

*Full Length Research paper*

# The use of expanded microteaching for reducing pre-service teachers' teaching anxiety about mathematics

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Accepted 4 August, 2009

The purpose of this study was to investigate the effects of expanded microteaching on the pre-service mathematics teachers' teaching anxiety in teaching practicum course. There were 43 pre-service mathematics teachers divided into 2 groups, experimental and control groups, involved in the study. The experimental group contained 21 (12 females and 9 males) and control group contained 22 pre-service mathematics teachers (10 females and 12 males). The pre-service mathematics teachers in experimental group were lectured using expanded microteaching at the secondary school they were assigned to. Those who were in control group were lectured in a traditional way at another secondary school. Mathematics teaching anxiety scale (MATAS) was administered to pre-service teachers before and after eight weeks of teaching period. After collecting the data, the researcher used the independent samples t-test and ANCOVA to analyze the quantitative data. Results showed that there were statistically significant difference found regarding teaching anxiety between the control and experimental groups favoring the experimental group. In other words, using of the expanded microteaching in teaching practicum course reduced the teaching anxiety levels of pre-service mathematics teachers.

**Key words:** Teacher training, microteaching, expanded microteaching, teaching anxiety, mathematics, pre-service teacher.

## INTRODUCTION

Math achievement is considered as an important factor in students' career development (Olkun et al., 2005). On the other hand, it has been known a relatively difficult subject to learn (Olkun and Aydogdu, 2003; Toluk, 2003; Durmus, 2004). Therefore, math teachers are expected to have adequate skills and knowledge to teach effectively in the classroom before their graduation (Ubuz, 2002; Umay, 2002). In other words, mathematics teachers are required to be competent in many aspects of teaching profession as well as mathematics. However, these expectations cause anxiety in teachers, especially the inexperienced ones (Huber and Ward, 1969; Ameen et al., 2002). Some of these ambiguous anxiety forms are as follows; organization of subject matter content, timing, planning, teaching skills, questions of students, working conditions, guide teachers and the school administrators. The pre-service mathematics teacher is really afraid of how he/she will look, what he/ she will do and what he/ she will say when placed in the classroom environments. These conditions cause anxiety in mathematics teachers (Peker, 2009a).

## Teaching anxiety about mathematics

Recently, mathematics anxiety is a vital common phenomenon from elementary through university students (Newstead, 1998; Yüksel-Şahin, 2008; Vinson, 2001; Uusimaki and Nason, 2004). According to Baloğlu (1999), mathematics anxiety comes first among the most crucial problems in teaching mathematics. The research has demonstrated that there were many studies done on the pre- and in-service teachers' mathematics anxiety (Sloan et al., 1997; Tooke and Lindstrom, 1998; Vinson, 2001; Uusimaki and Nason, 2004; Brady and Bowd, 2005). For example, according to Uusimaki and Nason (2004), and Malinsky et al. (2006), the origin of the pre-service teachers' negative beliefs and anxiety about mathematics could be attributable to prior school experiences, such as their experiences as a mathematics student, the effect of prior teachers and of teacher preparation programs. According to Trujillo and Hadfield (1999), there were many similarities among the experiences of the pre-service elementary teachers, such as negative school

experiences, lack of family support, general test anxiety. They stated that all of the pre-service teachers suffer from severe mathematics anxiety and that despite these disadvantages, all of the participants plan to employ the constructivist and developmental methods they learned in their college mathematics methods classes in order to make mathematics meaningful to their own students.

Recently, teaching anxiety in mathematics is also common phenomenon in pre-and in-service teachers (Levine, 1996; Liu, 2008). Research has shown that there were many studies done on the teaching anxiety about mathematics (Levine, 1993, 1996; Peker, 2006, 2008; Peker and Halat, 2008; Liu, 2008; Peker, 2009b). Gardner and Leak (1994) conceptualized teaching anxiety as anxiety experienced in relation to teaching activities that involve the preparation and execution of classroom activities. Levine (1996) claimed that pre-service elementary school teachers usually experience anxiety for teaching mathematics and show feelings of mathematics anxiety. According to Levine (1993), anxiety for teaching mathematics is a frequent fear of pre-service teachers and it is associated with teaching mathematics.

What is teaching anxiety about mathematics? Teaching anxiety about mathematics can be defined as teachers' anxiety which occurs during teaching mathematical concepts, theories and formulas or during problem solving (Levine, 1993; Peker, 2006). It may reflect real or perceived knowledge deficits in mathematics content as well as in mathematics teaching skills and memories of past occurrences of mathematics failure or mathematics anxiety (Levine, 1993). According to Levine (1996), abstract discussions regarding mathematical concepts increased the teaching anxiety of the pre-service elementary teachers who had high level of anxiety for teaching mathematics, but using manipulative materials, getting familiar with developing creative teaching strategies for teaching mathematics and learning to design lesson plans in mathematical concepts reduced the teaching anxiety level of the pre-service elementary school teachers. Peker (2008) claimed that when the need of finding concrete examples for pre-service teachers' teaching is increasing, the pre-service teachers' level of teaching anxiety in mathematics is also increasing. Furthermore, Peker (2006) stated that there were several factors, such as content knowledge, pedagogical knowledge, attitudes towards mathematics teaching and self confidence related to both mathematics anxiety and teaching anxiety about mathematics.

