

Using Metaphors to Investigate Pre-service Secondary Mathematics Teachers' Perceptions of Mathematics and Mathematics Teacher Concepts

Zehra Taspinar Sener¹, Hasan Unal and Hasan Aydin

School of Education, Yildiz Technical University, Istanbul, Turkey

KEYWORDS Conception of Mathematics. Pedagogical Training. Qualitative Research

ABSTRACT The aim of this study is to examine the metaphorical images of pre-service mathematics teacher attending the 'pedagogical formation certificate program' concerning mathematics and its nature, and also the concept of mathematics teacher. Metaphors generated by these trainees with regard to mathematics and the mathematics teacher and to analyze whether there is a clear pattern or structure that underpins these metaphors. 280 mathematics trainee teachers took part in this study that was carried out at four different state universities. The data for the study were collected by asking a series of open-ended questions and analyzed using an internal analysis method. After completion of the analysis stage, it is concluded that, participants produced more negative metaphors towards both mathematics and mathematics teacher concepts than similar studies towards teacher trainee. The teacher trainees attending this program may be investigated why they attended this program and why they want to become a mathematics teacher by employing smaller sample groups and various qualitative methods.

INTRODUCTION

In every society, the issue of whether the individual (citizen) can perform and carry out mathematics has been incorporated into the principle goals of educational programs. In particular, due to the way in which technology is changing and developing so quickly, the need for individuals who possess mathematical thinking, creative and problem-solving skills is increasing day by day. In today's world that is undergoing such change, those who can understand and do mathematics will be more successful in shaping the future. For this reason, mathematics education provides the individual with knowledge and equips him or her with the skills that help them to understand the physical world around them and to realize social interaction more easily (Turkish Ministry of Education 2013). The fact that the teacher is an important factor in the process of delivering an effective mathematics education is an indisputable reality (Van De Walle et al. 2013; Sun and van Es 2015; Tang Wong and Cheng 2015). As regards the creation of a classroom environment in which students can truly approach mathematics in a constructive fashion, the individual ideas of teachers with regard to the topic of mathematics and how they see mathematics assume extreme importance (Van de Walle Karp and Williams 2013). Baydar and Bulut (2002)

in the example presented below, as well as demonstrating ideas that teachers hold with regard to how a subject should be taught, also emphasizes how important the beliefs are that they hold towards that topic (Toraman et al. 2015; Kaya 2015).

Some mathematics teachers regard mathematics as a well organized set of information/ knowledge, while some believe it is necessary to think of it as a way or tool to help explain the world. Another group of mathematics teachers, for their part, may favour evaluating mathematics as a branch of the arts, such as poetry or music. These differences between Mathematics teachers influence not only decisions regarding what needs to be taught but also concerning the issue of how it should be taught (Baydar and Bulut 2002).

Teachers, from the context of their beliefs regarding mathematics and its teaching, will deliver lessons in this way; as a result, students will be taught in the direction of these beliefs. In this regard, it is essential to determine how mathematics teachers perceive mathematics and its teaching. The best method to enter the world of how they make sense of mathematics both as an academic discipline and in terms of the teaching of that discipline is undisputably through the use and analysis of metaphors.

With their definition of a metaphor as a powerful cognitive tool that aids comprehension of an abstract, complex or conceptual concept (Hall and Quinn 2014; Saban et al. 2006) have attract-

¹Correspondent author:
E-mail: zehrataspinar@gmail.com

ed the keen interest of contemporary educators. The word 'metaphor' when employed in Turkish using the term 'mecaz' (which is also sometimes translated as figurative meaning) involves the comparison of complex/complicated cognitive phenomenon or issue with a concrete or tangible example or fact that allows us to make a connection or relationship; comprehension of this difficult-to-conceptualize abstract phenomenon or issue is rendered possible through exploration and analysis of this relationship. Lakoff and Johnson's *Cognitive Theory of Metaphor* (1980) that defined metaphors as "the cognitive constructs that shape human thought concerning the world and its reality" has been at the forefront of research conducted in this field. According to this theory, metaphors, are widespread, not merely in our language, but also in events and thoughts within our daily lives and, for this reason, they represent the fundamental constructs of understanding the thoughts and events that we experience (Lakoff and Johnson 1980) Therefore the metaphor serves as an additional tool that helps us to us to evaluate and comprehend the things that we have experienced and learnt but have not completely understood at first encounter (Lakoff and Johnson 1980). However, it helps us merely to reveal our own (deper) thoughts, as, in simple terms, a person cannot form or create a metaphor that exists outside him or herself.

