: Considerations in preparing elementary-school teachers. *Social Behavior and Personality*, 37(5), 631-644.

Kaplan, R . G. (1991). Teacher beliefs and practices: A square peg in a square hole. Proceedings of the Annual Meeting of the North American Chapter of the *International Group for the Psychology of Mathematics Education*, Blacksburg, VA.

Leder, G. C., Pehkonen, E., & Törner, G. (2002). Beliefs: A hidden variable in mathematics education? Boston: Kluwer Academic Publishers.

Martinez, J. (1987). Preventing math anxiety: A prescription. *Academic Therapy*, 23, 117–125.

Pajares, M. F. (1992). Teachers' beliefs and educational research: Cleaning up a messy construct. *Review of Educational Research, 62*(3), 307–332.

Peterson, P. L., Fennema, E., Carpenter, T. C., & Loef, M. (1989). Teachers' pedagogical content beliefs in mathematics. *Cognition and Instruction, 6,* 1-40.

Philippou, G. N., & Christou, C. (1998). The effects of a preparatory mathematics program in changing prospective teachers' attitudes towards mathematics. *Educational Studies in mathematics,* 35, 189-206.

Platas, L. (2008). Measuring teachers' knowledge of early mathematical development and their beliefs about mathematics teaching and learning in the preschool classroom. *Unpublished doctoral thesis*. University of California, Berkeley.

Rayner, V., Pitsolantis, N., & Osana, H. (2009). Mathematics anxiety in preservice teachers: Its relationship to their conceptual and procedural knowledge of fractions. *Mathematics Education Research Journal, 21*(3), 60-85.

Reymond, A. M. (1997). Inconsistency between a beginning elementary school teachers' mathematics beliefs and teaching practice. *Journal for research in mathematics education, 28*(5), 550-576.

Richardson, F., & Suinn, R. (1972). The mathematics anxiety rating scale: Psychometric data. *Journal of Counseling Psychology*, 19, 551–554.

Sloan, T. R. (2010). A quantitative and qualitative study of math anxiety among preservice teachers. *The Educational Forum*, 74, 242-56.

Smith, S. S. (1997). Early childhood mathematics. Boston: Allyn & and Bacon.

Stipek, D., Givvin, K., Salmon, J., & MacGyvers, V. (2001). Teachers' beliefs and practices related to mathematics instruction. *Teaching and Teacher Education, 17*(2), 213 –226.

Swars, S. L., Daane, C. J., & Giesen, J. (2010). Mathematics anxiety and mathematics teacher efficacy: What is the relationship in elementary preservice teachers? *School Science and Mathematics, 106*(7), 306-315.

Swetman, B., Munday, R., & Windham, R. (1993). Math-anxious teachers: Breaking the cycle. *College Student Journal*, 22(4), 421-427.

Vinson, B. (2001). A comparison of pre-service teachers' mathematics anxiety before and after a methods class emphasizing manipulatives. *Early Childhood Education Journal, 29*(2), 89–94.