

*Full Length Research Paper*

# Metaphor perceptions of pre-service teachers towards mathematics and mathematics education in preschool education

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The aim of this study was to identify the thoughts of pre-service teachers, who play an important role in the early preschool experience of children in mathematics, towards the concepts of mathematics and education of mathematics with the help of metaphors. The study group of the research consists of a total of 227 pre-service teachers at the Department of Preschool Education, Faculty of Education, Cukurova University in the 2013–2014 academic years. The data of the study were collected by asking preservice teachers to complete some sentences like “do you think, education of math is like .... in the preschool education; because Math is like ...; because....”. The responses obtained from pre-service teachers were categorized by content analysis. As a result of the study, seven categories created by preservice teachers towards the concepts of mathematics and education of mathematics are as follows: the source of life-itself, mathematics using skills of mental processes, math facilitating the fun learning, cumulative math facilitates life, complicated math difficult to learn and boring math. There are 223 metaphors in 112 types in this category. Considering the categories created, there are five positive and two negative categories. The rates of positive categories were calculated as 88.8%, while the rates of negative categories were 11.2%,. This shows that pre-service teachers produce mostly positive metaphors about mathematics and education of math and they have positive beliefs. As a result of the research, the categories like the source of life-itself, mathematics using skills of mental processes and math facilitating the fun learning come to the forefront.

**Key words:** Preschool, metaphor, mathematics, mathematics education.

## INTRODUCTION

The knowledge, belief and attitudes with respect to mathematics, science, music and many other fields are been developed in the preschool period. Math is closely related to concrete experiences of children towards their concept development. Since mathematics is an important part of early childhood, knowledge and concepts of

mathematics gained in the preschool period will allow children to integrate into society as individuals who can use mathematics in the future (Akman, 2002).

The preschool is important since it is the first step for children to interact with the outside world after their families (Aslan, 2013). Since the first identification model

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is preschool teachers after mother and father, they are important in shaping the character of the children (Aslan et al., 2015). Therefore, preschool teachers are critical in child development (Yavuzer, 2007). Children attending preschools are influenced by opinions, attitudes and behaviors of their teachers either consciously or unconsciously (Aslan et al., 2013). Thus, perceptions, attitudes and behaviors of teachers in preschool, which is the first step of education life and formation and shaping period of perceptions of children towards mathematics, have critical importance for children attending preschools (Aslan, 2013).

Metaphors are powerful tools used to present perspectives of pre-service teachers regarding mathematics and reflect their past experiences, present and prospective thoughts (Güveli et al., 2011). The concept of metaphor is defined in different ways by researchers. The word metaphor is generated from “Metapherein” in Greek. Considering the structures forming this word, “Meta” means changing and “pherein” means coding (Levine, 2005). According to the definition of Lakoff and Johnson (2005), metaphor is not only an idea material, a form of human understanding and figure of word, but also a figure of thinking. Metaphors are one of the most powerful mental tools structuring, navigating and controlling our thoughts about formation and process of events such as analogies, metaphors, figures and figures of speech (Yalçınkaya, 2013). Although, metaphors are managing our daily thoughts and actions in a conscious or unconscious way, they are used to show how realities and life are interpreted (Kılıç and Arkan, 2010). Metaphors are often used in educational research to determine the concept traces in the minds of people by other words not related to these concepts. Metaphors can be used to identify different dimensions of a concept in different ways (Saban, 2009). In recent years, another reason why metaphorical method is increasingly used in the studies is that understanding physical and social reality is already metaphorical (Özdemir, 2012).

Metaphors are considered to be a method providing rich data in terms of allowing individuals to establish strong links with other existing schemes in their minds to understand their world better. However, no study has been conducted yet to investigate thoughts of prospective preschool teachers regarding mathematics and education of mathematics by using metaphors in the literature. In this context, this study aimed to determine how prospective preschool teachers perceive mathematics and education of mathematics through metaphors.

## Objective

The purpose of this research was to determine thoughts

of pre-service teachers towards the concepts of mathematics and education of mathematics with the help of metaphors. In this regard, the following questions were tried to answer:

1. What are the metaphors of prospective preschool teachers regarding the concepts of mathematics and education of mathematics?
2. Under what categories can these metaphors be grouped in terms of common characteristics?

