

## Motivational Qualities of Mathematical Experiences For Turkish Preservice Kindergarten Teachers

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**Abstract:** This study is based on the principle that the mathematical anxiety in preservice kindergarten teachers-to-be should be removed and they should be encouraged towards mathematics. It is expected from teachers-to-be who are able to construct this confidence to prepare exercises improving mathematical ideas for their students. This study was carried out with second year students of Preservice Teaching Section, Primary School Teaching Department, Faculty of Education, Uludağ University who taking pre-school mathematics. The study continued for 14 weeks (1 semester). The researcher of this study gave the course. The training was realised as 1 hour of basic mathematics and 2 hours of pre-school mathematics teaching within one week. An attitude test was applied to the pre-service teachers-to-be both the beginning and at the end of training. In addition, several personal questions related with the course were asked to these pre-service-teachers-to be. In this study, it is concluded that pre-service-teachers-to-be have developed positive attitudes and are encouraged towards mathematics and their success to prepare exercises on mathematical subjects, such as classification, ordering, comparison, pairing, numbers, geometric shapes, calculation, measures, space perception, problem-solving and developing creativity, for pre-school kindergarten students has improved.

**Key words:** Mathematics Education, Math Anxiety, Attitude, Beliefs, Early Childhood Education.

### INTRODUCTION

Mathematics anxiety is prevalent among the preservice teacher population (Hembree, 1990).

*“I am afraid of Maths”*

*“I don’t like Maths ”*

*“It makes me uncomfortable to hear the word Maths”*

*“Maths is a boring course “*

*“I think I will never ever manage Maths “*

*“Is there something wrong with me I wonder?”*

These negative opinions of teachers-to-be towards maths support Hembree (1990). In fact, many teachers in our society always have a maths anxiety in themselves. This is cause for concern considering that teachers who possess higher levels of mathematics anxiety may unintentionally pass on this negative feelings to their students (Wood, 1988).

Research by Jackson and Leffingwell (1999) has shown that only about 7 % of Americans have had positive experiences with mathematics from kindergarten through college. It is 93 % of Americans who have negative math experiences. Studies in Turkey also put forward some anxiety on Mathematics lessons. Considerable reasons why these are crowded classrooms, students’ lack of necessity to reasoning on solving mathematical problems, and teachers

preferences on choosing classical teaching methods (Özyürek, 1995).

This clearly shows that there is a problem? If math anxiety is such a problem, why isn’t much being done about it? Many children, including those with disabilities and those without disabilities, as well as adults, do not feel confident in their ability to do math (Furner and Duffy, 2002).

Some researchers have proposed that mathematics anxiety may stem from teaching methods that are conventional and rule bound (Tobias,1993). This rule- based methodology is most often employed by elementary teachers who possess high levels of mathematics anxiety and negative attitudes towards mathematics (Bush,1989; Karp,1991). Moreover, mathematics instructors who teach primarily through lecture and rote memorization of algorithms often neglect to meet the learning styles of all students and, therefore, may unintentionally perpetuate mathematics anxiety (Hodges,1983; Zaslavvsky,1994). These instructors are more likely to implement practices, that are contrary to the standards proposed by the National Council of Teachers of Mathematics(NCTM; Mershet,1993). The NCTM standards advise teachers to use a variety of techniques and instructional strategies that will benefit all types of learners in the classroom (NCTM, 2000).

