PES
www.ijpes.com
International Journal of Psychology and Educational Studies

Metaphorical Perceptions of Fourth-Grade Primary Students towards Mathematics Lesson*

Sıtkı Çekirdekci[1]

[1]*Sinop University, Sinop, Turkey*

ARTICLE INFO

Article History:
Received 30.05.2020
Received in revised form 29.06.2020
Accepted 02.09.2020
Available online 28.09.2020

ABSTRACT

The aim of this study is to reveal the perceptions of fourth-grade primary students about "mathematics lesson" through metaphors and to investigate whether main categories identified regarding the common characteristics of the metaphors differed by gender. A qualitative research design was employed in the study. The study was carried out in the spring term of the 2018-2019 academic year with the participation of 116 fourth-grade students from three public primary schools in a province which is in the western Black Sea Region. The primary data source of the study is "Mathematics Lesson Metaphors Questionnaire ". The data of the study was obtained by completing the blanks in the sentence 'Mathematics lesson is like ……. Because ……..'. The students were asked to write down a metaphor about the mathematics lesson in the first blank and to explain the reasons why they wrote this metaphor in the second blank. The data were analyzed by content analysis method in this study. As a result of the study it is found that the fourth-grade students developed 64 different metaphors about mathematics. These metaphors are gathered in 13 subcategories under the main categories of mathematical knowledge, principles of mathematics teaching, mathematical skills, affective characteristic towards mathematics. At most metaphors are developed in the category of affective characteristic towards mathematics.

Keywords:
Fourth-grade primary students, mathematics, metaphorical perceptions.

1. Introduction

In today's world where there is an increasing need for problem-solving skills and Global Positioning System (GPS) and codes are widely used, mathematics continues to grow in importance. Mathematics is everywhere from daily routines to technological developments. Baykul (2016) contends that mathematics occupies everywhere that human exists. In this respect, being successful in all stages of life depends on knowing mathematics. This is because mathematics encountered in daily life requires individuals to possess basic mathematics knowledge (Tarım, Bulut Özsezer and Canbazoğlu, 2017). Helping to develop skills in logical reasoning, mathematics is utilized as a tool for understanding the world and developing the society we live in (Yenilmez and Özbey, 2006). Developing knowledge and skills to help students make sense of physical and social world is the duty of mathematics education (Gür, Hangül and Kara, 2014). Despite such importance, however, mathematics is considered a difficult subject by many students and they may come to feel that they fail in mathematics (Başar, Ünal and Yalçın, 2002; Doğan and Sönmez, 2019; Parzysz, Pesci and Bergsten, 2005). Not surprisingly, then, students cannot exhibit expected performance (Mutlu, Söylemez and Yasul, 2017). Students feel uneasy thinking they are going to fail and develop negative attitudes towards mathematics whereby they exhibit low self-confidence (Yenilmez and Özbey, 2006). Students' attitudes towards mathematics are closely related to their previous experiences (Akdemir, 2006). Particular

* This study was presented as an oral presentation at ERPA International Congresses on Education, 10-12 April 2020

Corresponding author's address: Faculty of Education, Department of Primary Education, Sinop University, Sinop / Turkey.
Telephone: 0368 271 55 26 / 2035
Fax: 0368 271 55 30
e-mail: cekirdekci-sitki@hotmail.com

http://dx.doi.org/10.17220/ijpes.2020.04.011

phenomenon and situations students experience during the school years may affect their attitudes and even change their perceptions towards mathematics.

Metaphors are commonly employed in educational sciences to explore individuals' attitudes and perceptions (Aydın and Pehlivan, 2010; Şahinkaya and Yıldırım, 2016). Metaphors is one of the effective cognitive tool to generate insights about students' perceptions and learning styles; and infer their beliefs, attitudes, thoughts and behaviours (Ocak and Gündüz, 2006; Lakoff, 2009). Further, metaphors help individual express their positive and negative experiences (Kemp, 1999). Metaphors reflect and shape our attitudes and, in turn, determine our behavior (Strenski, 1989). In this way, it is possible to elicit information regarding a person's perception and opinions on a concept through metaphors.

The term 'metaphor' is derived from the Greek word 'metaphora'. Meta means "beyond"; pherien means "to transfer" or "to carry over". The word "metaphor" means "carrying something from one place to another" (Lakoff and Johnson, 1980/2005). While Arnett (1999) defines metaphor as a tool of perception, according to Hasırcı (2017), metaphors are used as effective, cognitive and systematic tools for purposes of constructing, navigating and functionalizing ideas about a concept. According to Silman and Şimşek (2006), metaphors can be seen as a tool to understand, describe and compare social facts (cited in: Ertürk, 2017). The metaphor is also described as a powerful mental mapping and modelling mechanism in understanding and structuring of the individuals' world (Arslan and Bayrakçı, 2006). Thereby becoming a vital tool for deciphering individuals' opinions especially about challenging concepts and topics along with abstract concepts.

Metaphors allow the individual to see a certain fact as another fact by directing the mind from a certain perception form to another (Saban, 2008b). Metaphors are also used to determine the concept traces in the minds of people by other words not related to these concepts (Güler, Akgün, Öcal and Doruk, 2012). Metaphors are yet not just figurative linguistic devices, in fact, they constitute the foundation of our thought and conception (Lakoff and Johnson, 1980/2005). It is the result of individual creativity. According to Aydın and Pehlivan (2010), creativity paves the way for the individual to associate the situations they come across and think with other elements. Therefore, metaphor functions as a bridge between feelings and knowledge (Modell, 2009). Metaphors can thus be described as identifying perception of a concept or phenomenon using similes. Lakoff and Johnson (1980/2005) denote that metaphors not only make our thoughts noticeable and interesting but also structure our perceptions and understanding.

Metaphorical perceptions are generally created in classroom environment as part of the learning process (Şahin, 2013). In terms of learning and understanding, metaphorical perceptions regarding abstract mathematical concepts is also created in classroom environment. The classroom is where students will first experience mathematics (McColm, 2007; Tarım et al., 2017). It is thus worth noting that primary schools, the first stage of primary education, is a period constructing and shaping students' perceptions towards mathematics concepts (Güveli, İpek, Atasoy and Güveli, 2011). Further, primary schools play a vital role in educating individuals and molding their future and since primary schools are the first stage of the education process, they form the basis of the whole educational life (Cerit, 2008).

An analysis of the past studies in the literature investigating metaphorical perceptions of primary school students who are at the first stage of the formal education reveals various concepts used: teacher (Ertürk, 2017), ideal classroom environment (Ekiz and Gülay, 2018), school (Cerit, 2006; Saban, 2008b), knowledge (Saban, 2008a), Social studies lesson (Güven and Güven, 2009), Turkish language lesson (Sidekli and Ünlü, 2019). A large body of literature exists that examines the metaphorical perceptions of in-service and pre-service classroom teachers who play an essential role in the lives of the primary school students on mathematics (Güler et al., 2012; Güveli et al., 2011; Kelly and Oldham, 1992; Noyes, 2006; Şahin, 2013; Şahinkaya and Yıldırım, 2016; Şengül and Katrancı, 2012).

