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Araştırma Makalesi

Metaphoric Perceptions of Primary Pre-Service Teachers Towards Mathematics, Mathematics Teaching Process and Mathematics Teaching

Sınıf Öğretmeni Adaylarının Matematik Dersine, Matematik Öğretme Sürecine ve Matematik Öğretimine Yönelik Algılarının Metaforlar Yardımıyla Belirlenmesi

Ahmet Oğuz AKÇAY	**Osman ÇİL**
Dr. Öğr. Üyesi Eskişehir Osmangazi Üniversitesi	Dr. Öğr. Üyesi Kırşehir Ahi Evran Üniversitesi
aoakcay@ogu.edu.tr	ocil@ahievran.edu.tr
https://orcid.org/0000-0003-2109-976X	https://orcid.org/0000-0001-5903-9864

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Abstract

The aim of this study is to examine the metaphors of primary pre-service teachers regarding mathematics lessons, mathematics teaching and mathematics teaching process. In line with the purpose of the research, phenomenology pattern, one of the qualitative research methods, was used in this study. 80 pre-service teachers in two public universities in the Central Anatolia region, who studied in the department of primary education in the 2019-2020 academic year, participated. In the analysis of the research data, the responses of the primary pre-service teachers to the metaphoric perception form and the pictures they created were analyzed with the content analysis technique. Pre-service teacher candidates were found to produce positive and negative metaphors about mathematics, mathematics teaching and mathematics teaching progress and they had positive and negative perceptions about them. Particularly, the participants stated that mathematics and mathematics teaching are difficult courses, however mathematics is an indispensable part of life and that it is always needed. In addition, pre-service teachers' perceptions of mathematics are shaped especially by their negative experiences in their previous experiences. Also participants stated that mathematics is an indispensable part of people life and mathematics is always needed in their daily lives. The arrangement of the primary school curriculum of undergraduate programs and the courses in the curriculum in a way to reduce the anxiety of teacher candidates towards mathematics lesson and mathematics teaching and to provide a positive experience related to mathematics will help reduce the mathematical anxiety observed in the society and increase mathematical achievement.

Keywords: *mathematics, mathematics education, mathematics teaching, pre-service teacher, metaphor analysis*

Öz

Bu çalışmanın amacı sınıf öğretmeni adaylarının matematik dersi, matematik öğretimine ve matematik öğretme süreci kavramlarına ilişkin sahip oldukları metaforik algıları ortaya çıkarmaktır. Söz konusu çalışmanın amacı doğrultusunda nitel araştırma yöntemlerinden fenomenoloji deseni kullanılmıştır. Çalışmaya İç Anadolu bölgesinde yer alan iki devlet üniversitesinde 2019-2020 eğitim öğretim yılında sınıf eğitimi anabilim dalında öğrenim gören 80

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öğretmen adayı katılmıştır. Çalışmada elde edilen verilerinin analizinde sınıf öğretmeni adaylarının metaforik algı formuna vermiş oldukları cevaplar ve oluşturdukları resimler incelenerek içerik analiz tekniği kullanılmıştır. Sınıf öğretmeni adayları matematik dersi, matematik öğretimi ve matematik öğretmeni kavramları hakkında hem olumlu hem de olumsuz metaforlar ürettiklerini ve bu doğrultuda olumlu ve olumsuz inançlara sahip oldukları bulunmuştur. Öğretmen adayların matematik algılarını özellikle geçmiş yaşantılarında edindikleri olumsuz tecrübeler doğrultusunda şekillendiği söylenebilir. Özellikle katılımcılar matematiği ve öğretimini zor bir ders olduğunu belirmişlerdir. Ayrıca matematik hayatın vazgeçilmez bir parçası olduğunu ifade ederek günlük hayatlarında matematiğe her zaman ihtiyaç duyulduğunu dile getirmişlerdir. Bu doğrultuda lisans programlarının sınıf öğretmenliği müfredatının ve müfredat içerisindeki derslerin öğretmen adaylarının matematik dersine ve matematik öğretimine yönelik kaygılarını azaltacak ve matematikle ilişkili olumlu deneyim fırsatı sunabilecek şekilde düzenlenmesi, toplum içerisinde gözlenen matematiksel kaygının zamanla azaltılmasına ve matematiksel başarının artırılmasında yardımcı olacaktır.

Anahtar kelimeler: *matematik, matematik eğitimi, matematik öğretimi, sınıf öğretmeni adayları, metafor analizi*

Introduction

One of the most important factors of development of society is an effective education system (Alagöz & Sözen, 2021) and also effective education system is necessery for mathematics teaching. Mathematics is a basic lesson in various departments and areas from elementary school first-grade to higher education. Among purposes of mathematics education, there are skills of logical thinking, problem-solving, having mathematical communication, logical reasoning, and attaching meaning to spatial relationships (MEB, 2018). It is emphasized that mathematical thinking should also be taught in addition to teaching mathematical operations in mathematics lessons (Güner, 2013). One of the private purposes of the mathematics lesson teaching program is related to the expression that developing a confident approach to mathematical problems by developing a positive attitude towards mathematics with their experience in learning mathematics. National Council of Teachers of Mathematics) (NCTM) (2000) has emphasized that students must have problem-solving skills in order for them to apply mathematics to real-life situations. Besides, Yıldırım (2006) has emphasized that they must be raised as individuals who can solve problems and who have access to information instead of students who memorize information in our developing world. Köroğlu and Yeşildere (2004) have defined the purpose of mathematics as "Solving for learning and not for learning to solve" (p. 26). Putting it in other words, it has been emphasized in the literature (Elias, 2003) that it is required for students to have problem-solving skills and to be persons who solve problems and think over the problems. In addition, it has been expressed that people having a high level of problem-solving skills are successful in mathematics (Soylu and Soylu, 2006). Another factor that affects mathematical success, in addition to problem-solving skill is the mathematical perception that people have (Güveli, İpek, Atasoy and Güveli, 2011; Şahin, 2013). Saying it in another way, one of the most important factors that affect individuals' mathematical skills, such as problem-solving, is their perception with regards to the mathematical lesson.

Meaning that attached to mathematics by students affects their learning significantly. It has also been expressed in mathematics teaching programs that having a positive attitude towards mathematics and the impact of a positive attitude towards success in mathematics could not be neglected (MEB, 2018). The success of individuals having positive perceptions for mathematics lessons in the mathematics lesson develops accordingly (Tarim, Özsever, and Canbazoğlu, 2017). Başar, Ünal, and Yalçın (2002) have stated that mathematics success of students having negative perception against mathematics was low and that mathematics success of students developing positive meanings was high. Studies conducted reveal that attitudes of students against mathematics lessons affected their career choices (Baydar and Bulut, 2002). Perceptions of teachers against mathematics also affect students' success. "Teacher's having positive perceptions can affect success situation of student, effective participation of the student in the

lesson, the student realizes meaningful learning, student's gaining skills and confidence." (Tarım, Özsever, and Canbazoğlu, 2017, p. 1033). The role of the teacher bears importance with regards to the perception of students in relation to mathematics lessons, and in this regard, it is important to determine perceptions of future teachers, meaning teacher candidates in relation to mathematics. Noyes (2004) has stated that by determining perceptions of teacher candidates in relation to a phenomenon and concept, he would contribute to their professional developments.

Metaphorical structures and people describe their thoughts by making a correlation between abstract concepts and concrete concepts (Saban, Koçbeker, and Saban, 2005). The concept of metaphor is expressed as trying to explain the characteristics of another phenomenon by using the features of the phenomenon that people know well. As Ben-Peretz, Mendelson, and Kron (2003) have stated, metaphors can reveal the perceptions, thoughts, and underlying reasons of teachers and students about education, and they can provide opportunities for students to embody their abstract thoughts about their perceptions. Students can explain abstract concepts with concrete concepts with metaphors. Regarding the concept of learning mathematics, Güner (2013) expressed that "Learning mathematics is like climbing on Ağrı Mountain." as an example, he has expressed that mathematics is a difficult lesson by similarizing it to a mountain that is difficult to climb. Regardless of which lesson it is, teachers who determine the educational environment have important roles such as making students love the lesson, ensuring that they learn, and making them feel its importance. The perception that forms in relation to a lesson affects success in that lesson significantly.