Teaching anxiety may cause the development of teaching behaviors that are inappropriate, ineffective and damaging to the teachers' health. Teaching anxiety may result from difficulties in answering students' questions (Ameen et al., 2002). Similar problems are common among all the pre-service teachers including pre-service mathematics teachers. How can we decrease the pre-service teachers' teaching anxiety about mathematics? How can we give them some information about their

knowledge and their performance in real classroom environments? How can we assist them in gaining self confidence? Are microteaching applications effective in gaining teaching skills?

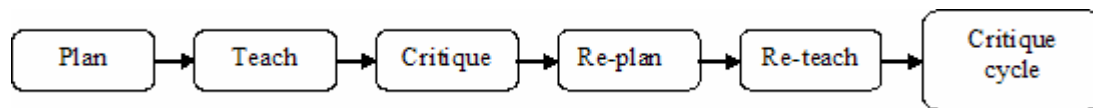
### **Microteaching and expanded microteaching**

Microteaching technique, developed at Stanford University in the United States, is a way to better train pre-service teachers (Huber and Ward, 1969). In the late 1960s and early 1970s, the use of microteaching spreaded rapidly in the U.S, Europe and some other developing countries (Klinzing and Floden, 1991). Today, numerous teacher education programs adopted this technique (Butler, 2001; Benton-Kupper, 2001; Amobi, 2005; Harrison, 2005; Lee and Wu, 2006; Bell, 2007). The use of it can also be seen in nurse education programs (Higgins and Nicholl, 2003).

Microteaching is a cycle of teaching and evaluation events in which a short, but complete, lesson is conducted in a small class by trainee teachers. Then, their teaching performances are evaluated. A regular microteaching class takes 5 to 10 (Huber and Ward, 1969) or 10 to 15 min (Klinzing and Floden, 1991; Kpanja, 2001). The number of students in a microteaching class is small varying between three and six (Huber and Ward, 1969) or ten and sixteen (Klinzing and Floden, 1991). Sometimes, it can be between 20 and 30 (Kpanja, 2001). It is important to follow the below process in microteaching (Figure 1).

In the microteaching process, a trainee teacher prepares a lesson plan on a specific subject and conducts the lesson before a group of audience including an advisor. Audience is usually the classmates. While conducting the lesson, the trainee teacher is videotaped. Then, the trainee teacher, the audience and the advisor watch the record, and they evaluate, criticize and provide feedback. Based on the critiques, evaluation and suggestions, the trainee teacher revises the lesson plan, makes changes if necessary and re-conducts the same lesson again to the same audience in the classroom. Similarly, the second teaching process is also videotaped. This video is also watched by himself/ herself, his/ her advisor and classmates. They repeat the same process on the second video recording as they did on the first recording (Benton-Kupper, 2001). According to Kpanja (2001), during the course of microteaching, the advisor usually sits and watches the teaching performance of the trainees. He or she does not interrupt the lesson but records the problems, which are used to provide feedback and correction after the microteaching lesson.

Microteaching, a valuable instructional tool for pre-service teacher education programs, is more effective than traditional teaching, if the required equipment and atmosphere are provided (Akalin, 2005; Benton-Kupper, 2001). Microteaching experiences provide pre-service teachers following benefits:



**Figure 1.** The microteaching process.

- (1) It exposes pre-service teachers to the realities of teaching.
- (2) Introduces pre-service teachers to their roles as teachers.
- (3) Helps them to see the importance of planning, decision making, and implementation of instruction.
- (4) Enables them to develop and improve teaching skills.
- (5) Helps them build their confidence for teaching (Subramaniam, 2006).

Participating in a microteaching training program increases pre-service teachers' confidence (Huber and Ward, 1969). Microteaching may be mini in nature but it is mighty in effect. It improves teaching skill by uncovering and correcting problematic aspects of the instruction (Kpanja, 2001).

According to Copeland (1975), there are two assumptions associated with using microteaching in teacher education programs. Firstly, "microteaching increases the probability that target skills will be acquired rapidly with a high degree of efficiency and secondly, microteaching is an effective method of increasing the range of behaviors employed by the teacher in the classroom after training is completed". Kpanja (2001) also recommends every teacher training institution to include microteaching with video equipment in their pre-service teacher education program.

With changes in educational research methods, with a greater focus on discourse and developments in the theory and practice of teacher education approaches, it is necessary to re-examine microteaching to improve its significance (Bell, 2007). The current microteaching applications have the following shortfalls for a pre-service teacher lecturing in a microteaching class:

- (1) The classroom environment formed artificially is not same with the actual classroom environment in an elementary, middle or secondary school.
- (2) The time to conduct the sample microteaching lesson is less than the actual duration of a lesson, which may result in pre-service teachers' lack of recognizing their own teaching skills.
- (3) Audience in a microteaching class knows the topic beforehand, which the lecturing pre-service teacher may not recognize the possible difficulties in teaching the same topic in a real school environment.
- (4) The pre-service teacher may not have an idea of his/her own classroom management skills.
- (5) Questions asked to the pre-service teacher by the audience in a microteaching lesson may not be asked by students in actual school settings.

In this research the term "expanded microteaching" was coined and applied in a pre-service math teacher training program. Expanded microteaching approach is similar to the microteaching approach except the number of students participating in a microteaching, the time devoted to teaching and the teaching environment. The number of audience is same with the number of students in an actual classroom setting and they are the actual target population, that is, primary, secondary and high schools students. The teaching environment is the real classroom setting and teaching time is also equal to the duration of a teaching period in a regular class. It was explained the process of expanded microteaching in the part of procedure.

Investigating pre-service math teachers' expanded microteaching experiences, Peker (2009a) found that after expanded microteaching, pre-service teachers had an opportunity to observe themselves lecturing identified where they need help to improve their teaching skills and strengthened these skills. Also, they made more and better preparations for lectures.