When it comes to metaphorical studies on primary school students' perception of mathematics, it is observed that concepts such as anxiety, motivation and belief are discussed (Ersoy and Aydın, 2017; Özdemir and Sezginsoy Şeker, 2019; Solomon and Grimley, 2011; Tang, Bobis, Way and Andersen, 2015). Ersoy and Aydın (2017) studied 22 fourth-grade primary students to find out how they combined mathematics with daily life. As a result of the study, a total of 75 metaphors were classified under nine categories. Likewise, Özdemir and Sezginsoy Şeker (2019) conducted a study on mathematical anxiety of fourth-grade primary students

and comparison of metaphorical perceptions with classroom teachers. In their study, 150 primary school students produced 209 metaphors in total. On the basis of these studies, it is understood that the metaphors generated by students related to mathematics were not analyzed according to different variables.

With respect to mathematics education, primary school is a critical period in the development and construction of students' perception on mathematics (Güveli et al., 2011). Harari, Vukovic and Bailey (2013) noted that first-grade primary school students have mathematics anxiety. Hannula (2005) claims that mathematics anxiety starts at early ages in the process of education and learning, also becomes more and more. McLeod (1993) points out that the ages of 9 and 10 is particularly defined as important in the developing of mathematics anxiety (cited in: Witt, 2012). Equally important consideration is that alteration of the attitudes which were formed during this step is quite hard and it may continue also in the adulthood life (Newstead, 1998). According to Dowker (2005), math anxiety affects mathematics performance after the fourth-grade. In this sense, it is thought to be important to investigate metaphorical perceptions of fourth-grade primary students towards mathematics, and determine whether their perceptions significantly differ by gender. With this in mind, fourth-grade primary students' opinions about mathematics lessons were examined through metaphors. The research question posed in the study is "What are the metaphors produced by fourth-grade primary students towards mathematics?" Specifically, answers to the following questions were sought:

1. What are the metaphors produced by fourth-grade primary students towards mathematics lessons?

2. Under which conceptual categories can the fourth-grade primary students' metaphors about mathematics lessons be classified in terms of their common characteristics?

3. Do conceptual categories classified regarding metaphors' common characteristics differ significantly according to the students' gender?

2. Method

In this section, the research model, study group, data collection tools and data analysis will be presented respectively.

2.1. Research Model

A qualitative research design was employed in the study. Qualitative researches are interested in understanding how people interpret their experiences, how they construct their worlds, and what meaning they attribute to their experiences; and widely applied in educational sciences using data collection methods such as interviews, observation or documents" (Merriam, 2013). The data was collected through a written form and the metaphorical perceptions of the fourth-grade students was used to interpret how they experience mathematics and what meaning they attribute to their experiences. For this reason, the qualitative research design was chosen.

2.2. Study Group

116 fourth-grade students in three public primary schools affiliated to a province which is in the western Black Sea Region in the spring term of the 2018-2019 academic year which were selected based on convenience sampling constituted the study group of the research. The convenience sampling was used because it brings speed and practice along with easy implementation (Yıldırım and Şimşek, 2008). The study group was composed of 49 (42.2%) male and 67 (57.8%) female students.

2.3. Data Collection Tools

The primary data source of the study is "Mathematics Lesson Metaphors Questionnaire". The questionnaire involves two parts. The first part includes questions in regard to students' gender, the second part asks the following question "Mathematics lessons is like …….. Because……..."

The students in the study group were asked to write a metaphor about mathematics lesson in the first blank of the question in the second part and explain why they use that metaphor in the second blank. Forceville (2002) suggests that in any metaphor relationship at least three basic elements are needed to be stated. These are i) the subject of metaphor, ii) the source of metaphor and iii) the features attributed from source of the

metaphor to the subject of the metaphor. In the sentence "Teacher is like a gardener", "teacher" is the subject of the metaphor, "gardener" is the source of the metaphor" and "Teacher need to take students' individual differences into account just like the gardener who treat their plants individually" refers to features attributed from the source of the metaphor to the subject of the metaphor (cited in: Saban, 2004). Yıldırım and Şimşek (2008) argue that each individual may attribute a different meaning to the same metaphor. Therefore, establishing a link between the source and subject of the metaphor and the purpose of the use of metaphor could be obtained by the answer given to the "why" question. For this reason, students were asked to write an explanation in the blank after the expression of "because" in the "Mathematics Lesson Metaphors Questionnaire" to find out why they use the metaphor. The data collection tool also includes a one paragraph of explanation regarding the concept of metaphor. Additionally, an example of one metaphor was presented in regard to the concept of "teacher". Each questionnaire which students write their own metaphors is a "document" and is considered a primary data source of the research.

2.4. Data Analysis

Content analysis method was used to analyze the qualitative data. In content analysis, interviews, branch notes and the content of the documents are analyzed; units of measurement concentrate on how many times a speech pattern or phrase is used (Merriam, 2013). The purpose of content analysis is to conceptualize the data, identify the themes and organize and interpret them in a logical way for the readers (Yıldırım and Şimşek, 2008). The metaphors were analyzed using the five stages suggested by Saban (2009).

2.4.1. Coding and Extracting Stage

At this stage, the metaphors produced by the students in the study group were temporarily listed in an alphabetic order. Then, metaphors were examined to determine whether metaphors were produced in the scope of the study. The questionnaire forms including no metaphor or more than one metaphor or incoherent metaphors were found and omitted. Consequently, a total of 8 forms were omitted from the analysis. The metaphors identified in the omitted forms are: working-teaching, apple, like a nice thing, I love mathematics so much, like a nice lesson, like a very nice lesson, box, and pear.

2.4.2. Sample Metaphor Image Compilation Stage

Following the coding and extracting stage, the remaining metaphors were listed alphabetically once again. Then, metaphors were numbered starting from the number 1 whereby the metaphors were coded. A total of 108 valid metaphors were obtained. During the compilation stage, metaphorical expressions were re-examined. Thus, a sample of list was formed for each metaphor from the participant metaphor images assumed to best represent them. Sample metaphor expressions were directly taken from Mathematics Metaphors Questionnaire. The gender (M for male students and F for female students) of the participant who produces the metaphor, "S" code for the students' statement and the paper number were stated in parentheses after the expression of metaphor.

2.4.3. Category Development Stage

The metaphors produced by the students were examined in terms of the common characteristics they have regarding the concept of "mathematics". The metaphorical perceptions towards mathematics were evaluated in terms of the subject of the metaphor, the source of the metaphor and the relationship between the subject of the metaphor and the source of the metaphor. Each metaphor was categorized with respect to the relationship between the subject of the metaphor and the source of the metaphor. As a result, four different conceptual categories were identified.

2.4.4. Validity and Reliability Stage

Expert opinion was consulted regarding the four conceptual categories identified in the scope of the study whereby it was intended to determine whether these categories were represented by each metaphor under the categories. In qualitative researches, surveying expert opinions is one of the reliability methodologies (Yıldırım and Şimşek, 2008). An alphabetical list of 108 metaphors and a list of the names of four conceptual themes were submitted to a faculty member experienced in qualitative studies and the expert was asked to match these lists with each other. Therefore, both an independent expert and the researcher examined the data whereby the method of diversification of investigators were utilized ensuring reliability (Johnson and

Christensen, 2014). The lists made by the researcher and the expert were comparatively analyzed and the reliability of the results was calculated using Miles and Huberman's (1994) reliability percentage formula [reliability = agreement / (agreement + disagreement) x 100]. As a result of the calculation, the agreement rate (Agreement= 105, Disagreement= 3) was found to be 97.2%. The field expert consulted for the reliability of the given study associated three metaphors (plant, rose, game) with different themes when compared to the researcher.