In this context, determining the perceptions of primary school teacher candidates, who will be responsible for teaching mathematical concepts at primary school level, about mathematics-related topics will provide information on how they will shape the future teaching process. This study aimed to reveal metaphoric perceptions of primary school teacher candidates in relation to mathematics lessons, mathematics teaching, and mathematics teaching process concepts. In line with this purpose, below questions were answered.

1. What are the metaphorical perceptions of the primary school teacher candidates towards the mathematics lesson?

2. What are the metaphorical perceptions of primary school teacher candidates towards the mathematics teaching process?

3. What are the metaphorical perceptions of primary school teacher candidates towards teaching mathematics?

Method

Phenomenology pattern, being one of the qualitative research methods, was used within the scope of the study. Phenomenological research aims to bring perceptions and experiences of individuals at the forefront from their perspective (Ersoy, 2016; p.55). Individuals or groups experiencing the studied phenomenon and reflecting these phenomenons constitute the source of phenomenological studies (Yıldırım and Şimşek, 2011).

Study Group

The study group of the research consists of eighty 3rd year students studying in the department of primary school education in two state universities in the Central Anatolia region in the 2019-2020 academic year and selected by easily accessible sampling method**.** The participants of the study were selected from junior students since they completed Mathematics Teaching-I and Mathematics Teaching-II courses which were two mandatory mathematics teaching methods courses in elementary education program. "Easily accessible sampling method is preferred due to

reasons that cost is less, there is participant group which is familiar to researcher, speed and practical application is gained to the research." (Yıldırım and Şimşek, 2013). Therefore, participants are given codes as S1, S2, S3, … S80 while their names are kept hidden.

Collection of data

In the collection of data, metaphoric perception form is used. Research data are collected with student writings and pictures they drew. For the purpose of increasing reliability and validity of the data gathering process the triangulation strategy is utilized (Yıldırım and Şimşek, 2016) and the primary school teacher candidates' perceptions regarding mathematics teaching are explored with three different types of metaphorical questions. In order to reveal metaphors primary school teacher candidates participating in research had in relation to the concept of a mathematics lesson, it is requested from them to complete the sentence of "Mathematics lesson is like....Because...." and to explain the statement "If it is asked from you to similarize mathematics teaching process to an object, animal, cartoon character or a historical event, which one would you choose? Why?". Furthermore, directives of "In addition to this, what does teaching mathematics mean to you? Try to explain by drawing a picture" and "Explain what the picture you drew means by depiction" is given, and appropriate space is left below the instruction for student writings and placement of visuals. Information is given to participants about the study during the application process, and necessary explanations are made. One lesson hour is given to participants to fill in the metaphoric perception form, and no intervention was made to students during the process. Ethics committee approval for the study was obtained from Eskişehir Osmangazi University Social and Human Sciences Scientific Research and Publication Ethics Committee with the protocol number 2020/08 dated 08/04/2020.

Analysis of Data

Answers that were given by participants to metaphoric perception forms and pictures they formed were examined with descriptive and content analysis technique. "Fundamental purpose in content analysis is to reach concepts and relationships that can explain collected data. For this purpose, collected data should be first conceptualized, then organized logically according to the emerging concepts, and the themes that explain the data should be determined accordingly." (Yıldırım and Şimşek, 2013).

Firstly, metaphors produced by participants are examined by being transferred to an excel file in the computer environment. Then, in content analysis, metaphors are grouped as similar and different ones in line with answers given by participants. Afterward, similar metaphors in these groups are divided into categories, and citations from explanations of participants are stated. Metaphors that are not written as realistic or not being specified are left outside evaluation.

In order to ensure reliability, data are analyzed separately by two academicians specialized in their fields and making studies in the mathematics education area, and at the end of the analysis, specialized academicians came together and looked at the conformity of categories being established. In the case of non-conformity, a common decision was taken by means of discussion, and themes were given their final version. Consensus and disagreement numbers were determined in the comparisons, and the reliability of the research was calculated using Miles & Huberman's (2015) Reliability=consensus/(consensus+disagreement) formula. Considering that a desired consensus will be achieved in cases where it is 90% or more. Also, in qualitative studies, reporting the collected data in detail and explaining how the researcher reached the results are among the important criteria of validity (Yıldırım & Şimşek, 2008). Specific to this research quotations from students' opinions are presented in the findings section.

Findings

In this section, findings relating to metaphors created by participants are given. In this context, the findings obtained in the research were classified under three sub-headings as "findings related

to mathematics lesson," findings related to the mathematics teaching process," and "findings related to mathematics teaching". In Figure 1, themes are shown under sub-headings.

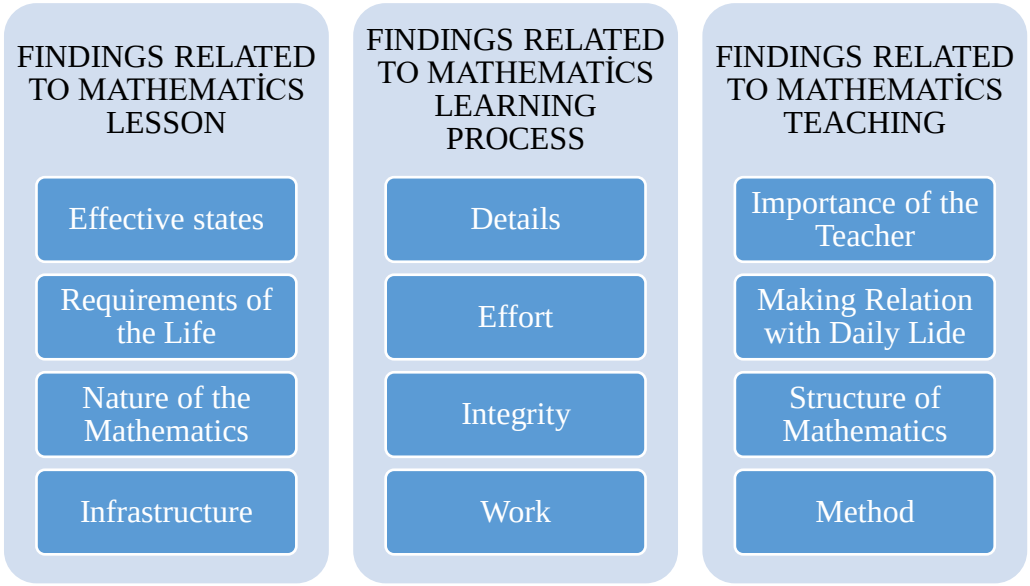


Figure 1. Themes under three sub-headings

3.1 Findings relating to the mathematics lesson

Answers of 77 out of 80 teacher candidates answering the question "Mathematics lesson is like..... Because ....." were considered to be worth being analyzed. Student answers are collected under four themes, and participant answers are stated under themes. Affective situations, the requirement of life, nature of mathematics, and infrastructure are themes created under this heading. In Figure 2, metaphors mostly used by students are given under this heading.