The Metaphor in Educational Research

With the emergence of metaphor analysis in education, the reasons for and the advantages of the use of metaphors is still being discussed/debated in many research studies (Carter and Pitcher 2010). Research indicates that education does not merely require definitions or explications, rather frequently requires the conveyance of complicated ideas and meanings and for this reason it is necessary to often resort to metaphors within the language of learning and teaching. At the same time, researchers have begun to employ the metaphor on a frequent basis as a method so as to reveal the ways of thinking of individuals. Knowles (1993) has defined the metaphor as a way of revealing the belief systems derived from the experiences of childhood and study years of teachers newly embarking on the profession. According to Gultekin (2010), the metaphor assumes an important part of the pro-

cess of revealing/bringing out the affective/emotional characteristics of trainee teachers. In this regard, a number of studies have been conducted with view to determining the metaphorical perceptions of trainee teachers and students with regard to a number of key concepts. For instance, on account of the fact that educators find themselves in an increasingly technological world, a number of metaphor studies have been carried out regarding technological concepts. Sahin et al. (2010), in their study that tried to employ metaphors so as to elicit the experiences of class teacher trainees with regard to the use of search engines, revealed that trainee teachers have problems in their information-access skills. There are also a number of studies that resemble the one above, employing the metaphor as a way of gauging the perceptions of sample groups towards the internet (Ak and Yenice 2009; Saban 2010; Sahin and Baturay 2012). In these studies, the metaphor(s) created from recipients with regard to the internet emphasized that it was a powerful tool and the results that emerged correlated highly with their backgrounds and previous experiences.

A number of studies may also be encountered that emanate from a positivist understanding of education in the light of the principle of constructivism that has reshaped modern education (Martinez et al. 2001; Saban et al. 2014; Dolphin and Tillotson 2015). These studies attempt to define perceptions in this context towards learning and teaching concepts. Martinez et al. (2001) have compared metaphors created by trainee teachers and experienced teachers with regard to the concept of learning and teaching. The results demonstrated that while teacher trainees employed more constructivist metaphors, the experienced teachers described learning and teaching through the use of more behaviorist metaphors. In the study conducted by Saban et al. (2014) that attempted to establish the metaphors that trainee class teachers held with regard to the "learning they had experienced" and the "learning in keeping with their ideals/idealized learning". The trainee class teachers questioned was found to associate more negative metaphors with the learning they themselves had experienced while they connected more positive metaphors with the learning in keeping with ideals of learning.

Furthermore, a number of metaphorical studies have been conducted with regard to concepts that form fundamental elements of the educa-

tional and teaching environment such as “the teacher”, “the student”, “the school” and “the educational program” (Aydin and Pehlivan 2010; Gültekin 2013; Hamilton 2016; Ozdemir and Akkaya 2013; Saban et al. 2006; Saban 2008, 2011). In Hamilton (2016) study revealed that more than half of the metaphorical images and responses teacher concept were as a means of guides and guiding. For instance, in his study “light” metaphor were generated for teacher by preservice mathematics teachers. In Saban’s study conducted to determine the metaphors held by students and trainee teachers with regard to the concept of school, a total of 74 valid metaphors were created and collected under 10 different conceptual categories. In Saban’s study, it was discovered that the metaphors generated by teachers and teacher trainees encompassed more behaviorist approaches to education than constructivist ones.