2.4.5. Quantitative Data Analysis Stage

After the valid metaphors and relevant conceptual categories were determined, the data was computerized. Accordingly, the metaphors in the 108 questionnaires and frequency (f) and percentage (%) values of the participants which represent four conceptual categories were calculated. In addition to that, chi-square test was performed to identify whether the conceptual categories differed according to participants' gender.

3. Findings

This section presents findings on fourth-grade primary students' metaphorical perceptions towards mathematics lessons according to the sub-problems of the research.

3.1. Findings on Fourth-grade Primary Students' Metaphorical Perceptions Towards Mathematics Lesson

Following the coding and extracting processes, the metaphors expressed in the 108 questionnaires were analyzed. Consequently, it is found that the fourth-grade students developed 64 different metaphors about mathematics lesson. The metaphors produced were tabulated in Table 1.

Table 1. Fourth-grade Primary Students' Metaphorical Perceptions towards Mathematics Lesson

Item No	Metaphor	f	%	Item No	Metaphor	f	%
1	Game	14	13,0	**33**	Planet	1	0,9
2	Brain Game	5	4,6	**34**	Sky	1	0,9
3	Book	5	4,6	**35**	Rose	1	0,9
4	The World	5	4,6	**36**	Intro to Life	1	0,9
5	The Sun	5	4,6	**37**	The Friend in Our Life	1	0,9
6	Tree	3	2,8	**38**	The Rope In Our Life	1	0,9
7	Plant	3	2,8	**39**	A Part Of Life	1	0,9
8	Sea	3	2,8	**40**	Light	1	0,9
9	Life	3	2,8	**41**	A Mixed Wool Ball	1	0,9
10	Puzzle	2	1,9	**42**	Amusement Park	1	0,9
11	Monster	2	1,9	**43**	Music Lesson	1	0,9
12	Apple	2	1,9	**44**	Unhappy Face	1	0,9
13	Human	2	1,9	**45**	Breath	1	0,9
14	Music	2	1,9	**46**	Playing with Objects	1	0,9
15	Playing a Game	2	1,9	**47**	Playhouse	1	0,9
16	Number	2	1,9	**48**	Teacher	1	0,9
17	Rubik's Cube	1	0,9	**49**	Pudding	1	0,9
18	Key	1	0,9	**50**	Painting	1	0,9
19	Fire	1	0,9	**51**	Watch	1	0,9
20	Letter B	1	0,9	**52**	Art	1	0,9
21	Baklava	1	0,9	**53**	Computer	1	0,9
22	Our Flag	1	0,9	**54**	Playing with Numbers	1	0,9
23	Someone drowning me in the water	1	0,9	**55**	Black and White Film	1	0,9
24	Little Finger	1	0,9	**56**	Women's Programs	1	0,9
25	Science Book	1	0,9	**57**	An Infinite Straight Angle	1	0,9
26	Riding a Bike	1	0,9	**58**	Theater	1	0,9

Table 1 (contunied) Fourth-grade Primary Students' Metaphorical Perceptions towards Mathematics Lesson

27	Sunflower Seed	1	0,9	**59**	Space	1	0,9
28	Chinese	1	0,9	**60**	Star	1	0,9
29	Multi-Storey House	1	0,9	**61**	Time	1	0,9
30	Nature	1	0,9	**62**	Water	1	0,9
31	Football	1	0,9	**63**	Brain Game	1	0,9
32	Ship	1	0,9	**64**	Cube	1	0,9
Total						**108**	**100,0**

As can be seen from Table 1, the fourth-grade students developed 64 different metaphors about mathematics lesson. Given the analysis of the metaphors, it is seen that the highest frequency is 14, the lowest frequency is 1. "Game" (f=14) metaphor was the most frequently repeated metaphors by students. Below are given examples related to the game metaphor:

"Mathematics lesson is like a game. Because it is more fun and nice." (S80, F),

"Mathematics lesson is like a game. Because it makes us informed." (S81, M),

"Mathematics lesson is like a game. Because playing shapes and numbers in mathematics makes you feel happy." (S73, M).

The "game" metaphor is followed by "brain game", "book", "the world" and "the sun" (f=5). To illustrate, students responded as follows:

"Mathematics lesson is like a brain game. Because it is both easy and difficult and like a brain game." (S5, F),

"Mathematics lesson is like a book. Because it contains a lot of knowledge like a book" (S62, F),

"Mathematics lesson is like the world. Because it is beautiful like the world." (S32, F),

"Mathematics lesson is like the Sun. Because it is so burning and big." (S44, M).

These metaphors were followed by "tree", "plant", "sea", "life" (f=3) in terms of the frequency level. The examples related to these metaphors are given below:

"Mathematics lesson is like a tree. Because each leaf of the tree in mathematics is a knowledge." (S2, F),

"Mathematics lesson is like a plant. Because it grows as you care" (S18, F),

"Mathematics lesson is like a sea. Because it is very beautiful." (S28, M),

"Mathematics lesson is like a life. Because as we grow up, our duties grow as well and we progress as we learn more mathematics" (S48, M).

Despite the low frequency of use, the students also used the following metaphors: "puzzle", "monster", "apple ","human ","music ","playing a game ","number "(f = 2); "Rubik's cube", "key", "fire", "letter b", "baklava", "our flag", "someone drowning me in the water ", "little finger", "science book", "riding a bike", "sunflower seed" , "Chinese", "multi-storey house", "nature", "football", "ship", "planet", "sky", "rose", "intro to life ", "friend in our life", "rope in our life", "A part of life", "light", "a mixed wool ball", "amusement park", "music lesson", "unhappy face", "breath", "play with objects", "playhouse", "teacher", " pudding, "painting", "clock", "art", "computer", "playing with numbers", "black and white film", "women's programs", "an infinite straight angle ", "theater", "space" , "Star", "time", "brain game", "cube"" (f=1).

Following are the examples of the metaphors produced by the students:

"Mathematics lesson is like a puzzle. Because we should think about complexities" (S22, F),

"Mathematics lesson is like a music. Because there are notes in music as well. Notes give different sounds if we forget the formulas like in mathematics, there will be no solution." (S69, M),

"Mathematics lesson is like Chinese. Because it is very complex." (S25, M),

"Mathematics lesson is like playing with numbers. Because we make arithmetic operations in mathematics using numbers such as addition, subtraction, multiplication and division. Such operations are like playing a game and we learn those numbers, operations and mathematical rules" (S99, M),

"Mathematics lesson is like a black and white film. Because it is very boring" (S100, F).

3.2. Findings on Conceptual Categories Classified According to the Common Characteristics of Fourth-grade Primary Students' Metaphorical Perceptions towards Mathematics Lesson

The 64 metaphors produced by students were classified under 13 categories in terms of their common characteristics. These categories were regarded as subcategories. Subsequently, they were associated with mathematics education in terms of their common characteristics and grouped under four main categories. In attempt to identify main categories, the relevant literature on mathematics education was reviewed (Altun, 2016; Baykul, 2016; Kılıç, 2019; Republic of Turkey Ministry of National Education [MoNE], 2018). In light of the findings on conceptual categories according to the common characteristics of fourth-grade primary students' metaphorical perceptions towards mathematics, the main categories, subcategories and metaphors were detailed in tables.

