



VISUAL ANALYSIS OF THE CLASSROOM TEACHER CANDIDATES' METAPHORICAL PERCEPTIONS RELATED TO THE MATHEMATICS COURSE

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Abstract:

The aim of this study is to evaluate the classroom teacher candidates' metaphorical perceptions about the mathematics course through the visuals they create. The sample of the study consists of 36 classroom teacher candidates studying at a state university in Istanbul. The case study, which is one of the qualitative research methods, was used as the research design of this study. As a data collection tool, the metaphorical perception form prepared by the researchers, which includes the instruction "Draw what comes to your mind first when we say mathematics lesson and explain the drawing you have created" was used. In the analysis of the data, the visuals created by the teacher candidates or the pictures they drew were analyzed in detail. The metaphors formed by the classroom teacher candidates within the scope of the sample have been grouped under 4 categories: affective situations, impact on life, school and classroom environment, mathematical expressions and concepts in line with the opinions of the experts. As a result of the study, it was seen that the classroom teacher candidates mostly expressed the school and the classroom environment related to the mathematics lesson. In addition, it was found that mathematical expressions and concepts were also found to be an effective factor related to mathematics lesson by teacher candidates. Another finding is the association between mathematics lesson and daily life. Expressions such as being happy-unhappy, anxiety, confusion, and love when it comes to mathematics lessons are also the findings in the affective states category. Recommendations for the research and researchers were given by discussing the research findings.

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1. Introduction

As a requirement of today's information and technology age, the importance of individuals' problem solving has increased. Problem solving is actually a very general concept and it can be said that individuals gain their first problem solving experiences in mathematics lesson because most of the problems encountered in the first years of mathematics lessons are related to daily life. On the other hand, the mathematics course includes concepts related to the discipline of mathematics and applied and pure mathematics. Mathematics discipline, on the other hand, plays an important role in people's relationships in daily life and takes part in problem solving processes related to many other disciplines. Therefore, mathematics, which takes place almost everywhere from primary education to higher education and all through lifelong learning, is more than a lesson.

Mathematics, which constitutes the most important dimension of all kinds of human activity from the beginning to the present (Mankiewicz, 2002), is one of the most important building blocks of basic education and is also included in almost all curriculums and courses since it is a reference source for every field in scientific progress (Altun, 2002; Umay, 2003). The mathematics used in daily life is actually encountered as a product of human efforts to mathematize nature (Olkun & Toluk-Uçar, 2007). That is why, it is possible to say that mathematics is an important tool in solving problems in daily life (Baykul, 1998). In this context, the fact that classroom teachers are an important phenomenon comes to the fore when it is considered that mathematics and individuals encounter mathematics lessons in the first grades.

It is known that teachers lead students towards what kind of individuals they will become in the future (Aktürk, 2012; Çakır & Akkaya, 2017; Receptoğlu, 2013). On the other hand, based on the wholeness principle of the human development, teachers are expected to take into account that a student's achievement will also affect the other areas of development (MOE, 2018). In this context, considering that students will meet with the mathematics course for the first time via their classroom teachers, it is important to examine the classroom teachers' and therefore the classroom teacher candidates' perceptions of mathematics and mathematics lessons. The reason for this is that the perceptions of classroom teacher candidates regarding the concepts of mathematics and mathematics teaching and the way they present them will give us clues about what attitudes they will have in their professional lives (Tarım, Bulut-Özsezer & Canbazoğlu, 2017).

As is known, when teachers have positive perceptions, it can affect the student's success, the student's active participation in the lesson, the student's meaningful learning, and the student's gaining ability and confidence. Therefore, the positive perceptions of teachers, especially prospective teachers who will pursue this profession

in the future, play an important role in teaching processes (Tarım, Bulut-Özsezer & Canbazoğlu, 2017). Along with this, it is known that determining the perceptions of teacher candidates about any concept or a phenomenon is important in terms of contributing to their professional development (Noyes, 2004). In this context, determining teacher candidates' perceptions of mathematics lesson will contribute to determining what kind of teachers they will become in the future (Tarım, Bulut-Özsezer & Canbazoğlu, 2017).

What is more, the teacher who decides on the arrangement of the teaching environment, the determination of the activities, the choice of course materials and teaching methods and their use has significant effects on both the effectiveness of teaching activities and the students' perceptions. The first stage of primary education, to which students bring some of their informal knowledge, is known as the period of formation and shaping of their perceptions of mathematical concepts. It is also important how classroom teacher candidates, who will play a critical role in the perspective of students at the first level of primary education, perceive mathematics and therefore mathematics lesson (Güveli, İpek, Atasoy & Güveli, 2011).

It is important to analyze metaphors as one of the most important perception tools to reveal the roles of teachers in the classroom, the beliefs and assumptions about students and education (Ben-Peretz, Mendelson, & Kron, 2003) because it is known that metaphors have an important function to see reflections from teacher training programs due to their effective role in the conceptualization of special teaching roles adopted by teachers (Tobin & LaMaster, 1992). Generally speaking, metaphors include describing abstract notions or the facts that are difficult to understand with more familiar expressions. According to Goodman (2003), metaphors enable the transformation of abstract concepts into specific forms and help them to be understood, based on the known. There is a relationship between the constructed metaphors and understanding the world in general, way of thinking and perspective (Morgan, 1998). In other words, when an individual encounters a new concept or an abstract situation, the concrete expressions in his attempt to express it concretely by looking at that concept or situation from his own perspective are called metaphors (Saban, Koçbeker & Saban, 2006).