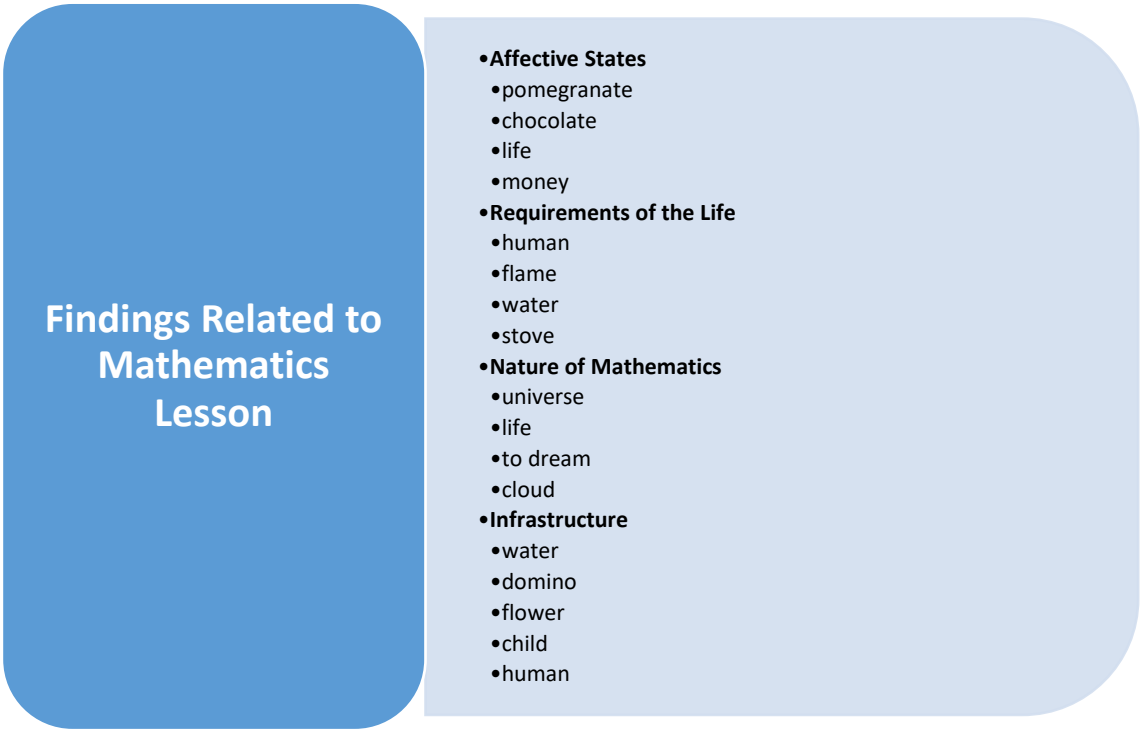


Figure 2. Themes formed within the context of mathematics lesson and metaphors that are mostly used

In line with the answers under the theme of affective states, their feelings towards the mathematics lesson differ. Pre-service teachers associated the mathematics lesson with the emotions they felt in their own lives. S62 compared the mathematics lesson with happiness by comparing it to chocolate.

> *"Mathematics lesson is like chocolate. Because as you eat chocolate you want to eat more. As being similar to this, as you solve mathematics you want to solve more."* (S62)

T33, one of the pre-service teachers, expressed the feelings that money makes him feel by associating his perception of the mathematics lesson with the metaphor of money.

> "*Mathematics lesson is like money. Because; you feel bad when you're lacking, you feel good because you've grown intellectually as the amount increases.*" (S33)

S55 associated the mathematics lesson with dark chocolate by saying, "Mathematics lesson is like dark chocolate. Because; you don't like pain at first. When you love, you can't give up. Too much will make you sick." S35, on the other hand, stated that the mathematics course was difficult and associated it with the metaphor of pomegranate and explained his thoughts as follows.

> *"Mathematics lesson is like a pomegranate. Because it is difficult to cut and shred. But when you open it, it is a beautiful fruit. Although it is difficult, the result is beautiful."* (S35)

However, S50 has associated mathematics lessons with the fire inside the stove.

> *"Mathematics lesson is like the fire inside the stove. Because when it is looked at from a distance I like it, and it is something required in my life, but if I stepped inside it would burn me."* (S50).

Under the theme of the necessity of life, the teacher candidates stated that mathematics is a part of our lives and generally stated that the mathematics lesson is as difficult as life. S71 and S13 associated the mathematics lesson with life and explained their perceptions as follows.

> *"Mathematics lesson is similar to life. Mathematics is an aid we use to understand the world and improve the environment we live in. If you want, you can live life very well, but if you don't, you won't live. If you want, you can understand and do mathematics very well. But you can never solve it if you don't want to."* (S71)

> "*Mathematics lesson is like life. Because it is tiresome and boring."* (S13)

S41 has correlated mathematics lessons with water metaphor and expressed his thoughts as follows.

> *"Mathematics lesson is like water. Because you always need it, but it seems difficult to get up and drink it."* (S41)

S49 stated that if mathematics lesson is not correlated with humans and if interest is not shown, it will be forgotten by students, and it could be learned slowly within a period by allocating time.

> *"Mathematics is like a human. Because you can't solve it if you don't care, but if you spend a little more time, you will gradually begin to understand."* (S49).

Under the category of mathematics, the teacher candidates associated the mathematics lesson with different concepts such as being abstract and having too many subjects. In this direction, S25 stated that the mathematics lesson is abstract.

> "*Mathematics lesson is like daydreaming. Because; however real it is, it is very abstract. The more we visualize in our minds, the more successful we can be."* (S25)

S12, on the other hand, similarized the mathematics lesson with a cloud, referring to the induction and deduction methods and that mathematics is done with operations.

> "*Mathematics lesson is like a cloud. Because; it is very wide. Sometimes they unite, sometimes they separate. Different operations can be done in the same question, and a solution can be reached*." (S12)

In addition, some students compared the mathematics lesson to the universe and stated that the mathematics lesson is infinite. Students' opinions in this direction are given below.

> *"Mathematics is like the universe. Because it is endless, it grows constantly. It is like that in mathematics, it has no end."* (S15)

> *"Mathematics lesson is like the universe. Because it has a very wide usage area. Many things that seem to be independent from each other make sense when they come together. In addition, there are unknown theorems that will be identified with the black hole, waiting to be discovered."* (S23)

Under the theme of infrastructure, students associated the mathematics lesson with different metaphors such as process, driving, swimming in the rough sea, and stairs. In this context, S20 stated that mathematics lessons should be progressed step by step by saying, "Mathematics course is like a ladder. Because you can't go up without a bottom step." S9 expressed a similar situation in the metaphor he wrote.

> *"Mathematics lesson is like a domino. Because you start as missing at the beginning and it continues in this way."* (S9)

S21, who similarized mathematics lesson with the wavy sea, expressed his thoughts by saying, "Mathematics lesson is like a wavy sea. Because in mathematics lesson, the student is like in a wavy sea. If he knows his method and technique, he knows how to swim by fighting these waves." S27 expressed his thoughts by saying, **"***Mathematics lesson is like water. Because new*

information is constantly coming, everything is changing all of a sudden, and we students cannot even learn new ones without comprehending the previous information."

In addition, the students stated that the mathematics lesson could not be accomplished without effort and attention. In this context, the students associated the mathematics lesson with the effort spent in raising a flower and human and explained their thoughts with the metaphors presented below.

> *"Mathematics lesson is like a flower. Because when we work, we can see that something tangible emerges, like a flower. The flower also grows when you take care of it, change its soil and water it."* (S42)
>
> *""Mathematics lesson is like a child. Because understanding and agreeing with him is not always easy, but if you understand the logic of the business, it will be easy to understand and do. If you understand the logic with children, it is easy to get along with them."* (S5)
>
> *"Mathematics lesson is like a human. Because if you are not involved, you can not solve it, but if you allocate more time, you start to understand it slowly in time*." (S46)

3.2 Findings Relating with Mathematics Teaching Process

In this section, findings of the written metaphors which participants created about the mathematics teaching process are included. Instruction is given as "If we wanted to compare the mathematics teaching process to an object, animal, creature, cartoon character or historical event, which would you compare it to? Why is that?" Answers of 73 out of 80 teacher candidates are considered to be worth being analyzed. In accordance with metaphors created in relation to object, living creature, cartoon character and historical event with which teacher candidates similarized mathematics teaching process, *Detail, Effort/involvement, Integrity, and labor* were the themes that were created. In Figure 3, metaphors used mostly by students are given under this heading.