Table 2. The Category of Mathematical Knowledge and Subcategories Consisting of Metaphors

Main Category	Subcategory	Item No	Metaphor	f	%
Mathematical Knowledge	The Content of the Mathematics Lesson	1	Book	3	16,7
		2	Tree	2	11,1
		3	Brain Game	2	11,1
		4	World	2	11,1
		5	Science Book	1	5,6
		6	Apple	1	5,6
		7	Football	1	5,6
		8	Planet	1	5,6
		9	Sky	1	5,6
		10	Music	1	5,6
		11	Art	1	5,6
		12	Computer	1	5,6
		13	Brain Game	1	5,6
	Total			**18**	**100,0**
	The infinity of the Mathematics Lesson	1	Plant	2	28,6
		2	Ship	1	14,3
		3	Life	1	14,3
		4	Music	1	14,3
		5	An Infinitive Straight Angle	1	14,3
		6	Space	1	14,3
	Total			**7**	**100,0**
	The Complexity of the Mathematics Lesson	1	Human	2	25,0
		2	Rubik's Cube	1	12,5
		3	Brain Game	1	12,5
		4	Puzzle	1	12,5
		5	Chinese	1	12,5
		6	A Mixed Wool Ball	1	12,5
		7	Painting	1	12,5
	Total			**8**	**100,0**
	The Instructive Role of Mathematics Lesson	1	The Sun	3	33,3
		2	Book	1	11,1
		3	Light	1	11,1
		4	Game	1	11,1
		5	Teacher	1	11,1
		6	Playing with Numbers	1	11,1
		7	Theater	1	11,1
Total				**9**	**100,0**

As can be seen in Table 2, there are subcategories under the category of mathematical knowledge, namely, the content of mathematics lesson, the infinity of mathematics lesson, the complexity of mathematics lesson and the instructive role of mathematics lesson subcategories and the metaphors produced. The category has 33 different metaphors (f=42). After the analysis of metaphors, it is seen that the most repeated metaphors are book (f=3) and the Sun (f=3). Similarly, since metaphors were collected under conceptual categories according to their common features attributed from the source of the metaphor to the subject of the metaphor, book metaphor is placed under the subcategory of the content of mathematics lesson and the subcategory of the instructive role of mathematics lesson, music metaphor is placed under the subcategory of content of mathematics lesson and the subcategory of the infinity of mathematics. The brain game metaphor is placed under the subcategory of the content of mathematics lesson and the subcategory of the complexity of mathematics lesson. Below are the examples of metaphors classified under the subcategory of the content of mathematics:

"Mathematics lesson is like a football. Because there are many football players in football mathematics also have many numbers. If you ask the number of players, we add numbers." (S38, M),

"Mathematics lesson is like planet. Because it is a lot like the world and planet. Because it includes many operations." (S40, M),

"Mathematics lesson is like a science book. Because it includes lots of things like the science book." (S16, M).

With reference to the metaphors in the subcategory of the infinity of mathematics, the following examples can be given:

"Mathematics lesson is like a ship. Because it sails into infinity." (S39, M).

"Mathematics lesson is like an infinite straight angle. Because it is always necessary for us. It helps us everywhere. There is no end at all." (S102, F).

To illustrate the metaphors related to the subcategory of the complexity of mathematics lesson:

"Mathematics lesson is like a Rubik's cube. Because it's so complicated, I don't understand how to find its direction and that's why I compare it to Rubik's cubes" (S4, F),

"Mathematics lesson is like a mixed wool ball. Because it is so complex like a wool ball." (S58, F).

As for the subcategory of the instructive role of mathematics lesson, the following metaphors were developed:

"Mathematics lesson is like a theatre. Because as you watch, it gives us lessons. We can find the solutions from the lessons given." (S104, F),

"Mathematics lesson is like the Sun. Because when I study mathematics, I'm enlightened." (S46, F),

"Mathematics lesson is like a teacher. Because it teaches and instruct us like a teacher. It knows everything." (S90, K).

Table 3. The Category of Principles of Mathematics Teaching and Subcategories Consisting of Metaphors

Main Category	Subcategory	Item No	Metaphor	f	%
Principles of Mathematics Teaching	Prerequisite Relation	1	Tree	1	50,0
		2	Multi-storey House	1	50,0
	Toplam			**2**	**100,0**
	Representation	1	Apple	1	50,0
		2	Playing with Objects	1	50,0
	Total			**2**	**100,0**

As can be seen from Table 3, the category of principles of mathematics teaching consists of two subcategories which are prerequisite relationship and representation. Under the category, there are a total of 4 different

metaphors (f= 4). The fact that there is a prerequisite relationship among mathematical subjects because of the nature of mathematics and mathematics lesson has a spiral structure were seen in the metaphors produced by students.

"Mathematics lesson is like a multi-storey house. Because we learn a lot more information in each class. When we finish one, we move on to the other and we study mathematics in each class." (S26, F),

"Mathematics lesson is like a tree. Because we climb a tree. As we do, we pass on to other subjects." (S3, F).

When it comes to representation subcategory, students developed metaphors toward benefitting the environment to concretize mathematical concepts.

"Mathematics lesson is like an apple. Because you add, subtract, divide apples and do subtraction." (S36, F),

"Mathematics lesson is like playing with objects. Because it looks like objects used in subtraction and addition. Because they work out about that matter." (S72, F).

Table 4. The Category of Mathematical Skills and Subcategories Consisting of Metaphors

Main Category	Subcategory	Item No	Metaphor	f	%
Mathematical Skills	Reasoning	1	Brain Game	1	12,5
		2	Key	1	12,5
		3	Puzzle	1	12,5
		4	Book	1	12,5
		5	The Rope in Our Life	1	12,5
		6	Game	1	12,5
		7	Watch	1	12,5
		8	Star	1	12,5
	Total			**8**	**100,0**
	Associating with Everyday Life	1	Life	2	20,0
		2	Brain Game	1	10,0
		3	Little Finger	1	10,0
		4	The Sun	1	10,0
		5	Intro to Life	1	10,0
		6	The Friend in Our Life	1	10,0
		7	A Part of Life	1	10,0
		8	Breath	1	10,0
		9	Water	1	10,0
	Total			**10**	**100,0**

The metaphors given in Table 4 fall into the category of mathematical skills. This category includes two subcategories: reasoning and associating with everyday life. The subcategory of reasoning consists of eight metaphors (f=8) and the subcategory of associating with everyday life consists of nine metaphors (f=10). Although these two subcategories do not have any metaphors in common, both of them contains different metaphors related to everyday life. Below are the examples of metaphors produced with respect to the subcategory of reasoning:

"Mathematics lesson is like a puzzle. Because there is always a question in it and you can solve the question with intelligence. It improves brain cells and intelligence." (S21, M),

"Mathematics lesson is like a rope in our life. Because it is like time, numbers and problems. If it doesn't exist, nothing in our brain can improve the intelligence as it does." (S53, F),

"Mathematics lesson is like a chess. Because it works our brains like mathematics." (S94, F).