Metaphors that enable individuals to understand and construct their world are mental mapping or modeling mechanisms (Arslan & Bayrakçı, 2006) and are a tool of perception (Arnett, 1999). Metaphors are a thought figure that allows to understand one thing (such as a phenomenon, concept, object) in terms of something else (Lakoff & Johnson, 2005). The concept of metaphor, which is the way individuals perceive a concept or phenomenon, using metaphors (Forcenville, 2002) is also stated as a tool that individuals use in trying to explain how they see objects, events, environment and life using different analogies (Cerit, 2008). In short, metaphor is the expression of abstract or difficult to understand facts with more familiar and familiar expressions (Deringöl & Gülten, 2016).

It is known that through metaphors, individuals try to understand another concept or a reality about life based on the images they create in their minds. According

to this, metaphors are seen as expressing a concept or phenomenon as perceived by using metaphors (Şengül, Katrancı & Gerez-Cantimer, 2014). In this context, metaphors as a part of reasoning are personal images and powerful educational tools that can be used for reflection (Şahinkaya & Yıldırım, 2016). Therefore, it can be said that metaphors are a powerful tool in revealing teacher candidates' perspectives on mathematics and reflecting their past experiences, and present and future thoughts (Güveli, İpek, Atasoy & Güveli, 2011). It was planned to conduct this study, especially considering that classroom teachers, who are at the most important step of the mathematics learning and teaching processes, have an important view on mathematics and mathematics lesson. The importance and necessity of determining the primary and secondary school teachers' metaphorical perceptions of mathematics lesson while they are still candidate teachers were taken into consideration.

When the literature is examined, it can be seen that there are studies on metaphors and metaphorical perceptions in relation to many disciplines both at home and abroad (for example, Ben-Peretz, Mendelson & Kron, 2003; Bullough, 1991, Cerit, 2006; Guerrero & Villamil, 2002; Inbar, 1996; Leavy, McSorley & Bote, 2007; Martinez, Sauleda & Huber, 2001; Massengill & Mahlios, 2008; Saban, 2004; Saban, 2009; Thomas & Beauchamp, 2011). Along with this, studies on metaphorical perceptions of mathematics and classroom teacher candidates (Güler, Öçal & Akgün, 2011; Güveli, et al.; 2011; Güler, Akgün, Öçal & Doruk, 2012; Güner, 2013; Şengül & Katrancı, 2012; Şahin, 2013; Şahinkaya & Yıldırım, 2016; Tarım, et al., 2017; Çetinsoy, 2019; Kükey, Kükey & Tutak, 2019; Yapıcıoğlu & Korkmaz, 2019) are present in the literature too. When the literature is examined, it is seen that most of the studies on metaphoric perception collected data with written expressions. However, it is thought that metaphorical perceptions can be expressed with drawings in a better way (Dönmez, 2017; Doğan & Sönmez, 2019) because drawings are one of the important ways to reveal the experiences of individuals on a subject objectively (Kearney & Hyle, 2004). On the other hand, it is known that drawings are defined as a form of communication that serves to reveal the personality, intelligence, fears and attitudes of individuals (Zians, 1997).

When the studies in the literature were examined, it was seen that there was scarcely any research on classroom teacher candidates' visual metaphorical perceptions about mathematics lesson. In this context, it was thought that it would be beneficial to conduct a research that examines classroom teacher candidates' metaphorical perceptions of mathematics lesson through visuals. In addition, it is thought that the study is important in terms of revealing the ways in which classroom teacher candidates, who will have an important role in teaching basic mathematical concepts in the future, make sense of the concept of mathematics by expressing them with metaphors and drawings. Along with this, it is expected that the results of this study will make a positive contribution to create a foresight in the teacher training process and to fill the perception gap about mathematics lesson and mathematics teaching. The research is also important in that it contributes to the literature with the analysis of the visuals created by the elementary teacher candidates for the mathematics lesson.

In the light of the above information, the problem of the study was identified as the determination of classroom teacher candidates' metaphorical perceptions of the mathematics course through the visuals they created. In order to find an answer to the research problem, the following sub-problems were sought to be answered:

- 1) What are the metaphors (or mental images) and categorical groups of these metaphors that classroom teacher candidates use in their written expressions about mathematics lesson?
- 2) What conceptual categories can the metaphors that are used by classroom teacher candidates in the pictures they draw for the mathematics lesson be categorized according to their common features?

2. Method

In this section, information about the research model, study group, data collection, validity, reliability and analysis of the data are given in detail.

