

Why Do Primary School Students Have Mathematics Anxiety? A Mixed Method Research*

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Abstract: The literature has emphasized that students' math anxiety begins in primary school years. For this reason, it is important to examine the causes of mathematics anxiety of primary school students in order to prevent students from experiencing mathematics anxiety. In this context, the study was carried out to examine the causes of mathematics anxiety of primary school students. The study was carried out with explanatory sequential design from mixed method research. 306 primary school students participated in the quantitative part of the study and eight primary school students participated in the qualitative part. In the study, data were collected by questionnaire and semi-structured interview form. Descriptive statistics were used in the analysis of the quantitative data of the study, and content analysis method was used in the analysis of the qualitative data. The results of the study showed that primary school students may experience mathematics anxiety due to the nature of the mathematics course as well as the reasons arising from the teacher or the student.

Keywords: Math anxiety, Anxiety, Primary school, Reason of anxiety

1. Introduction

Mathematics anxiety has attracted the attention of mathematics education researchers in recent years. Despite this, previous studies have focused on teachers and teacher candidates (Hollingsworth, & Knight-McKenna, 2018; Schaeffer, Rozek, Maloney, Berkowitz, Levine, & Beilock, 2020). Researches with students are few. In particular, researches with primary school students are very limited (Newstead, 1998). On the other hand, studies on mathematics anxiety of primary school students are considered important since primary school years are the period in which students' anxiety begins to develop (McLeod, 1992). Researchers focusing on primary school students' math anxiety examined students' math anxiety levels or conducted studies to compare students with and without math anxiety (Newstead, 1998; Szczygieł, 2020). However, they emphasized that it is important to examine the causes of mathematics anxiety of primary school students and directed them to studies to examine the causes of mathematics anxiety (Gürel & Yetkin-Özdemir, 2019; Harari, Vukovic & Bailey, 2013). In this context, the study was carried out to examine the causes of mathematics anxiety of primary school students. It is expected that this study will guide the teaching of mathematics in primary school years by shedding light on the causes of mathematics anxiety.

1.1. Theoretical Framework

Mathematics anxiety can be defined as feeling uncomfortable or uneasy when an individual encounters a mathematical task (situation) (Trujillo & Hadfield, 1999). Mathematics anxiety has some symptoms similar to but different from the disease (Erktin, Dönmez, & Özel, 2006). Therefore, math anxiety is not a disease (Arem, 2009, p.1). For the symptoms of mathematics anxiety, negative mental, physical and emotional states or feeling life experiences such as fear and uneasiness in the process of mathematical problem solving or mathematical thinking can be counted (Arem, 2009, p.1). Studies have emphasized that individuals with high mathematics anxiety may have low mathematics achievement and mathematical thinking skills (Arı, 2017, p.319; Şahin & Öztürk, 2019). Bursal and Paznokas (2006) stated that math anxiety significantly affects not only affective features but also cognitive features.

Researchers have pointed out that there may be different reasons for math anxiety. For example, Şahin and Öztürk (2019) pointed out that students' math anxiety may be due to the difficulty of the math course. Arem (2009, p.1-25) emphasized that some of the reasons for math anxiety may be exam anxiety, low academic achievement, dyscalculia (mathematics learning difficulty), fears experienced by previous students, and the language of mathematics. Bindak (2005) stated that students' math anxiety starts in the first years of primary school and that the reasons for math anxiety may stem from the teacher or parents. The claim that Bindak (2005)

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put forward in his research that mathematics anxiety begins to emerge in the first years of primary school makes it necessary to examine the reasons why primary school students experience mathematics anxiety. As a matter of fact, the claims made about the causes of mathematics anxiety in studies in the field of psychology make it necessary to examine the causes of mathematics anxiety scientifically (Arem, 2009, p.1-25).

1.2. The Present Study

The literature has shown that many studies have been conducted on mathematics anxiety, but these studies are mostly quantitative and using scales (Doruk, Öztürk, M., & Kaplan, 2016; Okur, Bahar, Akgün, & Bekdemir, 2011). Although there are qualitative studies on mathematics anxiety in the literature, studies on the causes of mathematics anxiety are very limited (Bekdemir, 2007; Sherman, & Wither, 2003). Studies examining mathematics anxiety of primary school students are not available in the literature, according to our literature review. Studies to investigate the causes of students' math anxiety will form the basis for research to increase students' math achievement and math self-efficacy perception. For this reason, this study was conducted to examine the causes of primary school students' math anxiety. For this purpose, answers to the following research questions were sought:

- (1) What is the level of mathematics anxiety of primary school students?
- (2) What are the reasons for primary school students' math anxiety stemming from teachers?
- (3) What are the reasons for primary school students' math anxiety caused by students?
- (4) What are the reasons for the mathematics anxiety of primary school students arising from the mathematics lesson?