When it comes to the metaphors collected under the subcategory of associating with everyday life as part of the mathematical skills, following statements were made:

"Mathematics lesson is like a life. Because wherever I look at life, I see mathematics. For example, there is a math lesson in hopscotch. There is a pattern in the carpet. For example, there is a rounding at the grocery and market. That's why mathematics is like a life" (S49, F),

"Mathematics lesson is like the Sun. Because mathematics is used in every area of our lives. There is always the Sun in our life just like mathematics." (S47, M),

"Mathematics lesson is like a little finger. Because it occupies a small place in my life. Mathematics is not everywhere." (S99, M).

Table 5. The Category of Affective Characteristic towards Mathematics and Subcategories Consisting of Metaphors

Main Category	Subcategory	Item No	Metaphor	f	%
Affective Characteristic Towards Mathematics	Love	1	The World	2	11,1
		2	Game	2	11,1
		3	Number	2	11,1
		4	Letter B	1	5,6
		5	Baklava	1	5,6
		6	Our Flag	1	5,6
		7	Riding a Bike	1	5,6
		8	Sunflower Seed	1	5,6
		9	Sea	1	5,6
		10	Nature	1	5,6
		11	Rose	1	5,6
		12	Music Lesson	1	5,6
		13	Playhouse	1	5,6
		14	Pudding	1	5,6
		15	Cube	1	5,6
	Total			**18**	**100,0**
	Fun	1	Game	10	76,9
		2	Playing a Game	2	15,4
		3	Amusement Park	1	7,7
	Total			**13**	**100,0**
	Time passes quickly	1	Time	1	100,0
	Total			**1**	**100,0**
	Dislike-Punishment	1	Monster	2	18,2
		2	Fire	1	9,1
		3	Someone Drowning Me in the Water	1	9,1
		4	Plant	1	9,1
		5	Sea	1	9,1
		6	The World	1	9,1
		7	The Sun	1	9,1
		8	Unhappy Face	1	9,1
		9	Black and White Film	1	9,1
		10	Women's Programs	1	9,1
	Total			**11**	**100,0**
	Motivation	1	Sea	1	**100,0**
	Total			**1**	**100,0**

The category of affective characteristics towards mathematics includes the following subcategories: love, fun, time passes quickly, dislike-punishment and motivation. When it comes to the number of metaphors in each subcategory, it is as follows: fifteen metaphors for love subcategory (f=18), three metaphors for fun subcategory (f=13), ten metaphors for dislike-punishment subcategory (f=11) and one metaphors for motivation subcategory (f=1). As seen in the Table, students generally have positive (love, fun, time passes quickly and motivation) affective characteristics about mathematics. Game metaphor is the most frequently (f=10) used metaphor in the category. Following are the examples of metaphors expressed in the love subcategory;

"Mathematics lesson is like our flag. Because it is full of love like our flag." (S14, F),

"Mathematics lesson is like a game. Because I feel happy as I solve problems. I want to solve more" (S86, M).

Regarding the fun subcategory, following are examples of the metaphors produced by students.

"Mathematics lesson is like an amusement park. Because you begin a journey with those numbers. Like a ferris wheel, numbers rotate around you and it is fun." (S66, F),

"Mathematics lesson is like a playing a game. Because it is always more interesting to teach mathematics with fun." (S89, F).

As to the time passes quickly subcategory, one metaphor was created. It is "Mathematics lesson is like time. Because time passes quickly whilst solving mathematics problem." (S107, F).

To illustrate the metaphors in the dislike-punishment subcategory including negative affective characteristics towards mathematics, the following metaphors can be given:

"Mathematics lesson is like someone drowning me in the water. Because I never like mathematics. Because the teacher teaches mathematics at all free times. For example, when there is no physical education, the teacher always always always teaches mathematics. So I dislike mathematics, I'm bored in mathematics." (S15, M),

"Mathematics lesson is like a monster. Because the teacher instructs to memorize, it makes me bored very much. The teacher gives us homework, my mother tells me to do it." (S23, M).

In the subcategory of motivation, there is one metaphor as follows: "Mathematics lesson is like a sea. It waves my courage." (S27, F)

3.3. Findings on the Whether Main Categories Regarding the Common Characteristics of the Metaphors Differ by Gender

Findings on whether four main categories identified regarding the common characteristics of the metaphors differed by gender were presented in Table 6.

Table 6. Differentiation Status of Main Categories by Gender

Main Category	Female (n= 62)		Male (n=46)		Total (n=108)	
	f	%	f	%	f	%
Mathematical Knowledge	24	(38,7)	18	(39,1)	42	(38,9)
Principles of Mathematics Teaching	4	(6,5)			4	(3,7)
Mathematical Skills	8	(12,9)	10	(21,7)	18	(16,7)
Affective Characteristics Towards Mathematics	26	(41,9)	18	(39,1)	44	(40,7)

$\chi^2(4, N=108) = 3,943$, sd= 3, p=0, 257

As detailed in Table 6, female students produced metaphors more frequently than male students in the categories of mathematical knowledge, principles of mathematic teaching and affective characteristics towards mathematics, while male students produced metaphors more frequently than female students in the category of mathematical skills. On the basis of the general evaluation in Table 6, no statistically significant difference was found among the conceptual categories in terms of the students' gender.

4. Discussion and Conclusion

The present study which sets out to identify fourth-grade students' metaphorical perceptions towards mathematics lesson yielded very striking results. Because identifying and understanding students' metaphors for mathematics will give information about students' views about mathematics (Schink, et al., 2008). Given that frequency values of 64 metaphors developed by fourth-grade primary students, the highest frequency is 14, the lowest frequency is 1. "Game" was the most frequently used metaphor. The result that students associated the mathematics lesson with game might be because students still are going through period of development and for this reason they are interested in playing and they need to play. The game metaphor produced, on the other hand, might be the result of the fact that students find mathematics fun, while they may tacitly deliver a message reporting "It is always more interesting to teach mathematics with fun". Due to their developmental stage, students have a tendency to get bored quickly and they have lots of energy. Considering these factors will make mathematics lesson more effective (Ekiz and Gülay, 2018). Because "the perception that will occur against a lesson affects the success of the lesson significantly" (Şahin, 2013). According to the findings of the study, the students developed 64 metaphors related to mathematics. When we look at the previous metaphorical studies in the literature, Şengül et al. (2014) reported in their study on the secondary school students' metaphorical perceptions of mathematics teachers that students produced 137 metaphors. In a similar vein, 200 pre-service classroom teachers participated in the study of Güveli et al. (2011) and a large number of metaphors were produced related to the concept of mathematics. Similar results were also seen in other metaphorical studies on such concepts as microscope, mathematics, mathematics lesson and mathematics teacher and the amount of metaphor generated was high. (Ekici, 2016; Özdemir et al., 2019; Şahin, 2013; Şahinkaya et al., 2016; Tarım et al., 2017). Consequently, the findings of the study were consistent with the results of the above mentioned studies. Considering metaphor as the way the individual perceive a concept or phenomenon, it is acceptable that a large number of metaphors were produced with respect to the mathematics lesson. Each student has a different perception about mathematics lesson as well as having different experiences, prior knowledge and observations about the lesson. It is also worth mentioning that some findings of the study contradict other studies in the literature. According to the study of Güler et al. (2012), 140 secondary pre-service mathematics teacher developed 28 metaphors about the concept of mathematics. Here the contradiction can be related to the age and education difference of the study group. Because fourth-grade primary students' perceptions of mathematics are different from the pre-service teachers' perceptions of mathematics. Mathematics conceptually has a broad, complex and abstract structure and this is the one reason underlying different perceptions (Güveli et al., 2011).