2.1 Research Model

In line with the research problem, qualitative research method, which is one of the research methods, was used. In this study, a case study, which is one of the qualitative research models seen as a distinctive approach in searching for answers to scientific questions, was used. The purpose of qualitative research is to reveal the depth of descriptions and meanings (Büyüköztürk et al., 2014). Therefore, the research was carried out with a case study model in order to examine the metaphorical teacher candidates' perceptions of mathematics lesson in depth. Case studies are a distinctive approach used to seek answers to scientific questions. The most basic feature of the qualitative case study is to investigate one or more cases in depth (Yıldırım & Şimşek, 2016). The case study is a method that allows a deep longitudinal study of a single situation or event rather than examining the variables that have been determined in a limited number or following various rules (Davey, 2009). What is essentially important in this method is that there is a "special case" that has been the subject of the research (Kaleli-Yılmaz, 2019).

2.2 Participants

The sample of the study consists of 36 classroom teacher candidates who are studying at a state university in the city of Istanbul, obtained by easily accessible sampling method. The easily accessible sampling method was chosen because it adds speed and practicality to the research (Yıldırım & Şimşek, 2016). The classroom teacher candidates participating in the study are third grade students and have taken basic mathematics and mathematics teaching lessons.

2.3 Data Collection

The metaphorical perception form was used as a data collection tool to determine classroom teacher candidates' metaphorical perceptions of the mathematics course. In

this form, there are the instructions of “Draw what comes to your mind first when we say mathematics lesson” and “Explain the drawing you have created”. Under each instruction, there is a section where there is a suitable space for the teacher candidates to create their visuals. For the validity study of the questions in the measurement tool, the content validity was checked and expert opinions were consulted. At the beginning of the implementation process, the required explanations were made to the teacher candidates, and one lesson hour (45 minutes) was given to draw/create visuals and explain the drawing. No intervention was made during the pre-determined implementation period, and it was stated that the participants should create their visuals and explanations individually.

2.4 Data Analysis

In the analysis of the data, the visuals and drawing explanations created by the teacher candidates were examined in detail. In order to reveal how the participants perceived the mathematics lesson, both their written expressions and drawings were evaluated together. The data obtained within the framework of the research were classified and grouped independently by the researchers and these groups were compared and gathered under the same title. The categories were created by determining the codes that are related to the metaphors used in the analysis of the statements and drawings done by the teacher candidates about the school. In order to evaluate the visuals created during the analysis process and to increase the reliability of the coding, the opinions of two more expert faculty members were taken.

3. Results

As a result of the analysis of the data obtained, when the metaphor perceptions of the classroom teacher candidates were examined, the themes consisting of four main categories were determined. These themes were determined as “*affective situations, impact on life, school and classroom environment, mathematical expressions and concepts*” as stated in the study conducted by Sönmez (2018). In this context, the findings are presented in the form of findings related to the written metaphors and findings related to the visual metaphors in accordance with the purpose of the research. In addition, some of the examples of visual metaphors that classroom teacher candidates created about the mathematics lesson were also included and the analysis of these metaphors was also added to the findings.

3.1 Findings Regarding Written Metaphors

Table 1 shows the categories created as a result of encoding the written statements of the teacher candidates and the number of metaphors in these categories.

Table 1: Written metaphors that make up the categories and their frequency of being indicated

Categories	The number of metaphors (f)
Affective situations	14
Impact on life	16
School and Classroom environment	28
Mathematical expressions and concepts	23
Total	81

The metaphors and the frequency values of the metaphors determined under the theme of “affective situations” in line with the metaphors expressed by the teacher candidates are given in the table below (Table 2). In addition, sample opinions on the categories are also included below the table.

Table 2: Metaphors created in the “Affective situations” category and their frequency of being indicated

Categories	The number of metaphors (f)
Happiness	3
Unhappiness	2
Confusion	3
Authority-fear	2
Love	2
Anxiety about the lesson	1
Positive reinforcement	1
Total	14

The opinion of a classroom teacher regarding this finding is as *“I drew the scene I saw in my classroom in elementary, middle and high school mathematics lessons. Math lessons were boring and too complex to understand. Teachers, on the other hand, had no effort to make this job easier and interesting. When this happened, people either struggled to understand what was told or gave up and slept.”* (Q12). The emotional state of happiness (Q24) is: *“I tried to draw those days when my teacher, Meral, who made me love mathematics from my secondary school years, told the class how beautiful and correct the solution I found while I was at the board, which lead to my interest in mathematics today and made mathematics and geometry my favorite subject.”*. The expression of (S4), which is considered as unhappiness is: *“It is a classroom in which the students in the front row listen to the teacher and are interested in the lesson while other students hang out on their own if the teacher does not care, and seem to listen to the lesson if the teacher is authoritarian. It is wrong but unfortunately this comes to my mind.”*

Table 3, on the other hand, gives the frequency values of another category, “Impact on life” category and the metaphors under this category. In addition, sample opinions are given below the table.

Table 3: Metaphors created in the “Impact on life” category and their frequency of being indicated

Categories	The number of metaphors (f)
Use in daily life	8
Using materials	5
From abstract to the concrete	2
Nature	1
Total	16

Regarding daily life usage (Q8), one participant said that *“When it comes to mathematics lesson, the first thing that came to my mind was numbers and digits. Numbers first appeared as hopscotch. Then it showed itself on the coins and the they came back to me as candy and chocolate. The numbers did not fit in my hand anymore, and they opened the doors of an adventure that started by saying “have 1 in hand”.* Drawing attention to the narration with the material (Q15) another candidate said that *“When I talk about mathematics lesson, the first thing that comes to my mind is a classroom environment and a board with numbers because we have been taught this way until now. I chose the multiplication table as the subject and created an environment where lessons would be implemented by using materials such as sticks, beans, apples, bananas etc. that the students bring from their house. After the teacher tells the subject with the materials, I thought that he would use the board with the classical method and I drew it this way.”* For Q19, a participant drew attention to the mathematics in nature by saying that *“Most objects in nature constitute the essence of mathematics. When I think about mathematics, I think of the reflection of nature on art.”*

Another category is “School and classroom environment” and the frequency values of the metaphors in this category are given in Table 4 and sample opinions are given below the table.