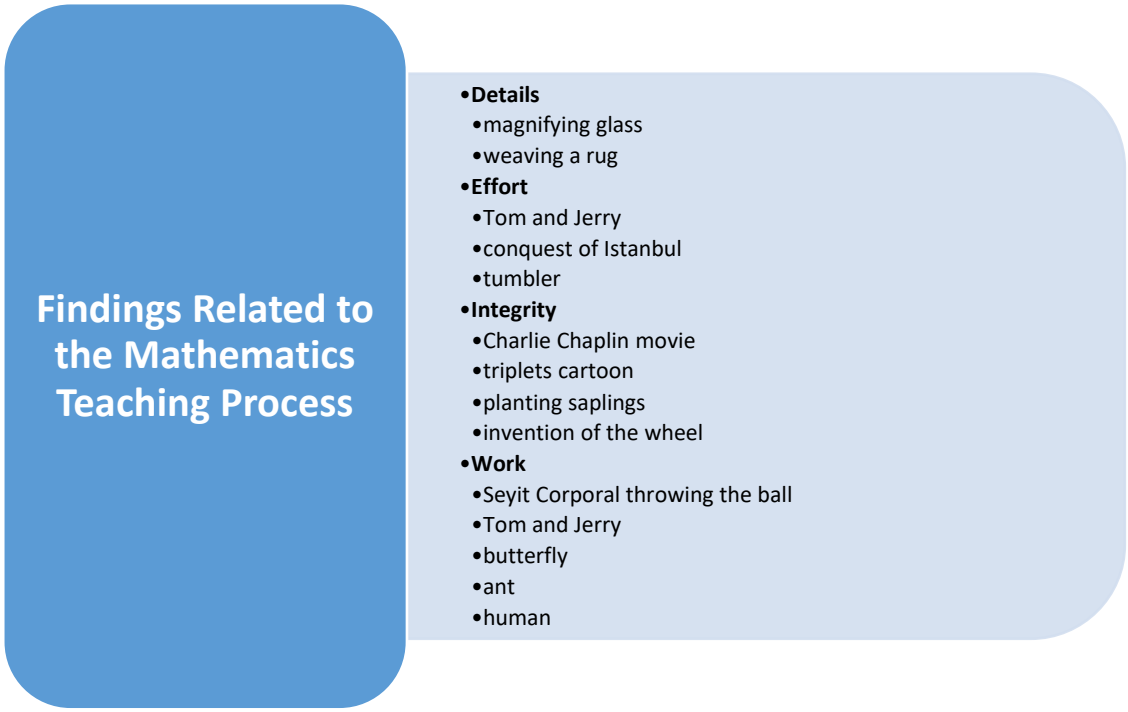


Figure 3. Themes established within the context of the mathematics teaching process and mostly used metaphors

Under the theme of detail, the participants stated that teaching mathematics is a detailed process and that this process should be well planned. In this context, S1 likened the mathematics teaching process to weaving a rug and said, "It is necessary to think in detail. There should be no wrong teaching so that the resulting form is correct." he stated. In addition, S37 compared the mathematics teaching process to a magnifying glass, and his thoughts are given below.

> *"Magnifying glass. Because when you look closely at mathematical problems, you see that there are many fine details in them. It is a lesson that should be carefully considered from the word used to the comma. That's why I think teaching mathematics is a process that we should take a close look at, and I liken it to a magnifying glass.*" (S37)

S3 similarized mathematics teaching process to Tom and Jerry under the theme of effort/struggle and said, "There is a constant chase, there is always chasing after it. Tom is mathematics, and Jerry is a math person." He stated that there is a continuous chase process. On the other hand, T31, who likened the mathematics teaching process to the conquest of Istanbul, said, "If Fatih conquered Istanbul at a young age with great effort, if a teacher approaches the student, gives him information, and displays a patient attitude, he will conquer the student's heart like Istanbul and settle in Istanbul. " He stated that in the process, the teacher could realize the teaching of mathematics by making an effort. In addition to these, S21 stated that there is a constant struggle in the mathematics teaching process and that it is necessary to make an effort to teach mathematics, and he expressed his thoughts in this sentence: *" Because no matter how much he falls, he gets up immediately. No matter how hard I try, I always have to stand up. I have to try harder for the process I have difficulty with and succeed in teaching."*Under the theme of integrity, the participants said that the mathematics teaching process should be considered as a whole and that success cannot be achieved in a deficient or disrupted situation. In this context, S6 likened the mathematics teaching process to the Charlie Chaplin movie, and he expressed his thoughts by saying, "Here, our character is a part of a factory. When the character disrupts the work, all the works of the factory are disrupted. I thought of the factory as mathematics and the character as the basis of mathematics." On the other hand, S10, who stated that the subjects of the mathematics lesson were interconnected, compared the mathematics teaching process to the Üçüzler cartoon and expressed his thoughts with these sentences: "Three girls were acting at the same time in that cartoon, they were dependent on each other. Many math subjects are like that. You cannot understand one subject without understanding the other." S26 and S43, on the other hand, likened the mathematics teaching process to the growth of a sapling and stated that this process should be implemented gradually, and their thoughts are given below.

> "*You plant a sapling, start watering it and wait for it to grow. The process of teaching mathematics is similar. You teach slowly, you wait for apples to come out." (S26)*

> *"Something that is difficult at first then grows like a tree, becomes beautiful and easy."* (S43)

S45, on the other hand, likened mathematics teaching to a historical event and said, "Mathematics teaching is like the invention of the wheel. It starts with a small sample at first and then grows as it grows (derivative-integral from 4 operations). It started with the wheel like this, and then it turned into complex vehicles. But this has made our life even easier," and he stated that mathematics teaching progresses from simple to complex and makes our life easier as we understand its complexity.

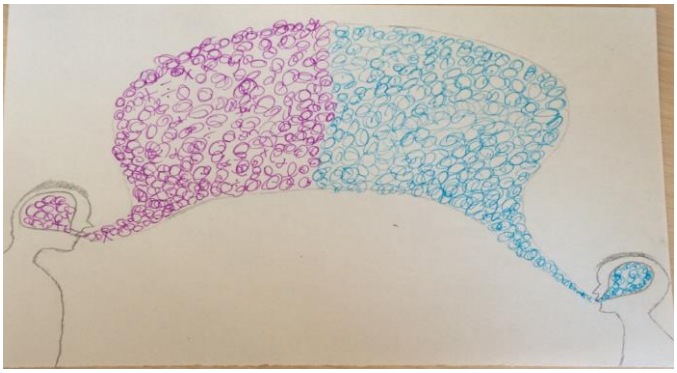
Under the theme of effort, S16, one of the participants, stated that effort should be spent in the mathematics teaching process and said, "I liken it to Corporal Seyit's throwing the ball. Mathematics is not a subject for everyone. But those who believe in it can do it." S42, who similarized mathematics teaching to Tom and Jerry from cartoon characters, said, "Tom is a cat that pursues a certain goal and does not give up to reach it. In mathematics teaching, students and teachers must be in learning with effort and patience to efficiently pass this process." S36, one of the pre-service teachers, likened mathematics teaching to a living creature and said, "It is an

inevitable fact that it is difficult and you have to make an effort, as it is the case in each field. Of course, my hard work pays off." In addition, S63 compared his thoughts to an ant and said, "Ant gathers food in summer and eats them in winter. Mathematics requires patience. You tell first, then this information accumulates, and it becomes useful. Of course, it is our job as teachers to make it useful. Like an ant."

3.3. Findings Relating with Mathematics Teaching

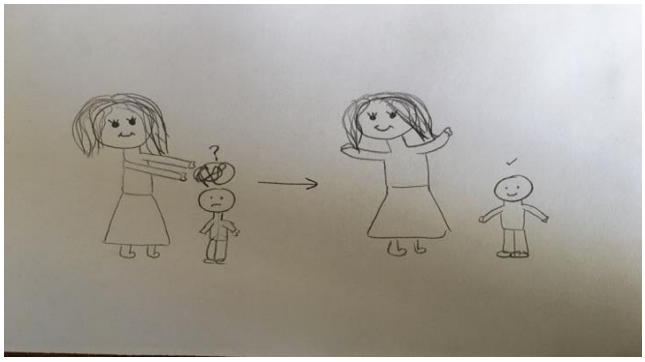
One of the teacher candidates instructed by asking, "What does teaching mathematics mean to you? Try to explain by drawing a picture?" and "Describe what the painting you have drawn represents?" The answers of 67 of the 80 pre-service teachers were found worth being analyzed. *The importance of the teacher, correlation with daily life, the structure of mathematics, and the method are the themes created under this title*.

Under the theme of the importance of the teacher, the participants talked about the important role of the teacher. He stated that the teacher should contact the students and provide opportunities for the students to express their thoughts. In this context, the picture drawn by S72 and his explanation in line with the picture is given below.



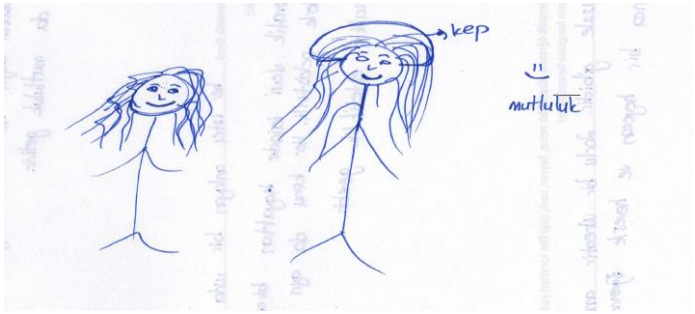
> *"I have the opinion that teachers should be in constant communication with their students and that their students should feel safe. In the picture I drew above, I tried to portray what a mathematics teacher means to me. The teacher is the sender, and the student is the receiver. When the teacher is in constant communication with his students, the students will express their thoughts without fear, and it will be easier for them to learn with a fresh mind, I tried to explain this with the picture I drew. Afterward, subjects etc. explain by the teacher are perceived in different forms. For this reason, I showed those that are told by a teacher in purple color, and I showed those of students in blue color."* (S72)

On the other hand, S80 stated that the teacher has an important responsibility in eliminating the confusion of students about mathematics, and the picture he drew and his explanation is given below.