2. Method

2.1. Research Model

In the study, explanatory sequential design from mixed research was used. The explanatory sequential design starts with collected quantitative data from a randomly sampling. A qualitative sample is formed from the collected quantitative data according to the purpose of the research. Finally, qualitative data is used to explain quantitative data (Creswell, 2019). Since in this study, it was aimed to determine the causes of mathematics anxiety of primary school students, it was first used with a descriptive research model, which is one of the quantitative research methods. Then, the findings of the quantitative research were analyzed and the participants of the qualitative research were determined. A case study model was used for qualitative research. A case study is a research model in which a situation with definite boundaries is examined in depth (Stake, 2013). Finally, qualitative research and quantitative research data were combined.

2.2. Participants

All ethical rules were complied with during the study process. In this context, the characteristics of the participants were included, and the information that would reveal the personal information of the participants was not included. The data of the study were collected via remote access via Zoom, and only voice recording was made during the interviews.

The participants of the quantitative part of the study were randomly selected. 306 primary school students, all of whom were Turkish, participated in the quantitative research. 144 of the students are in the 3rd grade (9 years old), 162 of them are in the 4th grade (10 years old). 168 of the students are girls and 138 are boys. The fathers of 29% of the students are primary school graduates, 25% of them are secondary school graduates, 28% of them are high school graduates and 18% of them are university graduates. The mothers of 45% of the students are primary school graduates, 26% of them are secondary school graduates, 19% of them are high school graduates and 10% of them are university graduates. 51% of the students stated mathematics as their favorite subject, 24% life studies, 15% Turkish, 10% English. While 82% of the participants stated that they liked the mathematics lesson, 18% stated that they did not like the mathematics lesson.

The participants of the qualitative part of the study were selected from among those who participated in the quantitative research. Participants were determined by purposive sampling method. Eight students participated in the qualitative part of the study. Four of them are in 3rd grade and four of them are in 4th grade. Typical case sampling method was used in the selection of the participants. All of the participants are individuals with high math anxiety. Four of the participating students are girls and four are boys. Direct quotations were made from the statements of the participants and code names were used for the participants in these quotations. These code names are Zülal (3rd grade girl), Fatma (3rd grade girl), Kezban (4th grade girl), Fikriye (4th grade girl), Hasan (3rd grade boy), İsmail (3rd grade boy), Nuri (4th grade boy) and İskender (4th class male) were selected.

2.3. Instruments

Questionnaire and semi-structured interview form were used as data collection tools in the study. The questionnaire was prepared by the researchers and consists of two parts. In the first part, descriptive questions were included, and in the second part, questions were asked to determine math anxiety. In the preparation of the second part of the questionnaire, firstly, the literature was searched and the math anxiety scales were examined and eight questions suitable for primary school students were written. The second part of the questionnaire was prepared in a three-point (disagree, undecided, agree) form. Since the age levels of the students are small, the number of questions was determined less. The prepared questions were presented to two faculty members who are experts in mathematics education and who work on mathematics anxiety. The opinions received from the faculty members are that the questions are appropriate. Two examples of questions used in the survey are as follows: “*I am afraid of getting up on the blackboard in math class.*” and “*When my teacher asks a question in math class, I do not hesitate to answer it.*”

The semi-structured interview form used in the study was prepared by the researchers. The form consists of eight questions and follow-up questions written for these questions. After the form was prepared, it was presented to two faculty members to whom the prepared questionnaire was presented and its final form was given in line with their opinions. Then, a pilot study was conducted with a student to determine whether the language of the questions was understandable. Two questions from the interview form are as follows: “*When your teacher asks a question in a math class, can you answer without hesitation?*” and “*What do you think about going into math class?*”

2.4. Data Analysis

Descriptive statistics were used in the analysis of the quantitative data of the study, and content analysis method was used in the analysis of the qualitative data. With descriptive statistics, students’ math anxiety levels were determined. The interviews for content analysis were first coded by the researchers, then categories were created according to the common features of the coding, and themes were created according to the common features of the categories. The coding made was checked by a faculty member and 91% agreement was determined between the coders. Finally, quantitative and qualitative data were evaluated together.