Table 4: Metaphors created in the “School and classroom environment” category and their frequency of being indicated

Categories	The number of metaphors (f)
Board	10
Teacher	7
Classroom environment	6
Students	3
Notebook, pencil, paper, exam	2
Total	28

As an example of this category, the following expressions are striking: *“When I say mathematics lesson, first of all, I think of a green board and a chalk board with many numbers, formulas, operations and geometric objects on it”* (Q6); *“When I think of mathematics, I think of a board full of abacus and addition operations because I think the first tool we meet with mathematics is abacus”* (Q23) and *“Mathematics lesson should be a lesson in which students and teachers can progress with the frame of respect and affection. This is my wish. The student should not feel nervous in maths class. If the student is nervous, it is definitely because of the teacher. The*

reason can never be the student. When I took maths class in high school, we had a teacher who got angry when we couldn't do a question. This is a picture that shows me how to behave in class. Mathematics lesson should be conducted in cooperation by encouraging the students to like the lesson" (Q21).

The last theme in line with the metaphors expressed by the teacher candidates is "Mathematical expressions and concepts", and the frequency values of the determined metaphors are given in Table 5, and sample opinions are expressed below the table.

Table 5: Metaphors created in the "Mathematical expressions and concepts" category and their frequency of being indicated

Categories	The number of metaphors (f)
Numbers	4
Four operations	6
Operations, symbols, formulas	4
Geometrical shapes	4
Problems	5
Total	23

"When I say "maths lesson", first of all, I think of a green board and a version of many numbers, formulas, operations and geometric objects with a piece of chalk on it" (Q6); "When I think of mathematics, the first thing that comes to my mind is these symbols: "+, -, x, :". We use almost all of them in daily life. When it comes to math lessons, these come to my mind. I drew a classroom in my picture. I also wrote these symbols on the board. Mathematics cannot be done without these symbols" (Q9); "When I think of math lessons, I think of problem questions. Especially the pool problems from the questions about the problems subject in the high school curriculum. In the question, there are 3 of the taps filling the pool at a certain speed, 2 of them emptying the pool and their speed of emptying the pool. I usually think of mathematical problems that are related to daily life, even partially" (Q36) are some of the answers from the teacher candidates.

In line with the second problem of the study, the information about the conceptual categories under which the metaphors the classroom teacher candidates used in the pictures they drew for the mathematics lesson were collected in terms of common features were given in tables, and sample drawings were given below these tables.

3.2 Findings Regarding Visual Metaphors

The metaphors and the frequency values of the metaphors determined under the theme of "affective situations" in line with the drawings of the teacher candidates are given in the table below (Table 6). In addition, sample visuals and analysis of categories are also available below the table. First of all, the category of "affective situations" related to visuals was discussed and the frequencies of metaphors were given in Table 6. In addition, a sample visual is attached to the bottom of the table.

Table 6: Visual metaphors created in the “Affective situations” category and their frequency of being indicated

Categories	The number of metaphors (f)
Happiness	10
Unhappiness	5
Confusion	4
Authority-fear	2
Total	21