In short; it is fair to believe that expanded microteaching can act as a reflective mirror for pre-service teachers. After this process, each of the pre-service teachers is expected to find out his/her weaknesses in teaching mathematics and improve his/her teaching skills. The main objective in expanded microteaching procedures is to educate prospective mathematics teachers as qualified with having self-confidence and being good at field knowledge as well as teaching skills, establishing a nice dialog with the students, dressing in a good manner and so forth. In other words, educating prospective mathematics teachers, who have superior self confidence before starting teaching without any anxiety of teaching mathematics, is the main purpose. The focus of this current study was to examine the effects of expanded microteaching on pre-service mathematics teachers' teaching anxiety about mathematics.

**Question:** Does expanded microteaching have an effect in reducing teaching anxiety about mathematics?

## METHOD

In this study, because survey instruments were administered and numerical data was collected a quantitative method was used in analyzing the data. Wiersma (2000) claimed that when theory-testing research is being done it is likely to be quantitative research (p. 12). This study tested the expanded microteaching in teaching practicum course. Quantitative method has several techniques. According to McMillan and Schumacher (2001), questionnaire is

very common technique for collecting data in educational research (p. 40). The research design used was based on a quasi-experimental pre-test/ post-test comparison group design. This is the one commonly preferred in educational studies (McMillan and Schumacher, 2001). According to Wiersma (2000), when conducting educational research, there are many situations in which random assignment of participants is not options. Participants sedom are assigned at random to programs. Quasi-experimental research involves the use of intact groups of participants in an experiment, rather than assigning subjects at random to experimental treatments (p. 128). And the researcher also followed convenience sampling procedure in which the participants are not randomly selected. According to McMillan and Schumacher (2001), a convenience sample is a group of subjects selected on the basis of being accessible or expedient and it is convenient to use the group as subjects. This could be a university class of a professor who is doing research on college student (p. 175). In this study, the participants just enrolled in teaching practicum course at a mathematics teacher education program.

### Participants

The research involved 43 pre-service secondary school mathematics teachers. The participants enrolled in teaching practicum course at a university located in mid eastern part of Turkey. The study was conducted during the spring semester of 2006 and it took place eight weeks. The pre-service mathematics teachers who are chosen as sample group for this research were the ones who attended the teaching practice at the last semester. Pre-service teachers volunteered for study. The participants were divided into two groups, experimental and control groups. The experimental group contained 21 pre-service teachers (12 females and 9 males) and control group contained 22 pre-service teachers (10 females and 12 males). Male and female pre-service mathematics teachers are approximately equally distributed to control and experimental groups. The mean age of experimental group was 23.48 years (SD =.87). The mean age of control group was 24.32 years (SD =1.43).

### Instrument

In this research, Mathematics Teaching Anxiety Scale (MATAS), which was developed earlier by Peker (2006), was used. The Mathematics Teaching Anxiety Scale is a five-point Likert-type scale with 23 items. In a previous study, factor analyses revealed four factors. These are below: content knowledge – 10 items (factor loading ranging from 0.53 to 0.86), self-confidence – 6 items (factor loading ranging from 0.57 to 0.76), attitude towards mathematics teaching – 4 items (factor loading ranging from 0.61 to 0.70) and teaching knowledge – 3 items (factor loading ranging from 0.68 to 0.78). Reliability estimates of the MATAS were obtained by using Cronbach's alpha measure for each subscale. They were "Content knowledge": 0.90, "Self-confidence": 0.83, "Attitude towards mathematics teaching": 0.71, "Teaching knowledge": 0.61, Total Scale: 0.91 (Peker, 2006). In this study, the calculated reliability coefficient was 0.91. The aim of using this scale is to determine the pre-service mathematics teachers' anxiety levels and anxiety scores, then to analyze the difference between the scores. Table 1 presents some of the statements from the MATAS.

The participants were asked to rate the statements on a five-point scale: completely agree, agree, undecided, disagree, or completely disagree. The negative statements were weighted from 5 to 1 and positive statements were reversed. Therefore, the sum of the scores on the questionnaire showed the mathematics teaching anxiety level of the pre-service mathematics teachers. The maximum possible score on the MATAS a person can make is 115 (23 x 5) and the minimum score is 23 (23 x 1). In the determination of the

anxiety level, the researcher used the total points taken from the MATAS.

### Procedure

In teacher training colleges in Turkey, a pre-service secondary school mathematics teacher is expected to complete his/her degree requirements normally in five years or ten semesters. First seven semesters focus roughly equally on discipline studies outside education (for example, music, foreign language, mathematics, science). There are also some mathematics courses such as calculus, linear algebra, differential equations, abstract algebra. The last three semesters focus roughly on education (for example, development and learning, planning and evaluation of instruction, special instruction methods, school experience, instructional technologies and material development, teaching practicum). The aspect of a teacher training college is to provide pre-service teachers with appropriate teaching experience. The Teaching Practicum course of the teacher training colleges in Turkey serves this purpose. The Teaching Practicum course is the last course that is required by the pedagogical course at colleges and therefore is usually taken during the final semester. The pre-service secondary school mathematics teachers are assigned to different secondary schools in order to teach in a real classroom environment at during the last semester of their education. They spend 6 h a week during a whole semester under the guidance of their mentor teacher at secondary schools. Within this period, every pre-service mathematics teacher conducts a lesson in a real classroom determined by the mentor teacher for 40 min, a duration which is defined and given by the Turkish Ministry of Education.