The Metaphor and Mathematics Education

Mathematics, on account of the fact that it is perceived as a ‘difficult lesson’ employs a wide range of different methods and techniques. So as to render a topic easier to understand, the mathematics teacher often employs the method of “connecting one thing to another” (Boero et al. 2001; Carreira 2001; Font et al. 2010; Guhe et al. 2009; Lai 2013). For this reason, the importance of using metaphors from the aspect of the effective teaching of mathematics lessons is emphasized and for that reason one regularly encounters studies on the topic (Boero et al. 2001; Guhe et al. 2009; Yee Lai 2013; Font et al. 2010; Carreira, 2001; Sahin and White 2015). For example, Font et al. (2010) in their study that aimed to identify the metaphors used by mathematics teachers in class, attempted to answer the questions of what types of metaphors were used and what were the differences in metaphors employed by high school teachers in the teaching of the graphical demonstration of functions. It was discovered that teachers were not aware that they employed “guiding metaphors” (such as the x-axis/co-ordinate is flat) and “speculative or fictional expressions (such as the graph of a function could be thought of a way or road that passed above a certain point on a graph. Carreira (2001), in his study that discussed the similarities between mathematical modelling and metaphorical thinking concluded that metaphorical thinking

developed reasoning skills. As has been highlighted in these studies, a lot of research studies have been conducted in which the metaphor has been used as a data collection tool to determine the perceptions of students, teachers and adults regarding the concepts of mathematics and teaching. In Fleener, Puordavood and Pamela’s study, that identified the metaphors generated by 65 mathematics teachers with regard to the role of the teacher, the most frequently created metaphors were: ‘a study guide’, ‘a leader’, ‘a manager’ ‘a mentor’ and ‘a mother’ Noyes (2006) in his study of the metaphors generated by mathematics teacher trainees concerning the learning and teaching of mathematics, cited the most frequently used metaphors as: ‘a language’, ‘a tool kit’, ‘a journey’ and a hierarchical structure’.

Furthermore, Atasoy and Guveli (2011) in their study set out the metaphorical perceptions of class teacher trainees towards mathematics and attempted to draw on their viewpoints on the topic of mathematics and past experiences; the trainees all felt mathematics was a powerful tool in the reflection of their thoughts. Three conceptual themes were then created from the metaphors submitted by the recipients: ‘mathematics as an exciting lesson’, ‘mathematics as a boring and difficult lesson’ and ‘mathematics as a lesson that consists of a many topics. In his study in which teacher trainees for maths, the humanities and class teacher trainees took part, collected their opinions and thoughts about mathematics through use of a metaphor analysis method. The humanities trainees were found to hold more negative thoughts regarding mathematics when compared to their peers. Guler et al. (2012) carried out a similar study with mathematics teacher trainees at secondary school level. In Güner’s study, the answers submitted by mathematics teacher trainees were all of a similar nature. In both studies, it was concluded that the majority of the mathematics teacher trainees defined mathematics as ‘life (in) itself’, namely as the most vital element of life.

In Turkey, as a result of various education policies enacted so as to address the demand for teachers, graduates of certain faculties outside education faculties are given the opportunity to receive teacher training. Teacher training, is defined as the acquisition of the competences necessary to deliver teaching and education (Yapici and Yapici 2013) This training which is necessary to become a teacher, is provided to those

who have not graduated from faculties of Education named 'pedagogical Formation Sertificate Program' delivered over a specified period. For example, in the 2013-2014 academic years the training course that had lasted for 14 weeks (1 term) was extended in the 2014-2015 academic year to cover two terms. At the same time, teacher training at faculties of Education were extended to a four-year study period. For this reason, two very distinct teacher profiles are emerging in Turkey. If we take into consideration that one of the most important criteria to ensure teacher proficiency is interest in the profession (Temizkan 2008 cited by Eraslan and Cakici 2011), many (of the newer) teacher trainees have been prepared for a different group of professions throughout their undergraduate studies with interest in other fields. This has created a need to establish the thoughts of this new group with regard to the profession of teaching. Furthermore, the interest of a teacher trainee in his field of study, his love for the profession, his dedication to that career, and his wish to demonstrate development in this profession all contribute to his success to a great degree (Ozkan 2012). By bringing to light the thoughts of students undergoing teacher training who have not made a direct preference for the profession of teacher, we may gain an indication of the teacher profile of this group. There exist a very small number of studies yet conducted that compare those students who have received teacher training as an extension to their original undergraduate degree and those teacher trainees who have studied at faculties of Education. However, with a particular increase over the past two years, the number of teacher trainees who have received teacher training after completing initial undergraduate studies in another faculty had over the previous two years reached a figure of hundreds of thousands. Over this short period of time, there has been an attempt to equip candidates who are in demand and equip them in terms of subject, professional and general knowledge for the requirements of the teaching profession. Simultaneously, there has emerged an urgent need to determine perceptions regarding the fields of study emanating from this group of trainees and their perceptions regarding the teaching profession.