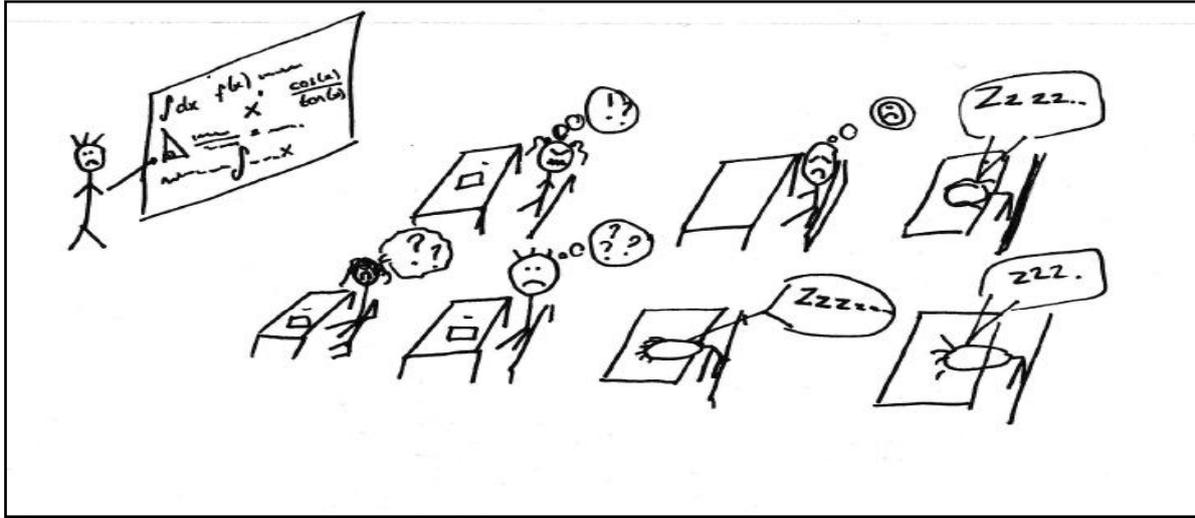


Figure 1: Visual created by the student with the code S12

The classroom environment stands out on the blackboard, with a teacher giving lessons unhappily, lots of formulas on the blackboard, angry, unhappy, angry and sleeping students in the classroom. For this teacher candidate, mathematics can be seen as a boring and difficult lesson. It is seen that there are many students who create many question marks in their minds and are unhappy because they cannot find answers to these questions.

In Table 7, the frequency values of the visual metaphors in the “Impact on life” category are given. In addition, a sample visual is also included below the table.

Table 7: Visual metaphors created in the “Impact on life” category and their frequency of being indicated

Categories	The number of metaphors (f)
Use in daily life	8
From abstract to the concrete	5
Nature	3
Using materials	2
Total	18

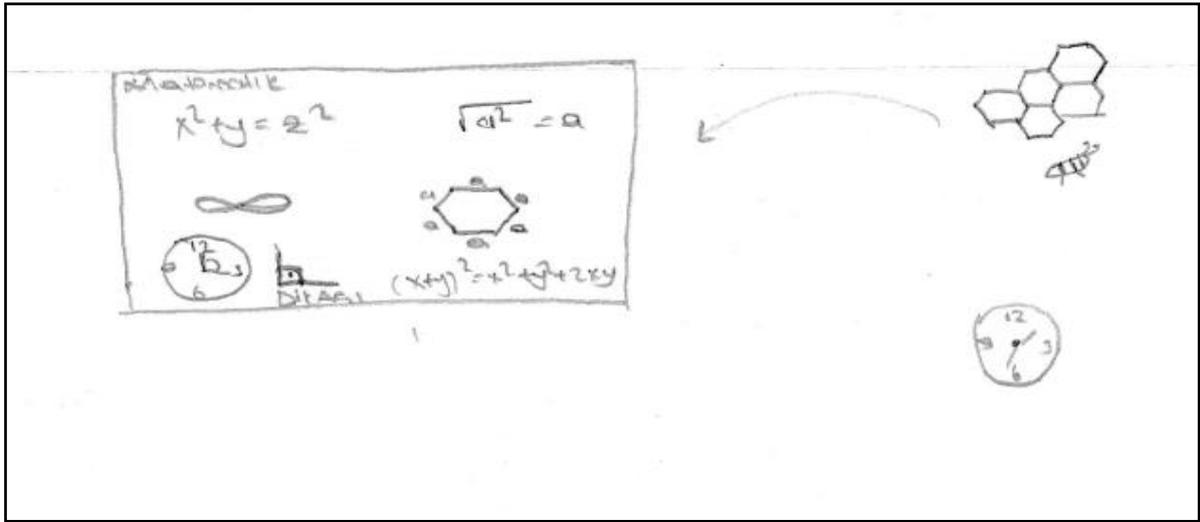


Figure 2: Visual created by the student with the code S19

The first thing that stands out is the board in a classroom setting. However, the applications of what has been learned in daily life are also seen on the board. Like honeycomb and hexagon. At the same time, we can say that the interior angles of the clock and the time are a connection made with objects we encounter in everyday life. For this teacher candidate, mathematics exists outside the classroom too.

Another category is “school and classroom environment” and the frequency values of the metaphors in this category are given in Table 8 and the sample drawing is given below the table.

Table 8: Visual metaphors created in the “School and classroom environment” category and their frequency of being indicated

Categories	The number of metaphors (f)
Board	20
Classroom environment	10
Teacher	9
Students	8
Notebook, pencil, paper, exam	4
Teacher’s desk	2
Abacus	2
Total	55