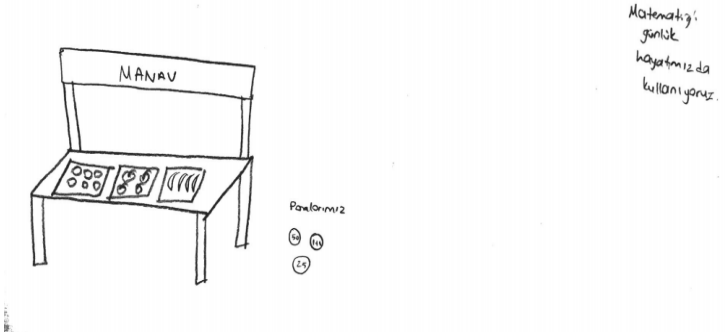
"In this picture, at first, the child is confused and does not understand mathematics. But the teacher helps the child to clear this confusion, and as a result, this confusion is cleared, and the child understands mathematics. I likened the mathematics teaching process to this. Because from time to time, I had some confusion about mathematics in primary school, but my teacher helped me clear my confusion in mathematics, and I understood mathematics at least partially." (S80)

S61 has mentioned the role and importance of mathematics teachers in making students love mathematics.



"It is required to teach well so that student is good in mathematics and learns it well. When taught well, it helps to provide self-confidence for every lesson, not just the student's success in mathematics, which brings happiness." (S61)

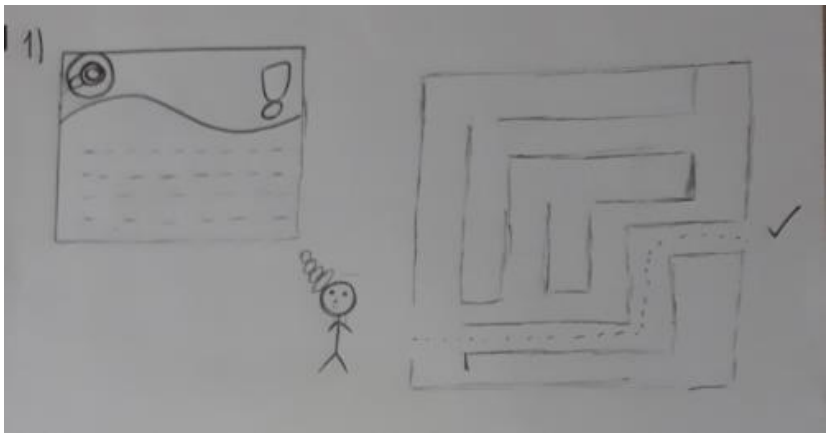
Under the theme of associating with daily life, the participants emphasized that mathematics is abstract and that it should be associated with daily life. In this context, S42 and his explanation with the picture he drew are given below.



"*Student uses the mathematics lesson as an abstract. He adopts it theoretically but does not know how to use it in daily life. I think that with the lesson, we embody (material, visuals, videos), and the student understands and adopts it better. The child who goes to*

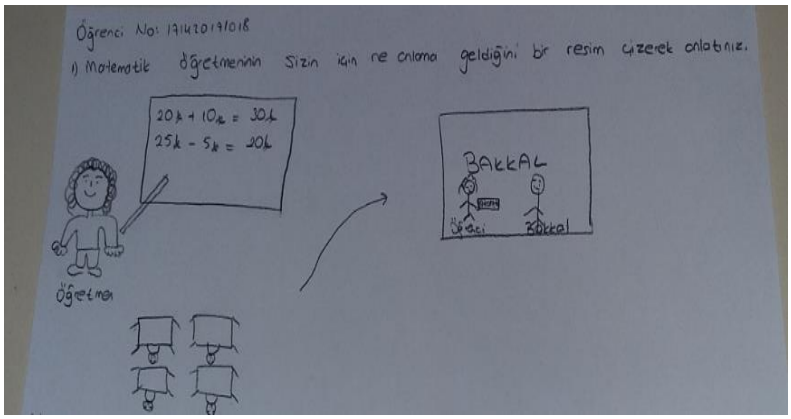
the grocery store also expresses himself comfortably with the issue of money, which is important in daily life." (S42)

S69 stated that the knowledge gained in mathematics lessons should be used in daily life, and in this context, education should be given in mathematics lessons accordingly.

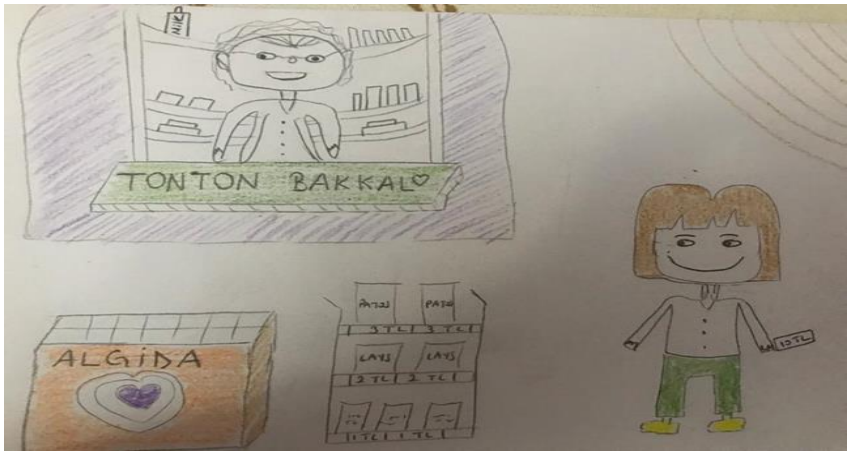


"Student solves the problems he encounters in daily life with the knowledge and skills he has acquired in the mathematics lesson. This is the thought I want to convey in the picture. For me, the mathematics teacher means that students can solve problems that require mathematical knowledge in daily life." (S69)

S70 and S71 used similar expressions and the pictures and explanations they drew under the linking phrase in daily life are given below.

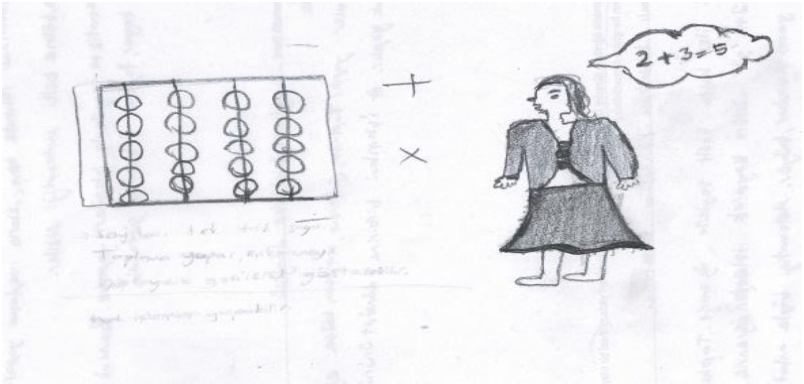


"A mathematics teacher talks about the subject of money. The students listen attentively, too. Later, students use the information they learned at school in the grocery store (in daily life)." (S70)



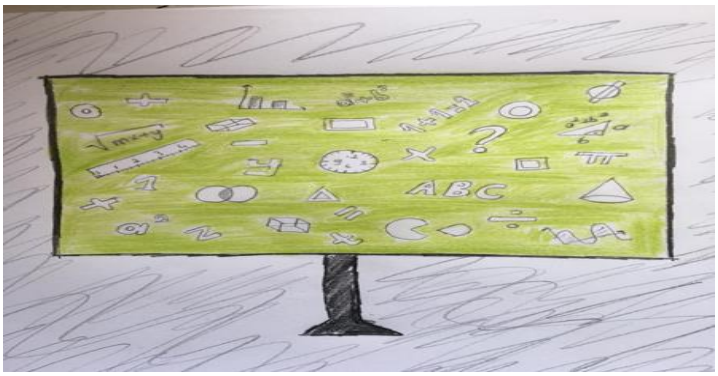
"I drew the grocery store next to my house. I drew a 'me' who goes and buys bread from there every morning. When I need something for the house, I draw a 'me' that goes to the grocery store and buys what is needed. I wanted to add chips and ice cream balls standing in front of the grocery store to my picture. If you are asking about their relevance to mathematics, let me explain immediately. The youngest of the house goes to the grocery store. Some money is squeezed into his hand, and he is sent from home. Our mother shouts from behind, "Check your remainder of money". This is where the mathematics we see at school comes into play. We give the money to the grocer uncle, and we check the money given to us with our vast mathematical knowledge. Mathematics is a very routine part of our lives. It's time to use the mathematical knowledge we learned in theory in the grocery store in practice. That addition and subtraction we learned at school are transferred to daily life in this way. That's why I drew this picture." (S71)

Teacher candidates drew pictures associating mathematics teaching with the structure of mathematics, and they have written their explanations. In the picture, S56 teacher drawing abacus, mathematical equations, and symbols have been depicted as someone who only explains the mathematical operations.