On conducting a scan of existing academic literature, there exist studies, although small in number, on the subject of the development of assessment criteria for the levels of service provision of teacher training and teacher training education (Eraslan and Cakici 2011; Toraman et

al. 2015) and determination of the attitudes of teacher trainees regarding the teaching profession. As discussed above in detail, one study was conducted concerning the identification of the metaphorical perceptions of teacher training students with regard to their teacher training was conducted using the metaphor as a powerful tool to reveal the understanding of the inner thinking of students (Dundar and Karaca 2013; Yurtseven and Altun 2015). However, researchers have not come across any study any study that has attempted to establish both the perceptions of trainee teachers regarding the academic field/subject of study in which they will work as teachers and towards the teaching profession in general.

Objectives of the Study

We may consider as the principle characteristics that a teacher needs to possess as his having a knowledge and education of his academic field. Therefore, the determination of perceptions with regard to these moderating factors assumes importance. In this regard, in this study, there is an attempt to determine the metaphorical perceptions with regard to the terms 'mathematics' and 'mathematics teacher' employed by the teacher trainees enrolled on teacher training programs. In this regard, within the context of this study, there was an attempt to find answers to the questions below:

- ♦ If there is any structure among the metaphors that students have produced about mathematics?
- ♦ If there is any structure among the metaphors that students have produced about mathematics?

METHODOLOGY

In this study, the responses of 280 mathematics teacher trainees studying on teacher training courses at 4 different universities to two open-ended questions were separated into conceptual categories employing a qualitative method.

Participants

The study group of the research study consisted of 280 teacher trainees who had studied on teacher training courses at 4 different state universities during the 2014-2015 spring term, who had completed the training course successfully and were planning to embark on careers as mathematics teachers. The teacher trainees who

participated in the study were selected by way of a random sampling method and consisted of a total of 280 people, 37 of whom were male and 207 female. 111 of these students underwent their teacher training course at Yildiz Technical University, 53 at Gazi University and 21 and 88, at Gazi and Mimar Sinan Universities respectively. Random samples, provide higher degrees of reliability as one progresses from small to larger sample population sizes (Patton 2002).

Data Collection

The data for the research study was collected in the spring term of 2014-2015 by use of a questionnaire. The questionnaire for the study was created by the first researcher and then a final version was created by taking the views into account of both the other researchers and an expert in the field not involved in the study. The research questionnaire consisted of two parts. In the first part of the questionnaire, with the aim of establishing demographic data/information concerning the teacher trainees participating in the study, the gender of the participant and the university at which he or she attended the teacher training course was asked. In the second part, two open-ended questions were directed to the participants so as to establish their beliefs with regard to the profession they were planning to exercise in future. The open-ended questions were phrased in the following way: "mathematics is like.....because....." and "the mathematics teacher is....because..." with blank spaces that were to be completed by the participants.

The data were completed during lessons at the universities where they received teacher training. After the concept of metaphor was explained and certain examples were provided, information was then given concerning the questionnaire and the questions were answered by the students voluntarily. The students were provided with an environment that allowed them to answer the questions on an individual basis.

Data Analysis

The metaphors generated by the participants were then analyzed using an internal analysis method. For this purpose, data obtained and metaphors obtained were listed in an Excel file together with the numbers allocated to the participants. The metaphors that were then codified with their reasons, explanations and justifications.

In cases where there were discrepancies between the metaphors and accompanying reasons or justifications, or where metaphors were submitted without reasons or justifications, then the metaphors concerned were ignored.

Although the words used in the metaphor may be the same, in cases where there were differences in the reasons or justifications provided were encountered, these differences in reasons were taken into account and categories were created for the metaphors. For example while the word 'technology' was used by one teacher trainee to describe a situation in which the characteristic of constant change was implied, another trainee used it with the reasoning that technology was something that simplified life. To provide another example, while two participants defined mathematics as 'water' on account of the fact that water could flow endlessly, another participant qualifies it as something without which life would be impossible.