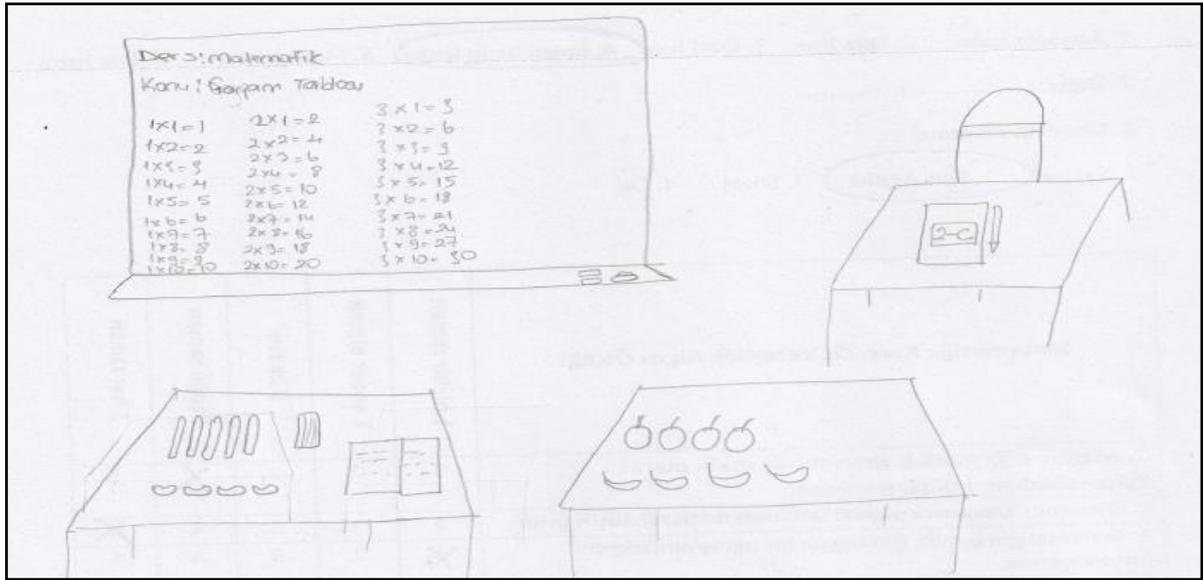


Figure 3: Visual created by the student with the code S15

At first glance, a classroom environment draws attention. Seats, board, teacher's desk. There is a multiplication table on the board. At first, it can be thought that this teacher candidate does not think mathematics apart from the classroom environment. However, when we look at the student desks closely, beans, counting sticks, and various fruits (apple, banana) stand out. For this teacher candidate, it can be argued that mathematics is explained by making a connection with life.

The last theme in line with the metaphors drawn by the teacher candidates participating in the study is "Mathematical expressions and concepts", and the frequency values of the determined metaphors are given in Table 9 and sample opinions are also expressed at the bottom of the table.

Table 9: Visual metaphors created in the "Mathematical expressions and concepts" category and their frequency of being indicated

Categories	The number of metaphors (f)
Numbers	12
Four operations	9
Operations, symbols, formulas	8
Geometrical shapes	4
Multiplication table	2
Problems	2
Total	37

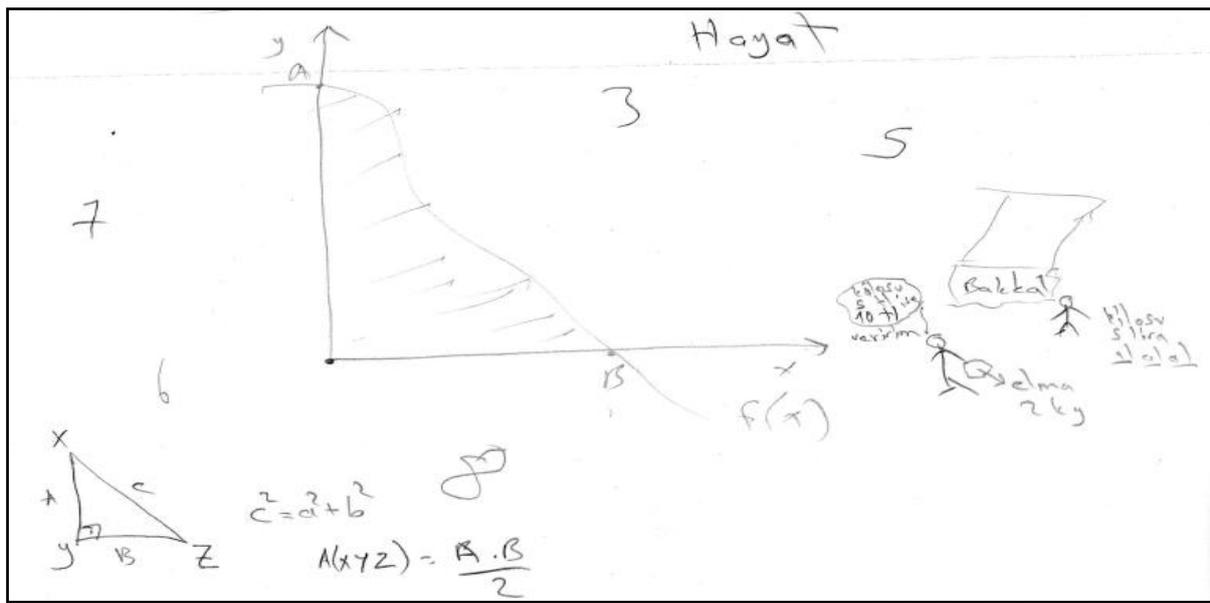


Figure 4: Visual created by the student with the code S35

The graph, numbers, triangle (Pythagorean theorem, area) first draw attention. However, it can be said that this teacher candidate thinks that mathematics is not just a classroom situation with the shopping theme he drew at the grocery store.

4. Discussion and Conclusion

When the visual metaphorical perceptions and written expressions were analyzed as a result of the research findings, it was seen that the classroom teacher candidates mostly expressed the school and classroom environment related to the mathematics lesson. When the metaphor frequencies used by the participating teacher candidates in the study were examined, it was understood that they saw mathematical expressions and concepts as an effective factor in the second place. The metaphors for classroom teacher candidates to associate mathematics lesson with daily life are under the category of impact on life and their rank is three. Finally, the expressions of the teacher candidates within the scope of the study, such as being happy-unhappy, fear, confusion, love, and authority when the mathematics lesson is mentioned, were included in the affective situations category.