The 64 metaphors obtained in the study were gathered under 13 subcategories according to their common features. Considering the mathematics literature, those subcategories were classified according to their common characteristics (Altun, 2016; Baykul, 2016; Kılıç, 2019; MoNE, 2018). Consequently, four main category were obtained. The content of mathematics lesson, the infinity of mathematics lesson, the complexity of mathematics lesson and the instructive role of mathematics subcategories were associated with the structure of mathematics lesson and subsequently they were classified under the main category of "Mathematical Knowledge". In the study carried out by Özdemir and Sezginsoy Şeker (2019), the scope of mathematics and part-whole relationship subcategories were placed in the category of mathematical knowledge. It can be argued that the finding of these two studies are similar to each other. In another study examining pre-service classroom teachers' metaphorical perceptions of science and math, a great majority of pre-service teachers used following metaphors to describe mathematics: complex, tough, confusing, skill, achieve (Cassel and Vincent, 2011). This result is parallel to subcategories and metaphors that fell into under the category of mathematical knowledge. In this study, while 4 main categories and 13 subcategories were reached, Latterell and Wilson (2016) reached twelve categories as a result of the research in which the pre-service elementary teachers examined the metaphor perceptions of mathematics. The high number of categories and subcategories may depend on the students' views about the nature of mathematics because of the interpretations of the mathematics in their own lives, both within and outside the school (Cameron, 2003).

The prerequisite relationship and representation subcategories which were created from metaphors fell into the "The Principles of Mathematics Teaching" main category. The subcategories show similarity with the effective mathematics teaching principles suggested by Altun (2016). Therefore, the subcategories developed

in regard to the characteristics of metaphors are supported by the literature. However, it is important to note that these two subcategories that demonstrate similarities with the principles are not adequate. Since mathematics involves abstract concepts because of its nature, it may result in negative results that lead students to anxiety (Ersoy and Aydın, 2017). Students' attitude and anxiety cause to withdrawal from mathematics and prevent the development of mathematical skills (Kutluca, Alpay and Kutluca, 2015). Improving mathematical skills depends on an effective mathematics teaching that is to say, paying attention to principles. (Altun, 2016). For this reason, the two categories are not deemed adequate. According to Erdoğan, Yazlık and Erdik' study (2014), mathematics teacher candidates perceived mathematics as "Cumulative" and "Interconnected". Similarly, Schinck et al. (2008) expressed that students described mathematics as "an Interconnected Structure". The finding of prerequisite relationship obtained in the study is consistent with the finding of these two studies. This also highlights that individuals who are connected to mathematics have a knowledge of mathematical structure.

"Mathematical Skill" category consists of two subcategories, namely, reasoning and associating with everyday life. Ersoy and Aydın (2017) studied 22 fourth-grade primary students and concluded that students categorized the most 'life itself category'. Similarly, Güler et al. (2012), Güner (2013) along with Tarım et al. (2017) found similar findings indicating the relationship between mathematics and life. Associating mathematics with everyday life can be supported by the fact that students feel they need mathematics in real life as well as the fact that mathematics is based on conceptual understanding. In addition to that, Yenilmez and Uysal's study (2017) confirm the present study which fourth-grade students associated mathematics with real life. According to Yenilmez and Uysal (2017), fourth-grade students demonstrated higher success than fifth and sixth grade students in terms of associating mathematical expression and symbols with daily life. This might be a sign of concretization of mathematics subjects and expressions or a result of the cognitive developmental characteristics of fourth-grade students.

While 10 out of 30 total metaphors in the main category of affective characteristics towards mathematics are in the subcategory of dislike-punishment, of 20 are in the subcategory emphasizing positive affective characteristics. It is of vital importance that students have positive affective characteristics towards mathematics lesson. Mathematics depends not only on cognitive abilities but also on emotional factors and attitudes (Thomas and Dowker, 2000). Affective dimension is a core part of cognitive structure. Therefore, learning is positively affected by positive affective situations, whereas it is adversely affected by negative affective situations (Ekici, 2016). The most important fact that prevent the abilities of successful students in mathematics, is negative attitudes of students towards mathematics (Hembree, 1990). Further, the fact that students developed affective metaphors toward mathematics, it can be implied that metaphors have both cognitive and affective aspects (Eren and Tekinarslan, 2013). The mathematics curriculum also underlines the importance of encouraging positive affective attitudes and conducting assessment and evaluation studies not only for cognitive skills but also for affective and psychomotor skills (MoNE, 2018). It is thus evident that the metaphors produced by students are considered in learning-teaching processes of the curriculum development. The result that the most repeated metaphors are related to positive affirmative characteristics are consistent with the study of Özdemir and Sezginsoy Şeker (2019) showing that students produced mostly the metaphor for subtheme of developing positive attitude related to mathematics. Similarly, in the study of Ummanel (2017), the metaphors of preschool, primary and secondary school students towards mathematics were examined, it was concluded that students in general have a positive attitude about mathematics. The development of metaphors with positive affective characteristics as to mathematics lesson indicates that mathematics holds an important place among students.

As a result of the analysis conducted to determine whether the four main categories consisting of metaphors differed according to students' gender, no statistically significant difference was found regarding the categories of metaphors produced by female and male students. Likewise, Şengül et al. (2014) reported that the concepts produced related to the concept of 'mathematics teacher' did not differ by gender.

Metaphors are one of the most important perception tools and are important in revealing the causes of educational beliefs (Ben-Peretz, Mendelson and Kron, 2003). As a matter of fact, given the metaphors produced in the scope of the study, two different perceptions emerged as follows: "Wherever I look in my life, I see mathematics. For example, there is a mathematics lesson in hopscotch. There is a pattern in the carpet. For example, there is a rounding at the grocery and market. That's why mathematics is like a life"

and "It hold a small place in my life. Mathematics is not at everywhere." It is noticed that mathematics was correlated with everyday life in the first statement, whereas the principle of association was neglected in the second statement. This attitude is also observed in the students' answers in regard to their perception of mathematics. In the similar vein, two examples of metaphors generated by students "Mathematics is like a music. Because there are notes in music. Notes gives different sounds. If we forget the formulas like in mathematics, there will be no solution" and "The teacher instructs to memorize, it makes me bored very much. The teacher gives us homework; my mother tells me to do it." proves that the emphasis is given to procedural knowledge rather than conceptual knowledge in mathematics lessons. The idea that mathematics is based on a memorization with full of formulas rather than learning with understanding lead students to adopt negative affective features towards mathematics. Likewise, the expression "I never like mathematics. Because the teacher teaches mathematics at all free times. For example, when there is no physical education, the teacher always always always teaches mathematics. So I dislike mathematics, I'm bored in mathematics" reminds the importance of integrity in terms of child development stages. When teachers lecture mathematics longer than the time allocated in the weekly schedule, students see mathematics as a punishment tool, thereby exhibiting negative affective attitudes towards mathematics. This is also confirmed by the study of Başar et al. (2002). In their study, they observed that that the importance of art, music and physical education lessons which are expression and skill lessons are underestimated and are not regarded as lessons, whereas mathematics is misleadingly seen as an important lesson and particularly male students reacted to instruction of expression and skills lessons instead of mathematics. It can thus be argued that teachers have a vital place in determining students' affective features.