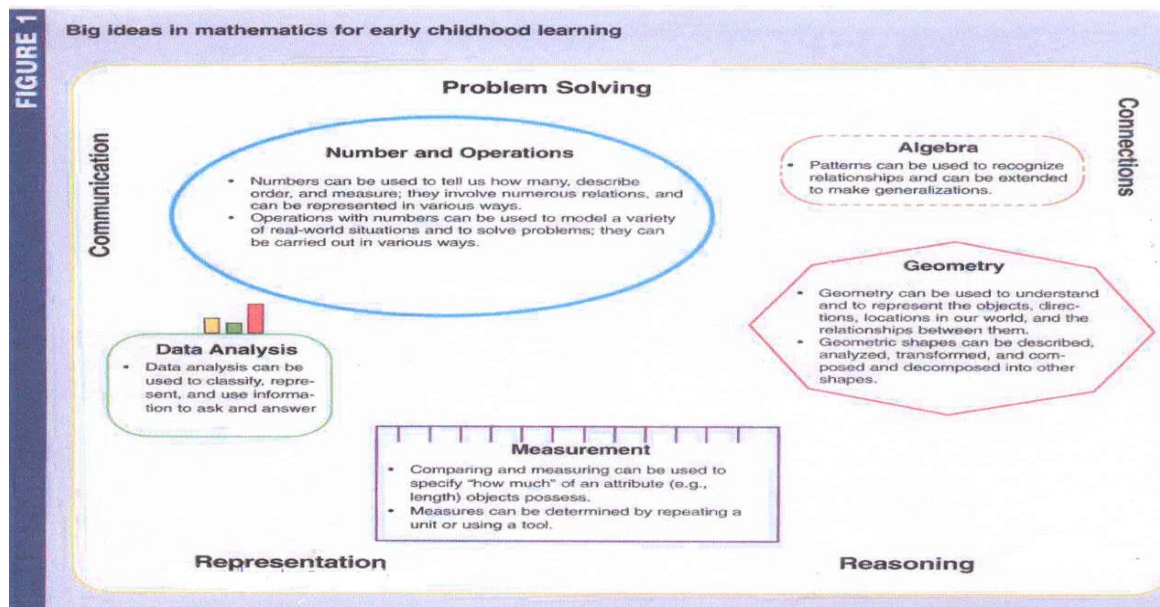


Fig.1:Big idea mathematics for early childhood learning

The early years are crucial to children's mathematical development. Undoubtedly, mathematical development in the earliest years is important (Clement and Sarama, 2000). The foundation for children's mathematical development is established in the earliest years. Many mathematics concepts, at least in their intuitive beginning, develop before school (NCTM, 2000) (fig. 1).

Due to the standards identified in NCTM (2000), it is very important for the children to receive support from pre-school institutions as well as their parents in order for their mathematical thinking to develop. The teachers who are going to supply this professional support: Should have a positive attitude towards maths & should know how s/he can teach mathematical concepts pre-schooling. That is, the teacher has a very important role in pre-school period.

Teachers demonstrating positive attitudes can be the keys to developing positive student attitudes toward mathematics (NCTM, 1991). Teachers must address their own anxiety and negative attitudes. Toward mathematics in order to create a learning environment in which students will develop positive attitudes (Souviney, 1994).

How the teachers are going to create a learning environment which will develop a positive attitude towards maths? Tobias (1981) indicated that teaching maths with traditional methods might be a factor in increasing mathematical anxiety.

Some researchers have discovered that when a nontraditional manner is used, anxiety can be reduced. The use of manipulative materials has been shown to assist in reducing anxiety (Took, 1988). Similarly, Putney (1998) commented on the efficiency of the approaches such as hand-on, manipulative used in maths methods courses of primary school trainee-teachers. He indicated that these approaches used in classes create a positive

change in the attitudes of the primary school trainee-teachers towards maths.

Taylor and Brooks (1986) report that mathematics anxiety can be reduced by teachers

*Establishing a supportive classroom.*

*Using manipulatives to bridge from concrete to abstract*

*Using a variety of teaching techniques.*

*Addressing students' attitudes toward mathematics.*

Tooke, Lindstrom, Leonard (1998) have shown that preservice elementary teachers mathematics anxiety may be reduced by completing a mathematics methodology course.

Finally, educators have had favorable results in using methods courses to influence attitudes of preservice elementary teachers toward mathematics (Teague and Austin-Martin, 1981).

Trujillo and Hatfield (1999) have drilled the mathematical anxiety of primary school teacher-trainees in detail and listed the reasons for the existence of mathematical anxiety all through primary, high school and university education as follows:

*Self perceptions*

*School Experiences*

*Family and peers influences*

*Mathematics Test anxiety*

*Plans for teaching children mathematics*

The examination of the study of Trujillo and Hedfield (1999) indicates that the teachers have an important role in reducing the mathematical anxiety.

The aim of this study is to investigate the importance of the pre-school maths education in the formulation of a positive attitude in the pre-school teacher trainees' towards maths and the efficiency of this course which is about teaching how teachers who have developed such a positive attitude themselves can form a plan which they can improve the mathematical thinking of their students with when they enter their classrooms as real teachers.

## METHOD

This study is carried out with 32 second year students of Preservice Teaching Section, Primary School Teaching Department, Faculty of Education, Uludağ University who are taking pre-school mathematics. The study lasted for fall semester. Most of the students taking pre-school maths teaching course are the graduates of vocational high-school child development branch and they have a weak maths background. The study lasted for 14 weeks. The researcher of this study gave the course. The training is realised as 1 hour of basic mathematics and 2 hours of pre-school mathematics teaching within one week.