When both the pictures drawn by the teacher candidates and the written expressions are examined, it is noteworthy that the most frequently used metaphors are the ones related the school and classroom environment when it comes to mathematics lesson. Candidates' blackboard, classroom environment, teacher, student, pencil, notebook, book, exam paper, etc. metaphors were encountered. In the visuals, there are different expressions of the teacher's desk and abacus. In the previous studies conducted with teacher candidates (Bramald, Hardman & Leat, 1995; Saban, 2004; Güveli et al., 2011; Şahin, 2013), it was stated that perceptions of mathematics were shaped according to the past learning processes and experiences. When the results of Saban's study (2004), which was conducted to determine the metaphorical perceptions of the classroom teacher

candidates for the concept of a teacher, were examined, it was seen that the classroom teacher candidates put forward the concepts depending on their past experiences. These perceptions of the teacher candidates are reflected in the metaphors they have developed. In the same study, the participants produced the most metaphors in the category of teacher as an information provider. Similarly, Koç (2014) found in his study that the most metaphors were in the category of teacher as a source of information. As can be seen in these studies, they defined the teacher as only an information transmitter in the usual way. Classroom teacher candidates' perceptions of mathematics and mathematics teaching concepts and the way they present them give clues about how they will behave in their professional lives (Tarım, Bulut-Özsezer, Canbazoğlu, 2017). They support our work in this respect. Teacher candidates see the mathematics lesson only in formal education.

Generally speaking, mathematics lesson is of course learned in the classroom, but mathematics is a lesson that is related to daily life and should not only be kept in the classroom environment. This finding is thought-provoking, especially when we consider that classroom teachers should also teach the fun and life-related aspect of mathematics lesson to students. This situation may also be because of the teacher candidates participating in the study. Therefore, it can be said that similar studies should be conducted with a larger sample.

The second finding of the study is the metaphor frequency of participants' expressions of mathematical terms and concepts in relation to the mathematics lesson. The metaphors in this category are expressed as numbers, four operations, symbols, formulas, geometrical shapes, and problems. When we look at the studies analyzing the metaphors for the concept of mathematics, we found similar results to the themes created by the metaphors obtained on the concept of mathematics in our study (Güler, Akgün, Öçal & Doruk, 2012; Güner, 2013; Güveli, İpek, Atasoy & Güveli, 2011; Şengül & Katrancı, 2012; Şahinkaya & Yıldırım, 2016; Tarım, Bulut-Özsezer & Canbazoğlu, 2017; Sağlam-Kaya, 2017; Olsen, Lew & Weber, 2020). In addition, it is seen that the metaphors about the concept of mathematics put forward by the classroom teacher candidates mostly have positive meanings (Tarım, Bulut-Özsezer & Canbazoğlu, 2017). In his study, Ayvaz-Can (2020) drew attention to the lack of a metaphor or justification that includes negativity although metaphors related to conceptual categories that include negativities such as maths' being difficult, time-consuming, and boring were created among the metaphors that had been developed in research on the concept of mathematics in the literature. It coincides with the result determined in their research by Doğan and Sönmez (2019) that the classroom teachers have a positive perspective about the use of mathematical games in their lessons. The fact that mathematical concepts have been expressed in a similar way is an indication that the perspective of mathematics lessons in our education system does not change as years or periods pass. In a metaphor analysis study by Sağlam-Kaya (2017) on teacher candidates' perceptions of mathematical examples, when the teacher candidates' perceptions regarding the use of samples in the classroom are analyzed, it is seen that they mostly think of using examples regarding the application of the pre-

learned procedures. This study is also an indication that teacher candidates do not want to go beyond certain patterns.

The fact that the first thing that comes to one's mind when talking about mathematics is concepts, symbols, operations, etc. is of course true. However, it is an important point that prospective classroom teachers who will explain mathematics in primary school should not neglect the fun side of mathematics lesson. It is more important for classroom teachers, who will form the foundations of the first mathematical concepts, to make their students love mathematics rather than see it just as a lesson. In this context, it can be thought that there is a need for necessary studies for classroom teacher candidates to carry the mathematics course beyond expressions and concepts.

This study's participant classroom teacher candidates' metaphor to associate mathematics lesson with life were found in the third place under the category of impact on life. It was observed that the participants expressed the metaphors of daily life, from abstract to the concrete, using materials and nature. In the study of Tarım et al. (2017), teacher candidates stated that mathematics teaching is a part of life, and that mathematics knowledge is an indispensable requirement while solving the problems we experience in our daily lives. In Şahinkaya and Yıldırım's (2016) studies, it was stated that teacher candidates perceive learning and teaching mathematics as a job that is largely associated with life. Similarly, within the scope of the theme determined as the attitudes of mathematics teachers towards the lesson, it was determined that mathematics teachers should first realize that mathematics is related to daily life and accordingly, they should show that mathematics and daily life are intertwined (Kükey & Aslaner, 2017). Yenilmez and Can (2006), Galbraith and Stillman (2006) have emphasized similar situations in their studies.