3. Results

3.1. Mathematics Anxiety Levels of Primary School Students

When the questions prepared for the mathematics anxiety of primary school students were examined, 16% of the students stated that they did not use mathematics anywhere, and 5% stated that it was used only sometimes. 21% of the students stated that they felt uneasy while entering the math class, and 26% were indecisive. 28% of the students stated that they were afraid of the teacher in the mathematics lesson, 57% were undecided, and 15% were not afraid. 32% of the students stated that they were hesitant to get up to the blackboard in the mathematics lesson, 47% were hesitant, and 21% were not afraid. 28% of the students participating in the study evaluated that they were nervous when the teacher asked a problem, 36% were indecisive, and 36% were not nervous. 40% of primary school students stated that they did not like the teaching of mathematics, 21% were undecided, and 39% liked it. 39% of the students stated that they were bored in the math lesson, 18% were indecisive and 43% were not bored.

Three themes were identified for the reasons of primary school students’ math anxiety: “Reasons from the teacher”, “Reasons from the course” and “Reasons from the student”.

3.2. Teacher-Related Reasons for Mathematics Anxiety of Primary School Students

When the causes of mathematics anxiety of primary school students are examined, the reasons arising from the teacher can be listed as follows: Teacher pressure, teaching the lesson and homework.

3.2.1. Mathematics anxiety due to teacher pressure

It has been determined that one of the reasons for primary school students' math anxiety is the pressure of the teacher. It was determined that the students who were determined to have mathematics anxiety due to the pressure of the teacher got angry or put pressure on the student especially when the students did not understand in the mathematics lesson.

Dialogue 1 between the researcher and İsmail, who stated that his teacher got angry when they did not understand the subject in the mathematics lesson, is as follows:

Researcher: Don't you ask the teacher where you don't understand?

İsmail: No, I'm not asking.

Researcher: Why don't you ask?

İsmail: Because he will be angry.

Researcher: Will he be angry?
İsmail: Yes.
Researcher: Why is your teacher getting angry?
İsmail: I don't know, I can't say because I have such a fear inside me.

In Dialogue 1, it is understood that İsmail was afraid of the teacher's anger. Dialogue 2 between the researcher and İskender, where a similar dialogue took place, is as follows:

Researcher: Why do you hesitate to answer questions?
İskender: Because my teacher is angry.
Researcher: When does he get angry?
İskender: While he/she explain something a hundred times, when we don't understand it.
...
Researcher: When there is a question you know, you want it, when there is a question you do not know, you do not want to come out. What do you think is the reason for this?
İskender: In case my teacher gets angry.

It is understood from Dialogue 2 that one of the reasons for the student's math anxiety is that the teacher is angry the students.

Pointing out that the teacher puts pressure on them in the mathematics lesson, Zülal added the following statements: *"The teacher comes, looks at the notebook like this, people tremble like this, and they get nervous."*

3.2.2. Mathematics anxiety experienced due to the teaching of the lesson

It has been determined that one of the reasons for primary school students' mathematics anxiety is related to the teaching of the mathematics lesson. It was determined that the students who were determined to have mathematics anxiety due to the conduct of the mathematics lesson did not find the teaching of the mathematics lesson enjoyable, they were bored with listening to the lesson and games were not included in the lesson.

Fatma is one of the students who stated that she did not find the teaching of the mathematics lesson enjoyable. She said that *"Math lesson would be more fun if there were such fun things in it."* It is understood from Fatma's statements that she did not find the math lesson fun.

Nuri stated that he was bored of listening to the math lesson and said, *"... Also, math is very boring. I get tired of listening to the teacher talking."* He expressed this thought with his words. It is understood from Nuri's expressions that the teacher told the math lesson, while Nuri was bored.

Kezban stated that games are not included in the math class, *"I would love the lesson if the lesson was taught by playing funny games in such a fun way and doing funny things with funny things."* Fikriye said, *"I would like to have a game in the mathematics lesson. The teacher sometimes makes it play in other lessons, but I would like him to play it in mathematics as well."* He used his expression. Dialogue 3 between Nuri and the researcher, who expressed a similar view, is as follows:

Nuri: The teacher plays games in some lessons, it would be nice if it was in mathematics.
Researcher: Doesn't the teacher play game in math class?
Nuri: It doesn't play, bought one game, but it just sits and doesn't play. He would play it in physical education, but he doesn't.