5. Suggestions

Conducting metaphorical studies on primary school students after each subject they learn in mathematics classes, it is suggested to gain insight into primary school students' perceptions of mathematics subjects as well as their affective characteristics, thereby designing learning-teaching process properly.

Further metaphorical studies on mathematics lesson can dwell on students' academic achievement in mathematics and the relationship between student achievement and metaphors can be investigated.

The results of the study denoted that "game" is the most frequently used metaphor by students. In this respect, primary school mathematic lessons can be taught by playing games and make learning fun.

Given the metaphors produced by students, there are some vague expressions. For example, given the statement "It is always more interesting to teach mathematics with fun", it is hard to infer whether students mean the mathematics lesson they perceive through real-life experiences or mean their dream mathematics lesson. For this reason, further metaphorical studies can be performed comparing students' perceptions of mathematics classes in real life with their dream mathematics.

References

Akdemir, Ö. (2006). *Elementary students' attitudes towards mathematics lesson and achievement motivation* (Unpublished master's thesis). Dokuz Eylül University, İzmir.

Altun, M. (2016). *Teaching mathematics for education faculties and classroom teachers* (20th ed.). Bursa: Aktüel Alfa Academy.

Arnett, R.C. (1999). Metaphorical guidance: administration as building and renovation. *Journal of Educational Admin-istration, 37*(1), 80-89.

Arslan, M. M., & Bayrakçı, M. (2006). An examination of metaphorical thinking and learning from educational view. *Milli Eğitim, 171,* 100-108.

Aydın, İ. S., & Pehlivan, A. (2010). The metaphors that Turkish teacher candidates use concerning "teacher" and "student" concepts. *Turkish Studies International Periodical for the Languages, Literature and History of Turk-ish or Turkic, 5*(3), 818-842. doi: http://dx.doi.org/10.7827/TurkishStudies.1465

Başar, M., Ünal, M., & Yalçın, M. (2002). Causes of math fear starting with primary school. *5th National Congress of Science and Mathematics Eduation,* (212-216 ss.).

Baykul, Y. (2016). *Mathematics teaching in primary education* (13th ed.). Ankara: Pegem Academy.

Ben Peretz, M., Mendelson, N., & Kron, F. W. (2003). How teachers in different educational context view their roles. *Teaching and Teacher Education, 19*, 277-290.

Cameron, L. (2003). Metaphor in educational discourse. London: Continuum.

Cassel, D., & Vincent, D. (2011). Metaphors reveal preservice elementary teachers‟ views of Mathematics and Science teaching, *School Science and Mathematics, 111*(7), 319-324.

Cerit, Y. (2006). Students, teachers and administrators' views on metaphors with respect to the concept of principal. *Educational Sciences: Theory & Practice*, 6(3), 669-699.

Cerit, Y. (2008). Students, teachers and administrators' viewson metaphors with respect to the concept of teacher. *The Journal of Turkish Educational Sciences, 6*(4), 693-712.

Doğan, Z., & Sönmez, D. (2019). Investigating metaphorical perceptions of 4th grade students in primary school towards mathematics course through the visuals they created. *Turkish Studies, 14*(1), 245-262.

Dowker, A. (2005). Individual differences in arithmetic: Implications for psychology, neuroscience and education. Psychology Press.

Ekici, G. (2016). Determination of the Preservice Biology Teachers' Perceptions of Microscope: Example for Metaphor Analysis. *Journal of Kırşehir Education Faculty (KEFAD), 17*(1), 615-636.

Ekiz, D., & Gülay, A. (2018). Exploring the metaphors of the primary school pupils about "ideal classroom environment". *Kastamonu Education Journal, 26*(4), 1121-1134. http://dx.doi.org/10.24106/kefdergi.434147

Erdoğan, A., Yazlık, D. Ö., & Erdik, C. (2014). Mathematics teacher candidates' metaphors about the concept of "mathematics". *International Journal of Education in Mathematics, Science and Technology, 2*(4), 289-299.

Eren, A., & Tekinarslan, E. (2013). Metaphors regarding teacher, teaching, learning, instructional material and evaluation: A structural analysis. *Gaziantep University Journal of Social Sciences, 12*(3), 443-467.

Ersoy, E., & Aydın, E. (2017). Metaphorical Perceptions of Primary School Students on Mathematics in Relation to Daily Life. *Sakarya University Journal of Education Faculty, (33),* 1-17.

Ertürk, R. (2017). Metaphorical perceptions of primary school students about "teacher" concept. *e-International Journal of Educational Research, 8*(3), 1-15. http://dx.doi.org/10.19160/ijer.285232

Güler, G., Akgün, L., Öçal M. F., & Doruk, M. (2012). Pre-service mathematics teachers' metaphors about mathematics concept. *Journal of Research in Education and Teaching, 1*(2), 25-29.

Güner, N. (2013). Pre-service teachers' metaphors about mathematics. *E-Journal of New World Sciences Academy (NWSA), 8*(4), 428-440. Retrieved from: https://dergipark.org.tr/tr/pub/nwsaedu/issue/19810/211892

Gür, H., Hangül, T., & Kara, A. (2014). Comparing metaphors that middle school and high school students' possess about the concept of 'mathematics'. *The Journal of Academic Social Science Studies, 25*(I), 427-444.

Güven, B., & Güven, S. (2009). Quantitative analysis relating to forming of metaphor which was made in social studies lesson by primary school students. *Kastamonu Education Journal, 17*(2), 503-512.

Güveli, E., İpek, A. S., Atasoy, E., & Güveli, H. (2011). Prospective primary teachers' metaphorical perceptions towards mathematics. *Turkish Journal of Computer and Mathematics Education, 2*(2), 140-159.

Hannula, M. (2005). "Affect in mathematical thinking and learning. The future of Mathematics education and Mathematics learning". BIFEB Strobl.Austria, August.

Harari, R. R., Vukovic, R. K., & Bailey, S. P. (2013). Mathematics anxiety in young children: an exploratory study. *The Journal of Experimental Education, 81*(4), 538-555.

Hasırcı, S. (2017). An analysis of preservice Turkish teachers' perceptions related to children's literature by means of metaphors. *Journal of International Social Research, 10*(51), 717-728.

Hembree, R. (1990). The nature, effects, and relief of Mathematics anxiety. *Journal of Research in Mathematics Education, 21*(1): 33–46

Johnson, B., & Christensen, L. (2014). *Educational research: quantitative, qualitive, and mixed approaches* (5th edition). Amreica: SAGE Publications.

Kelly, L., & Oldham, E. (1992, August). Images of Mathematics among teachers: Perceptions, beliefs and attitudes of primary teachers and student teachers in the Republic of Ireland. Paper presented at the 7th International Congress on Mathematical Education (ICME-7), Working Group 21: Public Images of mathematics, Quebec, Canada. https://www.researchgate.net/publication/319205762_Images_of_mathematics_among_teachers_Perceptions_beliefs_and_attitudes_of_primary_teachers_and_student-teachers_in_the_Republic_of_Ireland

Kemp, E. (1999). Metaphor as a tool for evaluation. *Assessment & Evaluation in Higher Education, 24*(1). 81- 89.

Kılıç, Ç. (2019). Skills in mathematics education. A. Kaçar (Eds.), In *Teaching Mathematics in primary school* (1st ed.) (pp. 65-92). Ankara: Pegem Academy.