In this study, pre-service secondary school mathematics teachers, who were taking the course named "teaching practicum", were divided into experimental and control groups. After having official authorization for the study, the pre-service mathematics teachers in the experimental group conducted lessons to ninth graders through expanded microteaching technique in a secondary school. For the first one of these presentations, the topic was determined and announced by the mentor teacher. Then, the trainee teacher prepared the lesson plan. Mentor teacher made amendments on the trainee teachers' lesson plan but did not interrupt the ongoing presentations. According to this plan, the trainee teacher conducted the topic within a lesson time in a real classroom setting. While conducting the lesson, the trainee teacher was videotaped. Then, this recording was watched by him/ her, the advisor and the other pre-service teachers in experimental group. They discussed and criticized the trainee teacher's performance. In other words, a critique of the teaching period was done. The difficulties faced by the trainee teacher in the real classroom setting, his/ her weak points, precautions be taken and suggestions to improve teaching skills were discussed. The weaknesses of the trainee teacher and his/ her mistakes in teaching were never judged. It was emphasized that the purpose of all those critiques was to enable the trainee teacher to be a more successful mathematics teacher in the future. Advices were given to the trainee teacher to overcome his/ her weaknesses which they had already found out while watching.

After the first presentation, the trainee teacher made necessary changes on his/ her lesson plan according to the advices and conducted the same topics to a different group of students who had not learned that topic before. This can be defined as "teach the same point you taught before" from the view of a trainee teacher. Again, the second teaching process was also videotaped. Then, this new recording was watched trainee teacher who conducted the lesson, the advisor and the pre-service teachers in expanded microteaching group. Then, they discussed and criticized the pre-service teacher's new performance. Advices were given to the trainee teacher again. In this respect, the other pre-service teachers gained experience without teaching. At this point, one can announce the

**Table 1.** Sample items for the MATAS.

Factor	Item Number	A sample of Items
Content knowledge	5	I got anxious when it comes to the point of teaching some mathematical topics.
Self-confidence	13	It is very easy for me to teach mathematics.
Attitudes towards mathematics teaching	19	I like answering questions about the topic I am teaching.
Teaching knowledge	21	Throughout my career as a teacher, I think I can make use of the different views and theories about teaching mathematic.

first teacher trainee as a victim because she or he teaches first. But it is not the case. Before they start learning how to teach, they observe experienced teachers during their first years at the college education under a course named "school experience".

During this process, the other pre-service teachers were expected to avoid the same mistakes made by their peers who used expanded microteaching and to strengthen their weak points as they watch and criticize their friend. Each of the pre-service mathematics teachers in experimental group made four presentations including the initial and the second presentations.

The pre-service mathematics teachers in control group, who were officially authorized, conducted lessons, traditionally without microteaching technique, to the ninth graders in a different secondary school for a period of eight weeks. In these presentations, no specific teaching method was followed; instead, the pre-service teachers decided on the methods to use and teach the topics. Each of these pre-service mathematics teachers made four presentations. After presenting, they discussed the problems occurred during the teaching period with their advisor. After this process, the pre-service mathematics teachers completed their practices in the school.

#### Data analysis

There were 21 pre-service mathematics teachers in experimental group and 22 pre-service mathematics teachers in control group. This limited number of participants might raise some questions concerning the assumptions of parametric statistics. Therefore, at the beginning of the analysis, normality assumptions were tested. Shapiro-Wilk test is a formal test of normality offered in the SPSS. The Shapiro-Wilk statistic is calculated for samples with 50 or fewer observations. The analysis of Shapiro-Wilks test for the MATAS scores of the experimental group was  $p = 0.363 > 0.05$ . Likewise, the analysis of Shapiro-Wilks test for the MATAS scores of the control group was  $p = 0.392 > 0.05$ . This implies that the participants in both groups are normally distributed. This supports the argument of Buyukozturk (2002) who stated that in a group if  $p > 0.05$ , then there is a normal distribution in the group. Therefore, parametric tests were used in the analysis of the data.

The data were responses from pre-service mathematics teachers' MATAS. Before and after the experiment, MATAS was administered to the pre-service mathematics teachers both in experimental and control group ( $N_E = 21$ ;  $N_C = 22$ ). There was no time limitation for testing session, however most pre-service teachers finished the MATAS within 15 min. The data gathered, then, were analyzed using One-way analysis of covariance (ANCOVA) with  $\alpha = 0.05$ , which is a variation of ANOVA, adjusts for pre-test differences that exist between control and experimental groups. "For instance, suppose in an experiment that one group has a mean value on the pre-test of 15 and the other group has a pre-test mean of 18. ANCOVA is used to adjust the post-test scores statistically to compensate for the 3-point difference between the

two groups. This adjustment results in more accurate post-test comparisons. The pre-test used for the adjustment is called the covariate" (McMillan, 2000).

## RESULTS

Question: Does expanded microteaching have an effect in reducing mathematics teaching anxiety?

Pre-service mathematics teachers' teaching anxiety scores, before and after expanded microteaching applications, were calculated. ANCOVA adjusted pre-test differences and compared post-test results. Table 2 shows the descriptive statistics for the pre-service mathematics teachers' teaching anxiety level based on the Mathematics Teaching Anxiety Scale (MATAS) scores and indicates that there is a change in the participants' teaching anxiety levels between pre- and post-test scores for both groups. There was a decrease between the pre- and post-test scores in the teaching anxiety level of the participants in the experimental and control groups. The mean score of the experimental group on the pre-test ( $M = 41.667$ ) was numerically lower than that of control group ( $M = 42.636$ ). Likewise, the mean score of the participants in the experimental group on the post-test ( $M = 36.523^a$ ) was numerically lower than that of control group ( $M = 40.274^a$ ).