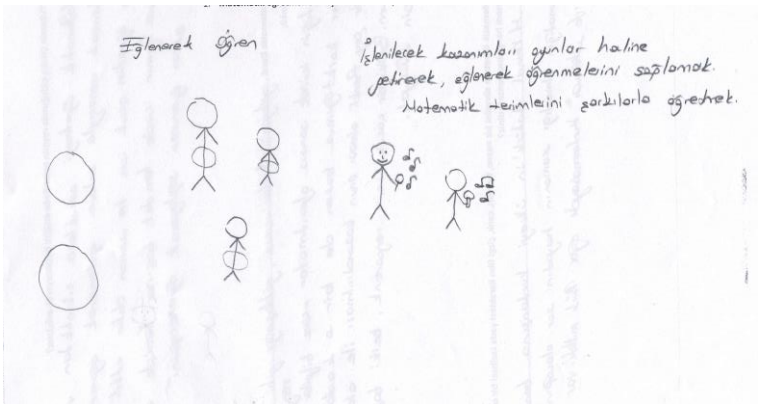
"He realizes addition operation with beads. Subtraction, addition, multiplication, and division affect mathematics. In mathematics, we make operations with numbers. We count the beads, put them on top, and collect." (S56)

S75, on the other hand, has stated in the picture he drew and the explanations he made that mathematics constitutes a whole, and regardless of how complex it is, mathematical expressions are always correlated. He also stated that teaching in mathematics is done through blackboards.



"In my drawing above, there is a board and different math expressions. The mathematics teaching that I want to explain in this picture is based on complex formulas and shapes. I also did some complex scrabbles on the outside. The meaning of this is that even though mathematics can be so complex, it constitutes a whole within complexities outside, and it defines a whole. I drew a board, and in this, I want to explain, the main material of the teaching is the board. The drawings on the board are all about mathematics." (S75)

Under the method theme, teacher candidates stated that they could make the lesson popular with different methods to be used in mathematics teaching. In this direction, S65 stated that mathematics teaching should be supported with games, and the picture he drew and his explanation is given below.



"I would like to teach mathematics to children with fun in order to save them from boredom and reluctance. I think that teaching with games will always be more effective for the child. I think you will learn by providing peer learning both alone and with friends in the game." (S65)

S9, on the other hand, expressed the necessity of using different teaching methods instead of giving direct information to students during mathematics teaching with the following visuals and explanations.

"I wanted to draw a picture showing that nowadays it is given directly to the student by the teacher, that there are no teaching methods that are different in mathematics teaching and that students get bored of the lesson and did not like the lesson." (S9)

Conclusion, Discussion, and Suggestions

In this study, metaphorical perceptions of primary school teacher candidates about the concept of a mathematics lesson, mathematics teaching, and mathematics teacher have been determined. In this context, primary school teacher candidates associated mathematics lessons, mathematics teaching, and mathematics education with different concepts. It was observed that primary school teacher candidates produced positive and negative metaphors, and they had positive and negative perceptions about the concepts of a mathematics lesson, mathematics teaching, and mathematics teacher. Reeder, Utley, and Cassel (2009) examined primary school teacher candidates' perceptions about mathematics and mathematics teaching through metaphors and stated that teacher candidates have positive and negative perceptions of these concepts. Similarly, Keles, Tas, and Aslan (2016) found in the study they conducted with teacher candidates that teacher candidates had more positive perceptions about mathematics and the concept of mathematics, while some teacher candidates also had negative perceptions. Especially the participants stated that mathematics and its teaching were difficult and that it was an integral part of life and was always needed.

It can be stated that teacher candidates' perceptions of mathematics are shaped in line with their negative experiences, especially in their past lives. Similar results are seen in the literature (Saban, 2004; Şahin 2013; Tarim, Bulut, Özsever, & Canbazoğlu, 2017). In this direction, generally, teacher candidates associated the perceptions of mathematics lessons and teaching with the way mathematics was taught to them. In another way of saying, they limited mathematics to mathematical operations and numbers and described it as a lesson that the mathematics teacher lectured and the student listened to. When the literature was examined, similar results were found. Yetim Karaca and Ada (2018) stated that students relate mathematics with numbers and operations and fit it into a narrow mold as a result of their study. Arıkan and Ünal (2015), who examined metaphors produced by superior talented students in relation to the concept of mathematics, also found similar results. As Gürbüz, Erdem, and Gülburnu (2013) stated, the mathematics education given throughout the university is mainly theoretical, and hence it differs from the mathematics teachers teach in their professional lives. It is necessary to develop a teacher-centered understanding of teacher candidates in mathematics and mathematics-related lessons in the primary education undergraduate program. In another way of saying, it can be ensured that mathematics is seen as a lesson in all areas of life by providing teacher candidates with opportunities to practice in the learning process, especially in teaching lessons. Teacher candidates can gain teaching experience, especially by using the micro-teaching method and by having the opportunity to practice more in real classroom environments.

Furthermore, it was stated by the participants that the mathematics lesson is difficult and that only those who love mathematics can do it. Ada (2013) and Güner (2013) found similar results in their study, and the participants defined the mathematics lesson as a difficult and boring course. As Dursun and Dede (2004) stated, mathematics, which is considered a difficult lesson by students, causes students to be afraid and feel alienated from the lesson. Students' negative attitudes towards mathematics and considering it as a difficult subject affect their success. MEB (2018) stated that a positive attitude towards mathematics is required in the mathematics curriculum, and the effect of a positive attitude on mathematics achievement cannot be disregarded. In this respect, it is necessary for the academicians who teach the undergraduate program of primary school education and especially Basic Mathematics and Mathematics Teaching I-II lessons to transform the perceptions of prospective teachers towards the mathematics course and teaching mathematics. By increasing the number of mathematics and mathematics-related courses, organizing the course content, increasing social activities for mathematics, and providing opportunities for students to experience mathematical success, the perceptions of primary school teacher candidates towards mathematics can be made positive.

It was stated by the participants that teachers and the teaching methods used play an important role in teaching mathematics. We can say that teachers like the lesson and shape students' perceptions of mathematics with the different teaching methods and techniques they use. In the study conducted by Toluk Uçar et al. (2010), students stated that they developed negative metaphors because the teacher was not close to the students. Teachers, who determine the educational environment, have important roles such as making students love mathematics, making learning meaningful, and making students feel important. Positive experiences and experiences that teacher candidates will have in the learning process are among the important factors for the positive perception they will create towards mathematics. In this direction, students' positive perception towards the mathematics lesson will significantly affect their success in that lesson.

However, some primary school teacher candidates stated that mathematics is an integral part of our daily life by correlating it with daily life. Tarim, Özsezer, and Canbazoğlu (2017) stated that teacher candidates perceive mathematics and mathematics teaching as a phenomenon that exists in daily life. In a similar way, Çetinsoy (2019) stated in his study he conducted with mathematics teacher candidates that mathematics is a lesson that is frequently used in daily life. It has been determined that the cprimary school teacher candidates are willing to correlate mathematics lesson with daily life, and it is important that innovative teaching approaches such as Realistic Mathematics Education, which are based on the transfer of information to daily life, are presented to the teacher candidates through the undergraduate program for them to have positive perceptions.