When it comes to mathematics and mathematics lessons, it would be expected that candidates who will become classroom teachers have more metaphors. Here, first of all, the level of the candidates' lessons that are related to daily life and mathematics teaching lessons should be questioned. In fact, primary school students need to associate both mathematics and all other lessons with real life. In this context, the reason for the low frequency of metaphors in the category of impact on life of future classroom teachers is considered as a situation that needs further research.

The last finding of the study is the category of affective situations that include metaphors of being happy-unhappy, fear, confusion, love, authority, and positive reinforcement that is only expressed in written form. In this case, it can be said that metaphors are mostly gathered under the theme of happiness. Supporting this situation, Güveli et al.'s (2011) study found that the metaphors preferred by classroom teacher candidates towards mathematics have more positive meanings. They also stated that the candidates' perceptions of mathematics were complex but well-developed. In his study, Şahin (2013) found that classroom teacher candidates who said they were successful, willing, hardworking in mathematics lesson found mathematics enjoyable, were successful and associated with intelligence, and he emphasized that knowing mathematics might have led to a positive perception towards it. In addition, the density

of the themes of “*unhappiness, fear and authority*” is unfortunately too high to be underestimated. Cassel and Vincent (2011) stated that it is the most general category among the metaphors about mathematics teaching, which classroom teacher candidates express with words such as complex, challenging, confusing, and sequential. It has been determined that some students studying in the classroom teaching department have negative thoughts about mathematical problems and perceive them as difficult and complex (Özsoy, 2005; Arslan & Altun, 2007; Yazgan, 2007; Işık & Kar, 2011; Sezgin-Memnun, 2015; Uygun, Gökkurt & Usta, 2016; Büyükalın-Filiz, 2018). Çetinsoy (2019) stated that the teacher candidates who participated in his study consider mathematics lesson as an indispensable lesson for primary level and are aware of its importance both for themselves and in daily life. However, according to the sentences they wrote, he emphasized that not being able to succeed in the mathematics lesson causes them to develop negative perceptions towards the lesson, and the further away the teacher candidates’ departments are from mathematics, the more negative their perception towards mathematics is. In this regard, faculty members have a great responsibility to positively change students’ perceptions about the mathematics course. To achieve this, it is recommended that students who are afraid of the mathematical problem or perceive the problem as difficult should be reminded of the use of the problem in daily life and the importance of problem solving, rather than the difficult-complex nature of the problem in the teaching process, and faculties should work on the development of these students’ problem-solving skills (Uygun, Gökkurt & Usta, 2016). In addition, it has been observed that the fact that the educators who teach mathematics lessons love students and behave sincerely towards them is important for the efficiency of the lessons (Kükey & Aslaner, 2017).

When the source and reasons of the metaphors developed by the classroom teacher candidates are analyzed, it is seen that the teacher candidates’ past mathematical experiences have affected their perceptions and perspectives on mathematics. The perceptions that teacher candidates develop against events/facts are very important in shaping their professional attitudes and perspectives. Metaphors can be used as a powerful research tool to reveal, explain and interpret the classroom teacher candidates’ perceptions of mathematics concept. Mathematical metaphors that can easily be found in real life can be selected and used to explain a mathematical concept easily (Hendriana & Rohaeti, 2017). Classroom teacher candidates’ perceptions, which develop with the effect of their pre-service education and experiences against events, situations or facts, form the basis of their attitudes and professional perspectives (Büyükalın-Filiz, 2018). In this respect, using mathematics games may be a good way to prevent teacher candidates’ fear, failure and math phobia (Beak, 2008). While playing games, students explore their mathematical knowledge in a highly motivated way to satisfy their curiosity and reach a result (Heshmati, Kersting & Sutton, 2018). Teachers can improve their students’ thinking skills by using math games (Sanders, 2016). In this way, students will also have the opportunity to apply their mathematical knowledge and skills while playing math games (Rutherford, 2015). A course like “Mathematics teaching with games” can be added to

the field training courses in the classroom teacher undergraduate program (Ayvaz Can, 2020). School mathematics and university mathematics should not be perceived as different and methods should be sought to develop a positive attitude towards mathematics, either as a research tool or in order to encourage mental growth (Wittmann, 2021). It can be ensured that teachers motivate students to overcome the fear that they will not succeed in mathematics, increase their interest with the help of creative games by introducing the entertaining side of mathematics (Ünlü, 2007; Çekirdekçi, 2020). Since the learning environment is among the factors that affect students' success and attitudes towards the lesson (Koçak & Bilecik, 2019), mathematics lessons that include different learning situations can be done with teacher candidates. Mathematics educators should use more open-ended and discursive teaching approaches that put more emphasis on developing students' conceptual understanding and problem solving skills (Wright, 2020). Word problems have always been an important part of school mathematics all over the world (Verschaffel, Schukajlow, Star & Dooren, 2020). The same research can be repeated using different data collection techniques and the similarities and differences between the results can be looked at. It can be provided to raise the awareness of teacher candidates with seminars explaining the importance and value of mathematics. In addition, the relationship between mathematics and daily life can be shown with the lessons for mathematics education that will show the connection between mathematics and everyday life.

Conflict of Interest Statement

The authors declare no conflicts of interests.

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