The course has two aims: The first one is to encourage teacher trainees to do maths and create this self-confidence in them. The second is that which basic mathematical concepts should be taught and how they should be taught in primary school.

The maths attitude scale (Duartepe, A., and Çilesiz, S., 1999) was used to measure the attitudes of the students towards maths both at the beginning and at the end of teaching (see Appendix A). This is a Likert scale type consisting of 38 items (for examples they were asked to choose between “completely agree” and “completely disagree”) and measures four different dimensions of attitude.

13 items in first dimension measure like, interest and enjoyment to mathematics, 9 items in second dimension measure confidence and anxiety. Third dimension includes 8 items and measure occupational and daily importance of mathematics and 8 items in the last dimension reflect interest, like and enjoyment. According to ITEMAN results, item-scale correlation supported validity. Smallest correlation value for first dimension is 0.55, for the second dimension is 0.62, for the third dimension is 0.51. To reliability analysis Cronbach Alpha coefficient is 0.96.

After the completion of teaching, some open-ended questions are asked in order to get personal views for the purpose of investigating the efficiency of the course on students (see Appendix B). The written answers to those questions are gathered.

### Presentation of Pre-School Maths Teaching Course

The researcher has presented the whole course. Based on the belief that teachers have an active role in reducing mathematical anxiety and making learning easier, in order to prepare a suitable learning environment; the suggestions in NCTM (2000) for preventing mathematical anxiety have been taken into consideration (see Appendix C). Moreover, the items presented below have been followed strictly.

- accommodate for different learning styles

Emphasising that they should ask something that they do not understand immediately and that they should learn the subject during the lesson.

Handing in the notes to the students before the class so that there would be no difficulty in taking notes.

Having free time so that such students to ask questions.

Making the students talk to themselves when they have encountered the problematic situation such as “what am I going to do first”, “I have to remember...” “what do I know?”, “Have we ever solved a similar problem before”...

Using active-learning and creative problem solving techniques.

- create a variety of testing environments

Giving key terms and methods orally and written way before the exam time

- design positive experiences in math classes

Being cheerful during the course, and putting on a smiling face.

Teaching maths by concretising.

- remove the importance of ego from classroom practice
- suggesting projects to the groups
- emphasize that everyone makes mistakes in mathematics

Telling the students that they can get over this and to persuade themselves by changing their negative statements towards maths such as “I will not be able to do maths” or “I cannot manage it” into statements such as “I can manage maths” or “I can do it”,

- make math relevant

Never ever showing humiliating actions towards students in front of their peers.

Emphasising that everyone can make mistakes

- let student have some input into their own evaluations

Being aware of the fact that each and every student has a different proficiency level.

Creating opportunities for the groups to present the concrete materials consisting of these project suggestions mixed with their own ideas and then the application of these presentations idea pre-school institutions (fig.4–5–6).

- allow for different social approaches to learning mathematics

Suggesting resources for the after-class homework and different questions.

Giving equal opportunities so that everyone can participate to the lesson.

- emphasize the importance of original, quality thinking rather than rote manipulation of formulas

Doing group work and providing the preparation of activities which will enable the formation of the basic mathematics concepts in pre-school such as number and calculations, measuring, geometry in the classroom (fig.2–3).

Explaining where some mathematical formulas come from

- characterize math as a human endeavor

Doing activities in the lesson



Fig.2. Doing group work and providing the preparation of activities



Fig.3. To prepare exercises on classification and ordering



Fig.4. Creating opportunities for the groups to present the concrete materials



Fig.5. The application of these presentations idea pre-school institutions - 1



Fig.6. The application of these presentations idea pre-school institutions - 2

## RESULT AND DISCUSSION

In this study the efficiency of pre-school maths teaching course in the change of the attitudes of the pre-school teacher trainees towards maths is evaluated.

It is observed that there is a change in the attitudes of the teacher trainees as a result of maths teaching course. In the statistical analysis of the questions paired samples t-test is used. According to the results given in Table 1, the average of the pre-test scores gained from Mathematics Attitude Scale (see Appendix A) is 136.87, and the average of post-test scores

is 146.93. This 10.06 difference in the average and that  $t(32) = -3.86$ ,  $p < .001$  is meaningful indicates that there is an important change in the attitude towards maths.