## METHODOLOGY

In this study, one of the qualitative research methods, phenomenology design was used. In this approach, cases that the authors are aware of but do not have detail understanding on are investigated. The aim of the phenomenology approach is to present and interpret individual perceptions about a case in general (Yıldırım and Şimşek, 2008). Individuals with the data obtained in studies using phenomenology approach experience, reflect or externalize these events. In this context, perceptions of pre-service teachers regarding mathematics and education of mathematics were discovered and reviewed.

### Participants

Participants consist of 227 pre-service teachers including 46 freshmen, 44 sophomore, 65 junior and 72 senior students at the Çukurova University, Department of Preschool Education in the academic years of 2013–2014.

### Data collection

In this study, preservice teachers were asked to fill out the questionnaire to collect the data. A number is given to each pre-service teacher's form. The numbers represent those pre-service teachers (e.g. PT-1, Pre-service teacher 1). Preservice teachers were asked to complete some sentences like “Do you think, education of math is like .... in the preschool education; because Math is like ...; because....” and their responses were grouped under specific thematic titles. In this context, they were asked to produce a single metaphor for each concept and explain why they used this metaphor.

### Data analysis

The data collected in this study were analyzed using content analysis, which is one of the qualitative data analyses. The blank answers or answers with no metaphors were excluded. After this step, metaphors were analyzed and grouped by their subject, attributed thought and source and then these metaphors developed by preservice teachers were presented in tables with the number of preservice teachers (f) representing the metaphor and percentage (%) values. In the last step, metaphors with common characteristics identified by the researchers were presented as categories that can meet these common characteristics. In the categorization process, the reliability formula proposed by Miles and Huberman (1994) was used for reliability calculation of the research. Accordingly, (Reliability = consensus / consensus + disagreements) was used. As a result, the reliability of the research was found to be 93%.

**Table 1.** The metaphors produced about the category of “mathematics is the source of life”.

Categories	Metaphors related to math	Metaphors produced related to the education of math	The number of metaphor types	The number of metaphors produced	Ratio by the number of metaphors
Math is the source of life	Life (5), tree (4), brain (3), logic (2), the essential part of life (2), engine of a car, air, God, life itself, life, source of life, breath	Base (12), water (6), tree (3), life (3), building (2), mother, breastfeeding, sleep, bread, olive pits	22	55	24.7

**Table 2.** The metaphors produced about the category of “mathematics using skills of mental processes”.

Categories	Metaphors related to math	Metaphors produced related to the education of math	The number of metaphor types	The number of metaphors produced	Ratio by the number of metaphors
Mathematics using the skills of mental processes	Puzzle (24), riddle (2), the path going to the same destination (2), cooking, photograph, Sudoku, reasoning with numbers, brain exercise, cycling of the brain, driving, science brain exercise, machine, chess	Crossword (6), puzzle (3), mental sports (2), chamomile fortunes (2), peas, chess, going to the market, race.	25	56	25.1

## RESULTS

In light of the findings of the research, seven categories were created from metaphors generated by preservice teachers with regard to mathematics and education of mathematics. There are 223 metaphors in 112 types in this category. These categories are the source of life-itself, mathematics using skills of mental processes, math facilitating the fun learning, cumulative math facilitates the life, complicated math difficult to learn and boring math. Considering the categories created, there are five positive and two negative categories. The rate of positive categories was calculated as 88.8%, while the rate of negative categories was 11.2%, respectively. The metaphors produced about the category of “Mathematics is the Source of Life” are given in Table 1. Considering the data given in Table 1, there are a total of 55 metaphors produced in 22 different from each other by prospective preschool teachers about the category of “Mathematics is the Source of Life”. In this category, the most-produced metaphors about mathematics were “life, tree and brain”. On the other hand, the most-produced metaphors about education of mathematics were “base, water, tree and life”. The metaphors developed by preservice teachers within this category are as follows:

For breath metaphor; “If we cannot imagine a life without breathing, then we cannot imagine a life without mathematics” (PT-25). For tree metaphor; “When you add water to a young tree, you can see how it grows.