When Dialogue 3 is examined, it is understood that Nuri's teacher did not include games in the mathematics lesson; therefore the mathematics lesson did not attract enough attention.

3.2.3. Math anxiety due to homework

It has been determined that one of the reasons for primary school students' math anxiety is too much homework in math class. Dialogue 4 between the researcher and Kezban, who was determined to have math anxiety due to too much homework, is as follows:

Researcher: Does your teacher give you a lot of homework in math class?
Kezban: Yes, a lot.
Researcher: He gives a lot?
Kezban: Yes. I get tired of making them.
Researcher: Got it.
Kezban: I'm also very tired.

When Dialogue 4 is examined, it is understood that the reason for Kezban's anxiety is the homework given too much in the mathematics lesson. In his other statement, Kezban emphasized that there are a lot of homework.

3.3. Student-Related Reasons for Mathematics Anxiety of Primary School Students

When the causes of mathematics anxiety of primary school students are examined, the reasons arising from the students can be listed as follows: shyness, fatigue and lack of interest in mathematics.

3.3.1. Math anxiety due to shyness

It was determined that one of the reasons for the mathematics anxiety of the students participating in the study was shyness. It was determined that the students who were determined to have mathematics anxiety due to shyness thought that their friends might make fun of them when they were solving or not being able to solve the questions in the mathematics lesson, so they felt uncomfortable in the lesson. İsmail “*Sometimes we are afraid that we will not know like that, because our friends will make fun of us, and sometimes we can comfortably go on the board and say what we know.*” used expressions. Kezban said, “*I am ashamed. They make fun of me because I can't solve a question.*” used phrases. It is understood from the statements of the students that they experience math anxiety due to shyness.

3.3.2. Math anxiety due to tiredness

It has been determined that one of the reasons for primary school students' mathematics anxiety is the fatigue experienced by the students in the mathematics lesson. It was determined that the students who were determined to have math anxiety due to fatigue were tired because of too much homework or they were tired from writing too much in the math class.

Nuri, who stated that she was tired of writing too much in the math class, said, “*I'm bored with writing because my hands are getting tired.*” used expressions. From these statements, it is understood that the reason for the student's math anxiety is the fatigue caused by writing in the math class.

3.3.3. Mathematics anxiety due to lack of interest in mathematics

It has been determined that one of the reasons for mathematics anxiety is the students' lack of interest in mathematics. It was determined that the students, who were determined to have mathematics anxiety due to their lack of interest in the mathematics lesson, did not want to take part in the lesson or did not ask about the place they did not understand because they were not interested in the mathematics lesson.

The dialogue 6 between the researcher and Kezban, who stated that he did not want to take part in the lesson because he was not interested in the mathematics lesson, is as follows:

Researcher: Got it. Don't you tell your teacher to explain a little slower?

Kezban: I don't like it, so I don't say it much.

Researcher: Well, when there are subjects that you do not understand, don't you ask your teacher about them?

Kezban: I'm not asking.

Researcher: Why don't you ask?

Kezban: No, I don't like math, so I don't want to ask too much.

Researcher: You don't ask because you don't like it.

Kezban: Yes.

From Kezban's statements in Dialogue 6, it is understood that the reason for the student's math anxiety is that she does not want to take a task because she is not interested in the math lesson.

3.4. Course-Related Reasons for Mathematics Anxiety of Primary School Students

When the causes of mathematics anxiety of primary school students are examined, the reasons arising from the course can be listed as follows: believing that one cannot understand mathematics, thinking that mathematics makes our lives difficult, and thinking that mathematics is difficult.

Believing that he could not understand the mathematics lesson, Hasan said, “*When I do not understand, I get bored with mathematics. I usually don't understand anyway.*” used expressions. It is understood from Hasan's statements that he has mathematics anxiety because he believes that he cannot understand mathematics. Similarly, Fikriye's sentences show that he believes that he cannot understand mathematics. She said “*We do not understand mathematics. That's why we're afraid, we don't want mathematics.*” It is understood from the statements of the students that they believe that they do not understand the mathematics lesson.

The dialogue 7 between Kezban and the researcher, who thinks that mathematics makes life difficult, is as follows:

Researcher: Got it. What do you think would happen if there was no such thing as mathematics in our lives?

Kezban: Everything would be very simple.

Researcher: It would be simple. Is math challenging, that is, is it challenging us too much?