Table 3 presents the analysis of covariance (ANCOVA) for both groups to the participants' teaching anxiety level and is based on the MATAS scores. Summary of ANCOVA showed that there were a statistically significant difference found regarding teaching anxiety between the control and experimental groups favoring the experimental group [ $F_{(1,40)} = 5.815$ ;  $p = 0.021 < 0.05$ ]. In other words, the study pointed out that the participants in experimental group conducted expanded microteaching based on applications had lower teaching anxiety level in mathematics than the ones who did traditional teaching experience in teaching practicum course.

## DISCUSSION AND CONCLUSION

### Discussion

The aim of this study was to investigate the effects of expanded microteaching on pre-service mathematics tea-

**Table 2.** Descriptive statistics for the pre-service mathematics teachers' teaching anxiety.

	N	Pre-test		Post-test		Post-test*	
		M	SD	M	SD	M	SE
Experimental group	21	41.667	9.31	36.048	10.18	36.523 <sup>a</sup>	1.11
Control group	22	42.636	10.64	40.727	11.42	40.274 <sup>a</sup>	1.09
Total	43						

a: Covariates appearing in the model are evaluated at the following values: pre-test = 42.1628. \*Estimated Marginal Means.

**Table 3.** Summary of ANCOVA for pre-service mathematics teachers' teaching anxiety.

Sources	Sum of squares	df	Mean square	F-statistic	p-value
Pre-test	3771.957	1	3771.957	145.445	.0001
Group	150.810	1	150.810	5.815	.021*
Error	1037.360	40	25.934		
Total	68589.000	43			

Note:  $\alpha = 0.05$ ,  $p = 0.021$ , \* $p < 0.05$ .

chers' teaching anxiety in teaching practicum course. The findings of this study showed that the mean scores gained on the pre-test of the pre-service mathematics teachers in experimental and control groups were 41.667 and 42.636 respectively. Likewise, the mean scores gained on the post-test of the pre-service mathematics teachers in experimental and control groups are 36.048 and 40.727 respectively. Result of the ANCOVA showed that there was statistically significant difference found regarding teaching anxiety between the control and experimental groups. The study revealed that using of the expanded microteaching applications have a statistically significant impact on the decrease in teaching anxiety levels of pre-service mathematics teachers.

Research has shown that there are some studies regarding the effectiveness of teaching strategies in mathematics methods course to identify and reduce mathematics anxiety or anxiety towards teaching mathematics of the pre-service teachers (Levine, 1996; Harper and Daane, 1998; Vinson, 2001; Bursal and Paznokas, 2006; Gresham, 2007; Liu, 2008). This study also showed that teaching practicum course reduced the teaching anxiety level of the pre-service mathematics teachers. Moreover, using of the expanded microteaching in teaching practicum course reduced teaching anxiety in mathematics. The study revealed that there was statistically significant difference found in terms of teaching anxiety level between the pre-service mathematics teachers who lectured with expanded microteaching and the others who followed the traditional way in the teaching practicum course. In other words, the participants who lectured the traditional way had higher teaching anxiety level in ma-

thematics than the others who lectured with expanded micro-teaching.

It is absolutely important that such anxieties should be reduced before the pre-service teachers become teacher (Liu, 2008), Hembree (1990) claims that mathematics anxiety causes a decrease in mathematics achievement and negatively affects performance. According to Brady and Bowd (2005), mathematics anxiety and its impact on confidence in teaching were related to the pre-service teachers' experiences with mathematics instruction. The study indicated that the expanded microteaching applications have a statistically significant impact on the decrease in teaching anxiety levels of pre-service mathematics teachers. The result of this study supports several research findings (Wada and Shimamura, 2005; Dogan-Dunlap et al., 2007; Yamamoto and Hicks, 2008; Peker, 2009a; Sen, 2009). For example, Wada and Shimamura (2005), Dogan-Dunlap et al. (2007) and Sen (2009) found that using of microteaching in teaching practice reduces teaching anxiety level of the pre-service teachers. It was reported that the pre-service or prospective teachers showed excitement about microteaching or expanded microteaching (Dogan-Dunlap et al., 2007; Peker, 2009a). According to Yamamoto and Hicks (2008), for pre-service teachers, watching they teach on video and analyzing their teaching practice with peers and instructors facilitate self-reflection. They stated that pre-service teachers may learn about their strengths and weakness by watching themselves. This study also indicated that the using of the expanded microteaching in teaching practicum course may cause a decline in the teaching anxiety levels of pre-service teachers in mathematics.

What would be the reasons behind the impacts of using expanded microteaching on the teaching anxiety level of the pre-service mathematics teachers? Research has showed that the pre-service teachers' confidence improved using of microteaching or expanded microteaching (Dogan-Dunlap et al., 2007; Sen, 2009; Peker, 2009a). Peker (2009a) reported that the expanded microteaching made improve the trainee teachers' confidence. According to him, the applications which caused improvement are; making more preparations for lecturing, opportunity for pre-service teachers to watch themselves, fulfill their deficiencies if there are any, being advised by other pre-service teachers and advisor, having feedback after watching the presentation, for other pre-services teachers having the opportunity to benefit from the strong points of their friend's presentation and strengthen their skills.