Kutluca, T., Alpay, F. N., & Kutluca, S. (2015). An investigation of factors affecting 8th grade Math students' anxiety levels. *Dicle University Journal of Ziya Gökalp Faculty of Education, 25,* 202-214.

Lakoff, G. (2009). *The political mind: A cognitive scientist's guide to your brain and its politics.* New York, NY: Penguin Books.

Lakoff, G., & Johnson, M. (2005). *Metaforlar: hayat, anlam ve dil* (G. Y. Demir, Çev.). İstanbul: Paradigma. (Orjinal yayın tarihi, 1980).

Latterell C. and Wilson J. (2016). Math is Like a lion hunting a sleeping gazelle: Preservice elementary teachers' metaphors of Mathematics. *European Journal of Science and Mathematics Education, 4*(3), 283-292.

Ma, X., & Xu, J. (2004). The causal ordering of Mathematics anxiety and Mathematics achievement: a longitudinal panel analysis. *Journal of Adolescence, 27*(2), 165-179.

McColm, G. (2007). A metaphor for Mathematics education. Notices of the AMS, 54(4), 499–502.

Merriam, S. B. (2013). Q*ualitative research: A guide to design and implementation* (S. Turan, Trans.). Ankara: Nobel.

Miles, M.B., & Huberman, A.M. (1994). *Qualitative data analysis.* Thousand Oaks, CA: Sage.

Mınıstry of National Education (2018). *Mathematics curriculum (Primary and Secondary School 1,2, 3, 4, 5, 6, 7 and 8th Classes).* Ankara: MEB.

Modell, A. H. (2009). Metaphor the bridge between feelings and knowledge. *Psychoanalytic Inquiry, 29*(1), 6-11. http://dx.doi.org/10.1080/07351690802246890

Mutlu, Y., Söylemez, İ. & Yasul, A. F. (2017). Examining of the relationship between Math anxiety and Math achievement of elementary school students. *Journal of Human Sciences, 14*(4), 4425-4434. http://dx.doi.org/10.14687/jhs.v14i4.5019

Newstead, K. (1998). Aspects of children's Mathematics anxiety. *Educational Studies in Mathematics, 36*, 53-71.

Noyes, A. (2006). Using metaphor in Mathematics teacher preparation. *Teaching and Teacher Education,* 22, 898-909.

Ocak, G., & Gündüz, M. (2006). The comparison of pre-service teachers' metaphors about the teacher-profession before and after the 'introduction to teacher-profession' course. *Afyon Kocatepe University Journal of Social Science, 8*(2), 293- 310.

Özdemir, E., & Sezginsoy Şeker, B. (2019). Investigation of Mathematical anxiety of primary school students and comparison of metaphorical perceptions with classroom teachers. *Journal of Uludag University Faculty of Education, 32*(1), 167-191. http://dx.doi.org/10.19171/uefad.533226

Parzysz, B., Pesci, A., & Bergsten, C. (2005). The role of metaphors and images in the learning and understanding of Mathematics. Fourth Congress of the European Society of Research in Mathematics Education (pp. 67–70). https://www.mathematik.uni-dortmund.de/~erme/CERME4/CERME4_WG1.pdf

Saban, A. (2004). Entry level prospective classroom teachers' metaphors about the concept of "teacher". *The Journal of Turkish Educational Sciences, 2*(2), 131-155.

Saban, A. (2008a). Primary school teachers' and their students' mental images about the concept of knowledge. *Elementary Education Online, 7*(2), 421–455.

Saban, A. (2008b). Metaphors about school. *Educational Administration: Theory and Practice,* 55, 459-496.

Saban, A. (2009). Prospective teachers' mental images about the concept of student. *Journal of Turkish Educational Sciences, 7*(2), 281-326.

Schinck, A. G., Neale, H. W., Pugalee, D.K., & Cifarelli, V.V. (2008). Structures, journeys, and tools: Using metaphors to unpack student beliefs about Mathematics. *School Science and Mathematics,* 594-599.

Sidekli, S., & Ünlü, C. (2019, October). *Methophorical perceptions of primary school students towards Turkish course.* 2nd International Primary Education Congress, Full Text Book (pp. 374 – 385). Muğla. http://utek2019.com/utek2019-tam-metin-bildiriler.pdf

Solomon, C., & Grimley, M. (2011). Metaphors used by year 5 and 6 children to depict their beliefs about Maths. Paper presented at the Mathematics: Traditions and [new] Practices. Alice Springs, Australia: AAMT–MERGA conference 2011, 3-7 July 2011.

Strenski, E. (1989). Disciplines and communities, armies and aonasteries and the teaching of composition. *Rhetoric Review, 8*(1), 137-146.

Şahin, B. (2013). The metaphoric perceptions of prospective teachers towards the concepts of "Mathematics teacher", "Mathematics" and "Mathematics lesson". *Mersin University Journal of the Faculty of Education, 9*(1), 313-321.

Şahinkaya, N., & Yıldırım M. (2016). Pre-service teachers' metaphoric perceptions of concepts related with Mathematics. *Turkish Studies -International Periodical for the Languages, Literature and History of Turkish or Turkic, 11*(3), http://dx.doi.org/10.7827/TurkishStudies.9474

Şengül,S. and Katrancı Y. (2012) Metaphors that prospective primary school teachers posses on the concept of Mathematics. *Procedia - Social and Behavioral Sciences 46*, 1470 – 1475.

Şengül, S., Katrancı, Y., & Gerez Cantimer, G. (2014). Metaphor perceptions of secondary school students about "Mathematics teacher". *The Journal of Academic Social Science Studies, 25,* 89-111.

Tang, M., Bobis, J., Way, J., & Andersen, J. (2015). Using metaphors to assess student motivation and engagement in Mathematics. In Beswick, K., Muir, T., & Wells, J. (Eds.). Proceedings of 39th Psychology of Mathematics Education Conference, (pp. 233-240). Hobart, Australia: PME.

Tarım, K., Bulut Özsezer, M., S., & Canbazoğlu, H., B. (2017). Pre-Service classroom teachers; perceptions of related with Mathematics and teaching Mathematics. *Journal Of Kırşehir Education Faculty (KEFAD), 18*(3), 1032-1052.

Thomas, G., & Dowker, A. (2000). Mathematics anxiety and related factors in young children. In British Psychological Society Developmental Section Conference.

Ummanel, A. (2017). Metaphorical perceptions of preschool, elementary and secondary school children about Science and Mathematics. *Eurasia Journal of Mathematics, Science and Technology Education, 13*(8), 4651-4668.

Witt, M. (2012). The impact of Mathematics anxiety on primary school children's working memory. *Europe's Journal of Psychology, 8*(2), 263.

Yenilmez, K., & Özbey, N. (2006). A research on Mathematics anxiety levels of the students of private school and the other schools. *Journal of Uludag University Faculty of Education, 19*(2), 431- 448.

Yenilmez, K., & Uysal, E. (2017). The primary school students' level of the ability of establishing relation the Mathematical expression and symbols with daily life. *Ondokuz Mayis University Journal of Education Facult, 24.* 89-98.

Yıldırım, A., & Şimşek, H. (2008). *Qualitative research methods in the social sciences.* Ankara: Seçkin Publishing.