Teachers of the future have important roles in relation to making their students love mathematics. Teacher candidates' perceptions relating to mathematics are shaped in line with negative and positive experiences they had in their past lives and their forms of living. It is mainly required to eliminate prejudices elementary students have against mathematics and to show that it is a lesson that can be achieved by making them love this lesson. Additionally, it should be shown that mathematics is a part of their lives by correlating it with daily life in elementary schools. In this direction, arranging the primary school teaching curriculum of undergraduate programs and the lessons in the curriculum in a way that will reduce teacher candidates' anxiety about mathematics and mathematics teaching and providing an opportunity for positive mathematics-related experience will help to reduce the mathematical anxiety observed in society over time and increase mathematical success. In addition, lessons related to mathematics and mathematics teaching can be included more in the primary school teaching undergraduate program. In addition to these, it is recommended to organize the course contents of the mathematics courses in the primary school teaching undergraduate program, to associate mathematics subjects with other

disciplines, to increase social activities for mathematics, and to provide opportunities for students to experience mathematical success.

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Research Article

Metaphoric Perceptions of Primary Pre-Service Teachers Towards Mathematics, Mathematics Teaching Process and Mathematics Teaching

Sınıf Öğretmeni Adaylarının Matematik Dersine, Matematik Öğretme Sürecine ve Matematik Öğretimine Yönelik Algılarının Metaforlar Yardımıyla Belirlenmesi

Ahmet Oğuz AKÇAY	**Osman ÇİL**
Dr. Öğr. Üyesi Eskişehir Osmangazi Üniversitesi	Dr. Öğr. Üyesi Kırşehir Ahi Evran Üniversitesi
aoakcay@ogu.edu.tr	ocil@ahievran.edu.tr
https://orcid.org/0000-0003-2109-976X	https://orcid.org/0000-0001-5903-9864

Genişletilmiş Özet

Giriş

Matematik ilkokul birinci sınıftan yükseköğretime kadar birçok bölümde ve alanda temel derslerden biridir. Matematik eğitiminin amaçları arasında mantıksal düşünme, problem çözme, matematiksel iletişim kurma, mantıksal akıl yürütme ve mekânsal ilişkileri anlamlandırma becerileri vardır (MEB, 2018). Ulusal Matematik Öğretmenleri Konseyini (National Councel of Teacher of Mathematics-NCTM) (2000) öğrencilerin matematiği gerçek yaşam durumlarına uygulamaları için problem çözme becerisine sahip olmaları gerektiğini vurgulamıştır. Matematiğe öğrenciler tarafından yüklenen anlam, öğrenmelerine etki etmektedir. Matematiğe karşı olumlu tutuma sahip olunması ve olumlu tutumun matematik başarısı üzerine etkisi göz ardı edilemeyeceği matematik öğretim programında da ifade edilmiştir (MEB, 2018). Matematik dersine yönelik sahip olunan olumlu veya olumsuz algılar, öğretmen adaylarının matematiğe karşı tutumuna da etki edebilir. Matematik dersine karşı olumlu algıları olan bireylerin matematik dersinde başarısı da bu doğrultuda gelişim göstermektedir (Tarim, Özsever ve Canbazoğlu, 2017). Öğretmenlerin matematiğe karşı algıları öğrencilerin başarısını da etkilemektedir. Öğrencilerin matematik dersine karşı algılarında öğretmenin rolü önem arz etmektedir ve bu doğrultuda geleceğin öğretmenleri yani öğretmen adaylarının matematiğe ilişkin algılarının belirlenmesi önemlidir. Noyes'ın (2004) öğretmen adaylarının herhangi bir olgu ve kavrama ilişkin algılarını belirleyerek onların profesyonel gelişimlerine katkı sağlayacağını belirtmiştir.

Metaforik yapılar ile kişiler düşüncelerini soyut kavramlarla somut kavramlar arasında ilişki kurarak ifade etmektedirler (Saban, Koçbeker ve Saban, 2005). Metafor kavramı, kişilerin özelliklerini iyi bildiği olgunun özelliklerini kullanarak başka bir olgunun sahip olduğu özelliği anlatmaya çalışması olarak ifade edilmektedir (Ben-Peretz, Mendelson ve Kron, 2003). Bu kapsamda ilkokul düzeyinde matematiksel kavramların öğretiminden sorumlu olacak geleceğin sınıf öğretmenlerin matematikle ilişkili konular hakkındaki algılarını belirlemek ilerikideki öğretim sürecini nasıl şekillendirecekleri hakkında bilgi verecektir. Bu çalışmada sınıf öğretmeni adaylarının matematik dersi, matematik öğretimine ve matematik öğretme sürecine yönelik sahip oldukları metaforik algılarını ortaya çıkarmak amaçlanmıştır. Bu amaç doğrultusunda aşağıda verilen araştırma sorularına cevap aranmıştır.

1. Sınıf öğretmen adaylarının matematik dersine yönelik sahip oldukları metaforik algıları nelerdir?

2. Sınıf öğretmen adaylarının matematik öğretme sürecine yönelik sahip oldukları metaforik algıları nelerdir?

3. Sınıf öğretmen adaylarının matematik öğretimine yönelik sahip oldukları metaforik algıları nelerdir? nelerdir?

Yöntem

Çalışmada nitel araştırma yöntemlerinden fenomenoloji deseni kullanılmıştır. Fenomenolojik araştırma, bireylerin kendi bakış açısından algı ve deneyimlerini ön plana çıkarmayı amaçlayan bir araştırma desenidir (Ersoy, 2016; s.55). Araştırılan olguyu yaşayan ve bu olguları yansıtan bireyler ya da gruplar fenomenolojik araştırmaların kaynağıdır (Yıldırım ve Şimşek, 2011).

Araştırmanın çalışma grubu, İç Anadolu bölgesinde yer alan iki devlet üniversitesinde 2019-2020 eğitim öğretim yılında sınıf eğitimi anabilim dalında öğrenim gören ve kolay ulaşılabilir örnekleme yöntemiyle seçilen 80 3. sınıf öğrencilerinden oluşmaktadır**.** Araştırmanın katılımcıları, sınıf eğitimi anabilim dalında yer alan iki zorunlu matematik öğretim yöntemi derslerinden Matematik Öğretimi-I dersini başarıyla tamamlamışlardır ve Matematik Öğretimi-II dersine kayıt yaptırmışlardır. "Kolay ulaşılabilir örnekleme yöntemi; maliyetin az olması, araştırmacıya tanıdık bir katılımcı grubu olması, araştırmaya hız ve pratiklik kazandırmak" (Yıldırım ve Şimşek, 2013) nedenleriyle tercih edilmiştir**.** Katılımcıların ismi gizli kalacak şekilde Ö1, Ö2, Ö3, … Ö80 olarak kodlanmıştır.

Verilerin Toplanması

Verilerin toplanmasında metaforik algı formuyla kullanılmıştır. Araştırma verileri öğrenci yazıları ve çizdikleri resimlerle toplanmıştır. Araştırmaya katılan sınıf öğretmeni adaylarının matematik dersi kavramına ilişkin sahip oldukları metaforları ortaya çıkarmak için, "Matematik dersi …….gibidir. Çünkü; ……" cümlesini tamamlamaları ve "matematik öğretme sürecini bir nesne, hayvan, canlı, çizgi film karakteri ya da tarihsel bir olaya benzetmeniz istersek hangisine benzetirdiniz? "Neden? ifadesini açıklamaları istenmiştir. Buna ek olarak matematik öğretmek size ne ifade ediyor, bir resim çizerek anlatmaya çalışınız?" ve "çizmiş olduğunuz resmin neler ifade ettiğini betimleyerek anlatınız?" yönergeleri verilerek bu yönergenin altına öğrenci yazıları ve görsellerin oluşturulması için uygun alan verilmiştir.