Kezban: Yes, it is very challenging because I do not like mathematics at all.

It is understood from Kezban's statements in dialogue 7 that he perceives mathematics as a concept that makes life difficult.

Thinking that mathematics is difficult, İskender said, "*Mathematics is a difficult subject. Because it is so, I cannot understand it and I am afraid.*" It is understood from İskender's statements that one of the reasons for his math anxiety is that he sees the math course as difficult.

4. Conclusions and Discussions

In this study, which aims to examine the mathematics anxiety of primary school students, some results supporting the literature were found. However, some reasons originating from the teacher and the student reached in this study, which aims to make an in-depth analysis of mathematics anxiety, distinguish this study from previous studies. For this reason, it is expected to make a significant contribution to the literature.

The results obtained in the study indicate that there are basically three reasons for students' math anxiety. These reasons were identified as teacher-based, student-based, and course-based. It was determined that the reasons stemming from the teacher stemmed from the oppressive attitude of the teachers, the way they handled the mathematics lesson, and the fact that they gave more homework than necessary. It was determined that the reasons stemming from the students stemmed from the shyness of the students, their tiredness in the mathematics lesson and their lack of interest in mathematics. The reasons arising from the mathematics course were determined as students believing that they could not understand mathematics, thinking that mathematics made our lives difficult, and thinking that mathematics was difficult.

Some of the students who participated in the study stated that the teachers exhibited an oppressive attitude in their lessons. It was determined that the students experienced math anxiety due to the teachers' oppressive attitude. Many studies in the literature have revealed that teachers' attitudes are effective on students' math anxiety (Arem, 2009, p.13). In this context, it can be said that the finding that students experience math anxiety due to teachers' oppressive attitudes supports the literature. Szczygiel (2020), on the other hand, investigated the relationship between math anxiety in parents and teachers, and math anxiety and math achievement in first and third grade children, and revealed that adults' math anxiety is not a social source of children's math anxiety. In this study, findings regarding teachers' behaviors towards students were obtained, and no purpose was determined for teachers' math anxiety. It is thought that the difference between the research results may be due to this. The findings of the study indicated that some of the primary school students experienced mathematics anxiety due to the teaching of the mathematics lesson. Arem (2009, p.19) determined that students experience anxiety because of the teaching method that teachers use in mathematics lessons. It can be said that the finding of primary school students' math anxiety due to the teaching of the math lesson supports the results of the aforementioned study. It was determined that some of the primary school students experienced math anxiety because their teachers gave too much homework. The literature indicates that students experience math anxiety because teachers give too much homework in math class (Arem, 2009, p.27; Demir & Durmaz, 2018). In this context, it can be said that the finding that homework creates a mathematical apricot supports the literature.

It was determined that some of the primary school students experienced math anxiety due to their shyness. Demir and Durmaz (2018) determined in their study with mathematics teachers that teachers think that students have mathematics anxiety due to their shyness. In this context, it can be said that the mathematics anxiety of the students reached in this study due to their shyness supports the literature. Another reason for the mathematics anxiety of primary school students was that the students were very tired in the mathematics lesson, and this fatigue was caused by the teachers taking notes. As a matter of fact, in this study, it was determined that the students experienced mathematics anxiety due to the teaching of the mathematics course. In this context, it is understood that the obtained finding indicates that the study is consistent within itself. Some of the students who participated in the study stated that they were not interested in mathematics. It is understood from the statements of the students that mathematics anxiety occurs as a result of this indifference. There are many findings in the literature that students' math anxiety may be related to their math interests (Arem, 2009, p.1-25; Şahin & Öztürk, 2019)

It was determined that some of the primary school students who participated in the study saw mathematics as difficult and believed that they could not understand mathematics, so they experienced mathematics anxiety. There are studies in the literature that low math achievement causes math anxiety (Şahin & Öztürk, 2019).

4.1. Limitations and Implications

As a result of this study, which aimed to examine the mathematics anxiety of primary school students, it was determined that the mathematics anxiety of the students could be caused by the teacher, the student and the lesson. In this context, it can be suggested that teachers should make the mathematics lesson more fun, include activities and give students more say. In addition, creating more positive classroom environments can also prevent students' math anxiety.

This study aimed to examine the causes of mathematics anxiety, and no application was made to relieve mathematics anxiety. It is recommended that future researchers plan research to eliminate math anxiety by conducting an intervention research.

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