Mathematics is like this and it is the base in the preschool period. This tree will grow with additions in the following years” (PT-43). The metaphors produced by prospective preschool teachers about the category of “Mathematics Using Skills of Mental Processes” are presented in Table 2.

There are a total of 82 metaphors produced in 26 different from each other by prospective preschool teachers about the category of “Mathematics Using Skills of Mental Processes”. In this category, the most-produced metaphors about mathematics were “puzzle, riddle and the path going to the same destination”. On the other hand, the most-produced metaphors about education of mathematics were “games, crossword and puzzle.” The metaphors developed by preservice teachers within this are as follows:

For Sudoku metaphor; “when you get the logic of the game, and understand the operations, you solve the puzzle” (PT-53). For the game metaphor; “You are replacing numbers with each other, it is like a game” (PT-25). The metaphors produced by prospective preschool teachers about the category of “Mathematics Facilitating the Fun Learning” are presented in Table 3.

Considering the data given in Table 3, there are a total of 28 metaphors produced in 14 different from each other by prospective preschool teachers about the category of “Mathematics Facilitating the Fun Learning”. In this category, the most-produced metaphors about mathematics were “games, happiness and love”. On the

**Table 3.** The metaphors produced about the category of “mathematics facilitating the fun learning”.

Categories	Metaphors related to math	Metaphors produced related to the education of math	The number of metaphor types	The number of metaphors produced	Ratio by the number of metaphors
Mathematics Facilitating the Fun Learning	Games (14), happiness (2), love (2), songs, fun visits, delight, drum, chocolate, shopping, music	Game (26), story reading, music, appetizers	15	54	24.2

**Table 4.** The metaphors produced about the category of “cumulative mathematics”.

Categories	Metaphors related to math	Metaphors produced related to the education of math	The number of metaphor types	The number of metaphors produced	Ratio by the number of metaphors
Cumulative Math	Constant dropping, chains, ladder, web, pulley, rapid succession	Ladder (3), organism, star, growing plants, chains	11	13	5.8

**Table 5.** The metaphors produced about the category of “mathematics facilitating the life”.

Categories	Metaphors related to math	Metaphors produced related to the education of math	The number of metaphor types	The number of metaphors produced	Ratio by the number of metaphors
Mathematics facilitating the life	Brother, friend, a new language, movie, elevator, trust, money, sports shoes, whole wheat bread, cake mold, investing in future	Drugs (3), problem solving (2), flotation ring, invention, trailer, pencil	17	20	9

other hand, the most-produced metaphors about education of mathematics were “reading stories, music and appetizers”. The metaphors developed by preservice teachers within this category are as follows:

For the game metaphor: “Children have fun when they are learning and participate in the active learning process, they interact with numbers and concepts in math as they interact with their friends in games” (PT-72). For the appetizers metaphor, “It is both fun and useful” (PT-15). The metaphors produced by prospective preschool teachers about the category of “Cumulative Mathematics” are presented in Table 4.

There are a total of 13 metaphors produced in 11 different from each other by prospective preschool teachers about the category of “Cumulative Mathematics”. In this category, the participants produced 6 metaphors about mathematics. On the other hand, the most-produced metaphor about education of mathematics was “ladder”. The metaphors developed by preservice teachers within this category are as follows:

For the sudden succession metaphor, “When you learn important points, formulas and methods, it comes

easily and quickly” (PT-127). For ladder metaphor, “children receive education in phases, they need more knowledge as they get higher on the ladder” (PT-145). The metaphors produced by prospective preschool teachers about the category of “Mathematics Facilitating the Life” are presented in Table 5.