It is obvious that pre-school maths teaching course has made a strong emphasis on the attitudes of pre-school teacher trainees and that they are successful.

The answers given to the three open-ended questions stated in Appendix B the pre-school teacher trainees to investigate the effectiveness of the pre-school maths teaching course are as follows (the responses of the students are given below without any change at all).

QUESTION 1: "Is there a change in your

Table 1. Comparison of Pre-and Posttest Scores

|      | Mean   | Std. Deviation | Std. Error | t     | N  | Sig.( 2- tailed ) |
|------|--------|----------------|------------|-------|----|-------------------|
| Pre  | 136,87 | 14,71          | 2,60       | -3,86 | 32 | ,001              |
| Post | 146,93 |                |            |       |    |                   |

P < 0,05



attitude towards maths after you have taken Pre-School Maths Teaching Course? Explain your answer.

After pre-school math education lessons most of the students stated that they were not afraid of maths anymore, developed self confidence and were couraged to deal with math.

*"I thought that I would never do it, that I had something lacking. Then I realised that there is no such thing as 'I will not be able to understand maths'. Once I have the sufficient background knowledge and study enough I can keep up with it".*

*"I used to afraid of maths because I didn't have a mathematical background. As I liked the instructor of the course, I started to like it as well."*

*"It makes me uncomfortable even to hear the word 'maths'. I used to have a feeling like I couldn't do it or I would fail this course (as I have graduated from a vocational high-school). This uneasiness I had gradually faded away. Since I had a good visa mark, I started to have a confidence in this lesson. Now I do it, I attempt to do it, I try..."*

Some students told that they realized maths is not only consist of numbers and formulas.

*"I used to like maths class even before I have taken this course. Yet, you did well by explaining how some mathematical formulas appeared. No one had ever explained them before. We were only given the formulas and required to memorise them".*

*"Maths class was on a course of numbers. I used to think that we could use [it] only in problem solving. After taking this course, I have learned how maths should be taught to the students and how we can present them in a funny and educative way".*

Also some students emphasized that while preparing the pre-school maths activities they enjoyed a lot.

*"I used to not like maths. I was very irritated when I couldn't solve the problems. The activities we did made me like maths. The lesson was funny."*

Depending on the answers given to question 1, it is seen that almost all of the students have left their negative mathematic attitudes and moved to a positive attitude towards maths.

QUESTION 2: "What kind of contributions can the teaching methods used in Pre-School maths Teaching Course make to your profession? List them in the order of importance."

Most of the students in pre-school education expressed that they realized which basic mathematical concepts to accept and how to teach them.

*"Using the activities and materials we have learned in this course while acquiring mathematical skills to the students will help the children to learn mathematics easily"*

*"I can use these activities while assisting development of the cognitive, perceptive and comprehension skills of the children"*

*"I have a greater self-confidence [now] . I can easily present this course to the children. I have formed many ideas on giving mathematical thinking. I can present the subjects in my professional life by taking the in-class presentations we have made as an example. I am also more handy now"*

When teaching maths almost all of the students stated that they could make the students learn it amusingly by using the activities they had learned. So they could raise new generations who are not afraid of maths.

*"By using these activities I can make it possible that the children will learn by enjoying maths and by having fun. A new generation who like maths will be raised since they will learn mathematical concepts via games !"*

*"I think that the activities used in the lesson have lots of contribution. We did these activities for the first time and we have learned. This made us have a broader vision".*

*"I think I will be able to prevent the formation of mathematical fears in the future".*

*"We have learned to give mathematical thinking to the students via games, the activities carried out were really a pro forma knowledge for us. I think that they are in fact quite beneficial. In fact, the part that I like most in the maths course is the activities."*

Most of the students expressed that they realized how important mathematics is in pre-school education.

*"I have understood the importance of maths in pre-schooling. This caused my interest in this subject to increase."*

*"I have now learned how maths should be taught in pre-school education. I have learned activities. I will be able to teach maths to the children better."*

In nearly all of the responses to the second question, the importance of the in-class activities and concrete materials used for teaching mathematical concepts is emphasised. It is seen that they are keen on teaching pre-school mathematical subjects in their professional lives as they have a positive attitude towards maths and that they have self-confidence.

QUESTION 3: Do you think that the content of this course is sufficient? If your answer is NO, what are your suggestions to increase the efficiency of this course, list them.