Philippou and Christou (1999) examined the efficacy believes of primary school teachers with respect to teaching mathematics. Regarding this issue, 90% of the teachers agreed with the statement: "sometimes I feel anxious that a student might ask me a question that I do not know how to answer or cannot explain". Baki (1996, 1997) suggests that mathematics teachers should be equipped with content and pedagogical content knowledge. It is not always possible for a pre-service teacher, who has a deep content knowledge, to teach his/her students what he/ she know. To know well is not always enough to teach well. Every pre-service teacher should know the ways of teaching what he/ she knows. It can be suggested that expanded microteaching applications are effectual in that it provides a pre-service teacher with the opportunity to find out to what extent he/she can teach what he/she knows.

Microteaching is an affective way of teacher training. The effectiveness still continues as well. However, it is necessary for microteaching applications to be expanded for the below mentioned reasons:

- (1) Time shortage of pre-service teacher's presentation.
- (2) The setting is not an actual class environment.
- (3) The audience is not composed of actual elementary, middle and secondary school students.
- (4) The first and second presentations are made to the same pre-service teachers group.

Due to the aforementioned reasons, during the microteaching applications, pre-service teachers may not recognize their possible weak points at planning, classroom management, solving the queries directed by the students, teaching difficulties, etc. It can be thought that these problems can be solved through expanded microteaching applications. This idea is supported by some research (Peker, 2009a). It was found out that pre-service teachers' anxiety which is based on self confidence and teaching knowledge declined with the help of expanded microteaching.

However, it is possible to face difficulties in expanded microteaching applications. When conducting an appli-

cation with a high number of pre-service teachers, more time length is needed for the process. This is also apparent in this study which took up much time, thus conducted under a challenging context. It can be put forward that it is sufficient to have 5 pre-service teachers to be included in the application. An expanded microteaching study can be carried out for a semester length with 5 pre-service teachers. However, it is expected that it will be more contributive to the evaluation of pre-service teacher's presentation if there are more pre-service teachers to watch the recording. It is thought that as the number of viewers increase, a variety of comments will probably arise.

## Conclusion

In short, this study concluded that there was a statistically significant difference found in regard to the mathematics teaching anxiety level between the pre-service mathematics teachers who lectured with expanded microteaching and the others who followed the traditional way in the teaching practicum course. This was in favor of the ones who lectured with expanded microteaching. In other words, the instruction using of the expanded microteaching in teaching practice may be effective on decreasing the pre-service teachers' teaching anxiety in mathematics or other areas. Therefore, if the teacher education programs hope to influence the development of effective instructional practices for trainee teachers, they may focus on expanded microteaching in teaching practicum course.

## Implications and recommendation for practitioners

The current study has several possible implications and suggestions for practitioners. The result of this study implies that incorporating an expanded microteaching experience into a pre-service teacher education program may cause a decline in the teaching anxiety levels of pre-service teachers in mathematics. Using of the expanded microteaching in teaching practicum courses is very beneficial from the pre-service mathematics teachers' perspectives. According to Peker (2009a), using of the expanded microteaching in teacher training has significant improvements on self confidence, planning, timing, giving different examples, asking questions, class management, using of effective material, pre-service teachers' physical appearance. This supports the recommendation of National Council of Teachers of Mathematics-NCTM (2000) stating that new educational theories and strategies be implemented in mathematics classrooms.

This research provides evidence that the use of expanded microteaching in pre-service mathematics teacher education programs can be a valuable instructional tool. The findings of previous research indicated that the pre-service mathematics teachers enjoyed the expanded microteaching experiences, learned about their teaching

abilities (Peker, 2009a), the findings of this research revealed that the pre-service mathematics teachers' confidence increased, and their teaching anxiety decreased. Therefore, the pre-service mathematics teachers would be more confident in the classroom and successful in the field if they prefer to use an expanded microteaching technique in their practices.

The instructors may use the expanded microteaching in teaching practicum course. The researcher recommends the use of the expanded microteaching for them in their teaching based on the result of this study. Because using of the expanded microteaching gives the instructors an opportunity to see and assess the pre-service teachers' planning, timing, giving different examples, asking questions, class management, using of effective material and pre-service teachers' physical appearance in the classroom (Peker, 2009a). Moreover, if the pre-service teachers lecture by expanded microteaching in their teaching practicum courses, they might have an opportunity to see their content and pedagogical content knowledge and they might have recognize strengths and weakness in their teaching practice.

### Limitations and future research

The findings of this current study should not be generalized to all pre-service mathematics teachers because this is not a pure-experimental research. The researcher followed the quasi-experimental study and convenience sampling procedure in the study. In this research design, the control group was compared with the experimental group, but participants were not randomly selected. Therefore, this research design limits the findings of the study. Besides, the researcher followed the convenience sampling procedure, and the sample size may not big enough for someone. Therefore, this sampling also limits the findings of the study. But, according to McMillan and Schumacher (2001), this does not mean that the findings are not useful.

There is enough support to encourage the further research studies of the use of microteaching and expanded microteaching in Teacher Training Programs. Sen (2009) reported that during the peer microteaching practices, prospective teachers' self confidence improved, they found the chance to observe themselves while gaining experience. He also claimed that microteaching practice helped reduce level of the first-time teaching anxiety. According to Peker (2009a), use of expanded microteaching in teacher training enhanced the pre-service teachers' confidence and teaching skills. He stated that the expanded microteaching practice allowed the pre-service teachers' instructional strengths and weakness.

In view of the lack of literature and empirical evidence on the use and benefits of expanded microteaching we would encourage others to implement and evaluate its appropriateness in mathematics teacher education programs and others.