Verilerin Analizi

Katılımcıların metaforik algı formuna vermiş oldukları cevaplar ve oluşturdukları resimler içerik analiz tekniği ile incelenmiştir. "İçerik analizinde temel amaç, toplanan verileri açıklayabilecek kavramlara ve ilişkilere ulaşmaktır. Bu amaçla toplanan verilerin önce kavramsallaştırılması, daha sonra da ortaya çıkan kavramlara göre mantıklı bir biçimde organize edilmesi ve buna göre veriyi açıklayan temaların saptanması gerekmektedir" (Yıldırım ve Şimşek, 2013). Miles & Huberman"ın (2015) Güvenirlik=görüş birliği/(görüş birliği+görüş ayrılığı) formülüne göre güvenirliğin %90 ve üzeri olması beklenmektedir. Veriler matematik eğitiminde çalışma yapan alanında uzman iki akademisyen tarafından ayrı ayrı analiz edilmiş ve analiz sonucunda uzman akademisyenler bir araya gelerek oluşturulan kategorilerin uyumuna bakmışlardır. Miles & Huberman"ın (1994) güvenirlik formulune göre yazarlar arası uzlaşma %91 olarak bulunmuştur ve tartışmalar sonunda görüş birliğine varılmıştır.

Bulgular

Bu kapsamda sınıf öğretmeni adayları matematik dersi, matematik öğretme süreci ve matematik öğretmeyi farklı kavramlarla ilişkilendirmişlerdir. Bu kapsamda araştırmadan elde edilen, "matematik dersi ile ilgili bulgular", matematik öğretim süreci ile ilgili bulgular" ve " matematik öğretimi ile ilgili bulgular" olmak üzere üç alt başlık altında sınıflandırılmıştır. Sınıf öğretmeni adayları matematik dersi, matematik öğretimi ve matematik öğretmeni kavramları hakkında olumlu ve olumsuz metaforlar ürettiklerini ve olumlu ve olumsuz algılara sahip oldukları görülmüştür. Reeder, Utley ve Cassel (2009) sınıf öğretmeni adaylarının matematik ve

matematik öğretimi ile ilgili inançlarını metaforlar aracılığıyla incelemişler ve öğretmen adaylarının bu kavramlara olumlu ve olumsuz algıları olduğunu belirtmişlerdir. Benzer şekilde Keles, Tas ve Aslan (2016) öğretmen adaylarıyla yapmış oldukları çalışmada öğretmen adaylarının matematik ve matematik kavramına yönelik daha çok olumlu algıları olduğunu ve bununla birlikte bazı öğretmen adaylarının da olumsuz algıları olduğunu tespit etmişlerdir. Özellikle katılımcılar matematiği ve öğretimini zor bir ders ve süreç olduğunu belirterek hayatın vazgeçilmez bir parçası olduğunu ve her zaman ihtiyaç duyulduğunu dile getirmişlerdir.

Tartışma, Sonuç ve Öneriler

Öğretmen adaylarının matematik algılarını özellikle geçmiş yaşantılarında edindikleri olumsuz tecrübeler doğrultusunda şekillendiği söylenebilir. Başka bir ifadeyle matematiği matematiksel işlemler ve sayılarla sınırlı tutmuşlar ve daha çok matematik öğretmeninin dersi anlattığı öğrencinin ise dinlediği bir ders olarak tasvir etmişlerdir. Alanyazın incelendiğinde benzer sonuçlar görülmüştür. Yetim Karaca ve Ada (2018) yapmış oldukları çalışma sonucunda öğrencilerin matematiği sayılar ve işlemlerle ilişkilendiklerini ve dar bir kalıba sığdırdıklarını belirtmişlerdir. Öğretmen adaylarına öğrenme sürecinde özellikle öğretim derslerinde uygulama yapma fırsatları sunularak matematiğin hayatın her alanında yer alan bir ders olarak görülmesi sağlanabilir. Özellikle mikro öğretim yöntemi kullanılarak ve gerçek sınıf ortamlarında daha fazla uygulama yapma fırsatı verilerek öğretmen adaylarının öğretim yapma tecrübesi kazandırılabilir.

Bunlara ek olarak matematik dersinin zor ve matematiği sadece sevenlerin yapabileceği bir ders olduğu katılımcılar tarafından belirtilmiştir. Öğrencilerin matematiğe karşı olumsuz tutumları ve zor bir ders olarak görmeleri başarılarını etkilemektedir. MEB (2018) matematik öğretim programında matematiğe karşı olumlu tutuma sahip olunması gerektiğini ve olumlu tutumun matematik başarısı üzerine etkisinin göz ardı edilemeyeceğini belirtmiştir. Bu kapsamda sınıf öğretimi lisans programının ve özellikle Temel Matematik ve Matematik Öğretimi I-II derslerini veren akademisyenlerin öğretmen adaylarının matematik dersine ve matematik öğretimine yönelik algılarını olumlu hale dönüştürmesi gerekmektedir. Matematik ve matematikle ilişkili ders sayılarının artırılması, ders içeriklerini düzenlenmesi, matematiğe yönelik sosyal etkinliklerin artırılması, öğrencilerin matematiksel başarıyı deneyimlemesi için fırsatların sunulması gibi düzenlemelerle sınıf öğretmeni adaylarının matematiğe karşı algıları olumlu hale dönüştürebilir.

Matematik öğretiminde öğretmenlerin ve kullanılan öğretim yöntemlerinin önemli bir role sahip olduğunu katılımcılar tarafından belirtilmiştir. Öğretmenlerin dersi sevdirdiğini ve kullandıkları farklı öğretim yöntemleri ve teknikleri ile öğrencilerin matematiğe karşı algılarını şekillendirdiklerini söyleyebiliriz. Eğitim öğretim ortamını belirleyen öğretmenlerin öğrencilerine matematik dersini sevdirmek, öğrenmeyi anlamlı kılmak, öğrencilerin önemli olduğunu hissettirmek gibi önemli rolleri vardır. Öğretmen adaylarının öğrenme sürecinde geçirecekleri olumlu yaşantı ve deneyimler matematiğe karşı oluşturacakları olumlu algı için önemli faktörlerden biridir. Bu doğrultuda öğrencilerin matematik dersine karşı oluşturdukları olumlu algı o dersteki başarılarını önemli derecede etkileyecektir.

Bazı sınıf öğretmeni adayları ise matematiği günlük hayatla ilişkilendirerek günlük hayatımızın vazgeçilmez bir parçası olduğunu belirtmişlerdir. Tarim, Özsezer ve Canbazoğlu (2017) öğretmen adaylarının matematik ve matematik öğretimini günlük hayatın içinde var olan bir olgu olarak algıladıklarını belirtmişlerdir. Sınıf öğretmeni adaylarının matematik dersini günlük hayat ile ilişkilendirmek için istekli olduğu belirlenmiş olup Gerçekci Matematik Eğitimi gibi bilgilerin günlük hayata transferi temeline dayanan yenilikçi öğretim yaklaşımlarının öğretmen adaylarına lisans programı vasıtasıyla sunulması olumlu algılara sahip olmaları için önem arz etmektedir.

Geleceğin öğretmenlerinin öğrencilerine matematiği sevdirme konusunda önemli rolleri vardır. Öğretmen adaylarının geçmiş yaşantılarında sahip oldukları olumlu ve olumsuz tecrübeler ve yaşantılar doğrultusunda matematiğe karşı algıları şekillenebilmektedir. Özellikle ilkokul

öğrencilerinin matematiğe karşı önyargılarından kurtarıp ve başarılan bir ders olduğunu göstererek öğretmen tarafından sevdirilmesi gerekmektedir. Ayrıca sınıf öğretmenleri tarafından ilkokullarda matematiği günlük hayatla ilişkilendirilerek öğrencilerin hayatlarının bir parçası olduğu hissettirilmelidir. Bu doğrultuda lisans programlarının sınıf öğretmenliği müfredatının ve müfredat içerisindeki derslerin öğretmen adaylarının matematik dersine ve matematik öğretimine yönelik kaygılarını azaltacak ve matematikle ilişkili olumlu deneyim fırsatı sunabilecek şekilde düzenlenmesi, toplum içerisinde gözlenen matematiksel kaygının zamanla azaltılmasına ve matematiksel başarının artmasında yardımcı olacaktır. Ayrıca, sınıf öğretmenliği lisans programında matematik ve matematik öğretimiyle ilgili derslere daha çok yer verilebilir. Bunlara ek olarak, sınıf öğretmenliği lisans programında yer alan matematik derslerinin ders içerikleri düzenlenerek matematik konularının diğer disiplinlerle ilişkilendirilmesi, matematiğe yönelik sosyal etkinliklerin artırılması ve öğrencilerin matematiksel başarıyı deneyimlemesi için fırsatların sunulması önerilmektedir.