Considering the data given in Table 5, there are a total of 20 metaphors produced in 17 different from each other by prospective preschool teachers about the category of “Mathematics Facilitating the Life”. In this category, the participants produced 11 metaphors about mathematics. On the other hand, the most-produced metaphors about education of mathematics were “drugs and problem solving”. The metaphors developed by preservice teachers within this are as follows:

For elevator, “It facilitates life. You can take the stairs, but it consumes your time and wastes your energy” (PT-205). For pencil; “It can be needed anywhere anytime” (PT-221). For the metaphor of movie, “The movie starts after trailer as math education starts with small pieces and emerges slowly” (PT-198). The metaphors produced by prospective preschool teachers about the category of

**Table 6.** The metaphors produced about the category of “complicated math difficult to learn”.

Categories	Metaphors related to math	Metaphors produced related to the education of math	The number of metaphor types	The number of metaphors produced	Ratio by the number of metaphors
Complicated math difficult to learn	Ocean, dreams, unpredictable cliffs	Space, infinite, schema, secret	6	6	2.7

**Table 7.** The metaphors produced about the category of “boring math”.

Categories	Metaphors related to math	Metaphors produced related to the education of math	The number of metaphor types	The number of metaphors produced	Ratio by the number of metaphors
Boring math	Torture (4), ascending stairs by five steps, labor, tunnels, different fruits, unimportant work consuming effort at the beginning, watching a bad movie, sometimes sunshine and sometimes thunder, boring life, my grandfather, drum	Fishbone, chameleon, first step, mixer, my environment.	16	19	8.5

“complicated math difficult to learn” are presented in Table 6.

There are a total of 6 metaphors produced in 6 different from each other by prospective preschool teachers about the category of “complicated math difficult to learn”. In this category, the participants produced three metaphors about mathematics. On the other hand, the participants produced three metaphors about education of mathematics. The metaphors developed by preservice teachers within this are as follows:

For ocean metaphor, “It continues without stopping and it has a knowledge like oceans that needs to be investigated continuously” (PT-102). For space metaphor; “It includes information on logical abstract concepts for children” (PT-101). The metaphors produced by prospective preschool teachers about the category of “Boring Math” are presented in Table 7.

Considering the data given in Table 7, there are a total of 19 metaphors produced in 16 types different from each other by prospective preschool teachers about the category of “Boring Math”. In this category, the most-produced metaphor about mathematics was “torture”. On the other hand, the participants produced five metaphors about education of mathematics. The metaphors developed by preservice teachers within this are as follows:

For tunnel; “if you lose your trail, the answer will be wrong all the time” (PT-109). For fishbone metaphor; “Since it has a very thin skeleton, it does not replace each other and it hurts” (PT-137).

## DISCUSSION

As a result of the study, seven categories were created by preservice teachers towards the concepts of mathematics and education of mathematics. There are 223 metaphors in 112 types in this category. Considering the categories created, there are five positive and two negative categories. The rate of positive categories was calculated as 88.8%, while the rate of negative categories was 11.2%, respectively. This shows that pre-service teachers produce mostly positive metaphors about mathematics and education of math and they have positive beliefs. Considering the relevant studies in the literature, Güveli et al. (2011) have conducted a similar study on perceptions of classroom teachers about the concept of mathematics and they have found six categories including five positive and one negative category. Furthermore, their categories seem to be similar to those that are found in this study.

Reeder et al. (2009) investigated the beliefs of preservice classroom teachers with regards to mathematics and teaching/education of math through metaphors and they obtained results in parallel with results of this study. As a result of the study, they identified some positive perceptions such as “usefulness”, “life” and “consisting of many subjects”, whereas there were also negative perceptions of preservice teachers such as “challenge”. Another study supporting the results of this study is the one conducted by Gürsel et al. (2012). They aimed to investigate the

perceptions of preservice math teachers with regard to mathematics. They concluded that the vast majority of preservice math teachers consider mathematics as an essential part of life, necessity, infinity and guidance.

Schinck et al. (2008) aimed to determine perceptions of secondary education and undergraduate students about mathematics and concluded that they consider mathematics as "difficult", "requiring work", "useful", "systematic", "hierarchical", "as an uncertain journey", "an entertaining voyage of discovery", "a vehicle" and a structure allowing students for active participation. In another study conducted by Özgün (2010), similar to the present results, they concluded that "consisting of many subjects", "challenge", "requiring hard work" and "usefulness for life" perceptions are important to mathematics as a type of food.

As a result, the findings of this research are in line with earlier studies. Prospective preschool teachers exhibit positive attitudes towards mathematics and mathematics education in general. These positive attitudes exhibited by preservice teachers will allow children to exhibit positive attitudes towards mathematics.

### Conflict of Interests

The author has not declared any conflicts of interest.

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