### REFERENCE

- Akalin S (2005). Comparison between traditional teaching and micro-teaching during school experience of student-teachers. *Eurasia J. Educ. Res.* 20: 1-13.
- Ameen EC, Guffey DM, Jackson C (2002). Evidence of teaching anxiety among accounting educators. *J. Educ. Bus.* 78(1): 16-22.
- Amobi FA (2005). Pre-service teachers' reflectivity on the sequence and consequences of teaching actions in a microteaching experience. *Teach. Educ. Quart.* 32(1): 115-130.
- Baki A (1996). Nitelikli Matematik Öğretmeninin Alan Eğitimi Bilgisi. *Modern Öğretmen Yetiştirme Gelişme ve İlerlemeler Sempozyumu, Ankara-Turkey* pp. 624-630.
- Baki A (1997). Çağdaş Gelişmeler Işığında Matematik Öğretmenliği Eğitimi Programları. *Eğit. Bil.* 103: 46-54.
- Baloğlu M (1999). A comparison of mathematics anxiety and statistics anxiety in relation to general anxiety (Eric Document Reproduction Service No. ED436703).
- Bell ND (2007). Microteaching: What is it that is going on here? *Ling. Educ.* 18(1): 24-40.
- Benton-Kupper JB (2001). The microteaching experience: student perspectives. *Educ.* 121(4): 830-835.
- Brady P, Bowd A (2005). Mathematics anxiety, prior experience and confidence to teach mathematics among pre-service education students. *Teachers and Teaching: Theo. Pract.* 11(1): 37-46.
- Bursal M, Paznokas L (2006). Mathematics Anxiety and Preservice Elementary Teachers' Confidence to Teach Mathematics and Science. *Sch. Sci. Math.* 106(4): 173-180.
- Butler A (2001) Pre-service music teachers' conceptions of teaching effectiveness, microteaching experiences, and teaching performance. *J. Res. Mus. Educ.* 49(3): 258-272.
- Buyukozturk S (2002). Sosyal bilimler için veri analizi el kitabı. Ankara: PegemA Yayıncılık.
- Copeland WD (1975). The relationship between microteaching and student teacher classroom performance. *J. Educ. Res.* 68(8): 289-293.
- Dogan-Dunlap H, Dunlap J, Izquierdo E, Koshekeva O (2007). Learn by teaching: A mediating approach to teaching and learning mathematics for prospective teachers. I. Undergrad. *Math. Prep. Sch. Teach. J.* 4: 1-15.
- Durmus S (2004). A diagnostic study to determine learning difficulties in mathematics (In Turkish). *Kast. Educ. J.* 12(1): 125-128.
- Gardner L, Leak G (1994). Characteristics and correlates of teaching anxiety among college psychology teachers. *Teach. Psych.* 21(1): 28-32.
- Gresham G (2007). A study of mathematics anxiety in pre-service teachers. *Early Child Educ. J.* 35(2): 181-188.
- Harper NW, Daane CJ (1998). Causes and reduction of math anxiety in preservice elementary teachers. *Act. Teach. Educ.* 19(4): 29-38.
- Harrison SD (2005). Born or made? Developing personal attributes of teachers. Paper presented 33<sup>rd</sup> annual conference of Australian Teacher Education Association.
- Hembree R (1990). The nature, effect, and relief of mathematics anxiety. *J. Res. Math. Educ.* 21(1): 33-46.
- Higgins A, Nicholl H (2003). The experiences of lecturers and students in the use of microteaching as a teaching strategy. *Nurse Educ. Pract.* 3: 220-227.
- Huber J, Ward BE (1969). Pre-service confidence through microteaching. *Educ.* 90(1): 65-68.
- Klinzing HG, Floden RE (1991). The development of the microteaching movement in Europa. Paper presented at the Annual Meeting of the American Educational Research Association in Chicago, IL. (ERIC Document Reproduction Service No. ED352341).
- Kpanja E (2001). A study of the effects of video tape recording in microteaching training. *Br. J. Educ. Tech.* 32(4): 483-486.
- Lee GC, Wu CC (2006). Enhancing the teaching experience of pre-service teachers through the use of videos in web-based computer-mediated communication (CMC). *Innov. Educ. Teach. Int.* 43(4): 369-380.
- Levine G (1993). Prior mathematics history, anticipated mathematics teaching style, and anxiety for teaching mathematics among pre-service elementary school teachers. Paper presented at the Annual Meeting of the International Group for Psychology of Mathematics