Many of the given results shows that the content of the lesson is adequate and enjoyable.

*"I think we have had this lesson in an efficient and funny way. Moreover, it was a good idea to implement the activities we carried out in the class in the kindergartens and to take their photographs. I think many more projects should be done this way. It is more educative and we also have experiences."*

*"I think this is enough. I enjoyed this course a lot"*

*Some students also wanted to include computer-assisted activities during the education*

*"The content of the course was enough. I wish it also had "computer-assistance" quality. This can increase progress positively."*

As a result, considering all the studies for changing the attitude towards mathematics, if all the maths teachers working at kindergarten, primary schools, high schools and even at universities organise the learning environment effectively they may make great changes in the attitudes of the students towards mathematics.

## Educational Implications

The findings of this study indicates the importance of motivation on preservice kindergarten teachers' academic performance. Mathematics educators create a nice atmosphere and students should play an active role during the course. Besides different teaching technics should be applied. While preparing pre-school mathematics activities, group works should also be included. These group work activities should be encouraged to present in pre-school institutions. As a result developing self-confidence and positive attitude leads to better mathematical achievement of students and to feel more comfortable in the future. Due to this established cycle, new generations who are not anxious about maths and who have developed a positive attitude towards maths are brought to the future.

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### Appendix A: MATHS ATTITUDES SCALE ( Duatepe, A., and Çilesiz, Ş., 1999)

1. (+) Maths doesn't scare me.
2. (+) Maths is among the courses that I like
3. (+) I want to study maths
4. (+) I will use maths throughout my life in many occasions.
5. (-) I am nervous/tense while studying Maths
6. (+) I feel comfortable/at ease when I deal with a new maths problem.
7. (-) It is waste of time to try to understand maths.
8. (-) There is no encouraging side of studying maths.
9. (+) Learning maths woths the trouble.
10. (-).Trying to solve maths problems doesn't appeal to me.

11. (+)When I encounter an unusual question while studying maths I keep on trying until I find the solution.
12. (-) I don't think that I will use the things I learn in this lesson in daily life.
13. (-) I can't understand how some people enjoy maths this much.
14. (-) I don't think that I will use maths in my professional life.
15. (-) If I wasn't obliged I wouldn't attend maths courses.
16. (+) It is hard to stop once I start studying maths.
17. (+) Being good at maths will increase my opportunities of work.
18. (+) I can get good marks in maths classes.
19. (+) I am not anxious while studying maths.
20. (-) I do not have the mathematical thinking ability.
21. (+) I like to solve the problems I have encountered by using maths.
22. (-) I think I won't be able to understand maths.
23. (-) Maths is not a science, it is only a means.
24. (+) I enjoy working on the problems which are not completely solved during the class hour.
25. (+) It is important for me to succeed in maths.
26. (-) I am not self-confident when it is necessary to study maths.
27. (+) I am pretentious in maths
28. (-) I do not like to talk about maths with other people.
29. (+) I enjoy maths course.
30. (-) I am restless even from hearing the word maths.
31. (-) I do not want to have another maths course other than this.
32. (-) Other courses seem to be more important than maths according to me.
33. (-) Maths confuses me.
34. (-) Maths is boring
35. (-) Maths is one of the courses that I dread most.
36. (-) I feel helpless while I am studying maths
37. (-) This course doesn't have any contribution to my profession.
38. (-) If only I didn't have to use maths in other courses.

#### Appendix B: QUESTIONS

The three questions below are for the efficiency of the maths teaching course. Indicate your personal opinion and ideas without mentioning your name.

1. Is there a change in your attitude towards maths after you have taken Pre-School Maths Teaching Course? Explain your answer.

2. That kind of contributions can the teaching methods used in Pre-School maths Teaching Course make to your profession? List them in the order of importance

3. Do you think that the content of this course is sufficient? If your answer is NO, what are your suggestions to increase the efficiency of this course, list them.

#### Appendix C : Recommendations for Preventing Math Anxiety

- \* accommodate for different learning styles
- \* create a variety of testing environments
- \* design positive experiences in math classes
- \* remove the importance of ego from classroom practice
- \* emphasize that everyone makes mistakes in mathematics
- \* make math relevant
- \* let student have some input into their own evaluations
- \* allow for different social approaches to learning mathematics
- \* emphasize the importance of original, quality thinking rather than rote manipulation of formulas
- \* characterize math as a human endeavor