- Education, North American Chapter. (ERIC Document Reproduction Service No. ED373972).
- Levine G (1996). Variability in anxiety for teaching mathematics among pre-service elementary school teachers enrolled in a mathematics course. Paper presented at the Annual Meeting of the American Educational Research Association in New York. (ERIC Document Reproduction Service No. ED398067).
- Liu F (2008). Impact of online discussion on elementary teacher candidates' anxiety towards teaching mathematics. *Educ.* 128(4): 614-629.
- Malinsky M, Ross A, Pannells T, McJunkin M (2006). Math Anxiety in pre-service elementary school teachers. *Educ.* 127(2): 274-279.
- McMillan JH (2000). Educational Research. Fundamentals for the consumers (3<sup>rd</sup> ed.). New York: Addison Wesley.
- McMillan JH, Schumacher S (2001). Research in Education: A Conceptual Introduction. (5<sup>th</sup> ed.). New York: Addison Wesley Longman, Inc.
- National Council of Teachers of Mathematics (2000). Principles and standards for school mathematics. Reston, VA: Author.
- Newstead K (1998). Aspects of Children's Mathematics Anxiety. *Educ. Stud. Math.* 36(1): 53-71.
- Olkun S, Altun A, Smith G (2005). Computers and 2D geometric learning of Turkish fourth and fifth graders. *Br. J. Educ. Tech.* 36(2): 317-326.
- Olkun S, Aydogdu T (2003). Üçüncü uluslararası matematik ve fen araştırması (Timms): matematik nedir? Neyi sorgular? Örnek geometri soruları ve etkinlikleri. *İlköğretim-Online*, 2(1): 28-35. [Online] Available from: <http://www.ilkogretim-online.org.tr> [Accessed 1 December 2007]
- Peker M (2006). Matematik öğretmeye yönelik kaygı ölçeğinin geliştirilmesi. *Eğit. Bil. Uyg.* 9: 73-92.
- Peker M (2008). Eğitim programları ve öğretmen adaylarının matematik öğretme kaygısı. VIII. Ulusal Fen Bilimleri ve Matematik Eğitimi Kongresi, 27-29 Ağustos, Bolu-Turkey.
- Peker M (2009a). Pre-service mathematics teacher perspectives about the expanded microteaching experiences. *J. Turk. Educ. Sci.* 7(2): 353-376.
- Peker M (2009b). Pre-service teachers' teaching anxiety about mathematics and their learning styles. *Eurasia J. Math. Sci. Tech. Educ.* (In press).
- Peker M, Halat E (2008). The pre-service elementary school teachers' mathematics teaching anxiety and gender, The European Conference on Educational Research, 10-12 September, Goteborg, Sweden.
- Philippou G, Christou C (1999). Efficacy beliefs with respect to mathematics teaching. *Mathematical Beliefs and their Impact on Teaching and Learning of Mathematics Conference at Mathematisches Forschungsinstitut Oberwolfach* pp. 115-121.
- Sen AI (2009). A study on the effectiveness of peer microteaching in a teacher education program. *Educ. Sci.* 151: 165-174.
- Sloan TR, Vinson B, Haynes J, Gresham R (1997). A comparison of pre- and post- levels of mathematics anxiety among pre-service teacher candidates enrolled in a mathematics methods course. Paper presented at the Annual Meeting of Midsouth Educational Research Association in Nashville (ERIC Document Reproduction Service No. ED417137).
- Subramaniam K (2006). Creating a microteaching evaluation form: the needed evaluation criteria. *Education* 126(4): 666-667.
- Toluk Z (2003). Üçüncü uluslararası matematik ve fen araştırması (TIMMS): matematik nedir? *İlköğretim-Online*, 2(1): 36-41. [Online] Available from: <http://www.ilkogretim-online.org.tr> [Accessed 1 December 2007]
- Tooke DJ, Lindstrom LC (1998). Effectiveness of a mathematics methods course in reducing math anxiety of pre-service elementary teachers. *Sch. Sci. Math.* 98(3): 136-140.
- Trujillo KM, Hadfield OD (1999). Tracing the roots of mathematics anxiety through in-depth interviews with preservice elementary teachers. *Coll. Stud. J.* 33(2): 219-232.
- Ubuz B (2002). Üniversite eğitimi ve öğretmenlik: Matematik öğretmenlerinin ve adaylarının görüşleri. V. Ulusal Fen Bilimleri ve Matematik Eğitimi Kongresi. [Online] Available from: [http://www.fedu.metu.edu.tr/ufbmek-5/b\\_kitabi/b\\_kitabi.htm](http://www.fedu.metu.edu.tr/ufbmek-5/b_kitabi/b_kitabi.htm).
- Umay A (2002). İlköğretim matematik öğretmenliği programının öğrencilerin matematiğe karşı özyeterlik algısına etkisi. V. Ulusal Fen Bilimleri ve Matematik Eğitimi Kongresi. [Online] Available from: [http://www.fedu.metu.edu.tr/ufbmek-5/b\\_kitabi/b\\_kitabi.htm](http://www.fedu.metu.edu.tr/ufbmek-5/b_kitabi/b_kitabi.htm).
- Uusimaki L, Nason R (2004). Causes underlying pre-service teachers' negative beliefs and anxieties about mathematics. Proceedings of the 28<sup>th</sup> Conference of the International Group for the Psychology of Mathematics Education, vol. 4: 369-376 (ERIC Document Reproduction Service No. ED489664).
- Vinson BM (2001). A comparison of pre-service teachers' mathematics anxiety before and after a methods class emphasizing manipulatives. *Early Child Educ. J.* 29(2): 89-94.
- Wada M, Shimamura S (2005). An empirical study for anxiety in using digital media: A reduction in teacher's anxiety and high-school students' anxiety in using digital media. *Bull. Cen. Res. Supp. Educ. Pract.* 1: 139-147.
- Wiersma W (2000). Research methods in education: An introduction. (7<sup>th</sup> ed.). Boston: Allyn and Bacon.
- Yamamoto J, Hicks J (2008). Digitalizing Microteaching. [Online] Available from: [http://academics.sru.edu/education/FEJ/FEJ\\_fall2008.pdf](http://academics.sru.edu/education/FEJ/FEJ_fall2008.pdf) Field Exp. J. 2: 1-16.
- Yüksel-Şahin F (2008). Mathematics anxiety among 4<sup>th</sup> and 5<sup>th</sup> grade Turkish elementary school students. *Int. Elec. J. Math. Educ.* 3(3): 179-192.