When creating conceptual categories for the purpose of this research, the conceptual categories used in other studies were taken into consideration. All metaphors obtained from the study were then evaluated according to their reasons and justifications, and were divided/separated into groups according to their common characteristics. Groups that encompassed similar characteristics were then brought together and categories were recreated. For instance, when creating the category of 'the constructivist mathematics teacher', it was decided to collect/group the group of metaphors designating the characteristics of the constructive teacher, namely: "one who shows the way", "one who develops himself/herself" and "one who develops others". The groups contained within the category were then presented to the reader as sub-categories.

The conceptual categories were then created with the agreement of three researchers; and consensus was reached after each researcher evaluated each metaphor on an individual basis.

RESULTS

Analysis of the Metaphors Used by Trainee Teachers Studying on Training Programs When Describing Mathematics

On analysis of the answers submitted to the open-ended question "mathematics is like....because....", it was established that a total of 273 participants had generated meaningful met-

aphors. These metaphors were then separated according to categories taking into account the reasons/justifications for their use and with particular focus on responses to the parts in the open-ended question following the word “because....” The metaphors were separated into categories as follows:

According to Table 1, the metaphors used by the group of teacher trainees were separated into five categories. Every main category was then separated into five sub-categories (within it). According to this classification, the metaphors that were entered under the main category of “not everyone is capable of doing mathematic” were the category of ‘understanding/comprehension’ that indicated that everyone could not understand mathematics, ‘study/work’ that suggested that mathematic could only be done by those who studied or worked hard, and the categories of ‘uncertain’ or ‘unclear’ in which it was indicated that everyone could not succeed at mathematics but did not provide any condition to support this assertion.

The metaphors that were included as sub-categories under the principal category of ‘Mathematics with a particular form/structure’ were those of ‘infinite’ that described mathematics as not having limits, ‘open to development’ in which mathematics was designated as developing constantly from the past until the present and into the future, ‘comprehensiveness’ that stressed the encompassing nature of mathematics, and ‘interconnected’ which stated that mathematics possessed a sequential structure in which elements were interlinked. The metaphors suggesting that mathematics was complicated and difficult were included within the category of ‘mathematics is a subject that is complicated and difficult. Those sub-categories of metaphors that were incorporated under the main category of ‘a positive attitude’ were that of ‘love and passion’ that expressed the feeling that implied that success in mathematics was connected to the passion the students had for the subject, and ‘entertainment’ that put forward the view that mathematics was fun and enjoyable. Finally, those metaphors that suggested that mathematics was essential for our lives were grouped under the ‘necessary’ main category; these included, ‘without it, there is nothing’ in which mathematics is necessary to allow us to live and the sub-category ‘beneficial’ in which mathematics is presented as something useful that makes our lives easier. By

providing specific examples for each category, the categories were rendered easier to understand. Moreover, as can be seen in Table 1, the same metaphors may have been entered under different categories. For instance, the word ‘puzzle’, when expressed with ‘fun’ or ‘entertaining’ in mind, was included within the ‘entertainment’ sub-category; however, when it was employed in connection with the thought that it was beneficial or useful, then it was entered under the ‘beneficial’ sub-category.

Analysis of the Metaphors Used by Mathematics Teacher Trainees When Describing the Mathematics Teacher

A total of 241 meaningful metaphors were produced for (the key word of) the Mathematics teacher.

When we examine Table 2, the metaphors generated by teacher trainees were separated into five main categories. The first of these were that of the ‘constructivist teacher’ and consisted of metaphors that symbolized the role of the teacher in classes organized/arranged according to the constructivist approach. Three sub-categories were included within the main category of the constructivist teacher: firstly, the ‘one who shows the way’ that is the teacher who does not merely impart knowledge from inside, but who guides the students to obtain knowledge, the ‘one who develops himself’ namely the teacher who develops himself within the learning process and the ‘one who develops’ or teacher who provides opportunities to students to develop themselves.

In other words, it emerged that the participants had perceptions regarding the qualities of the constructivist teacher that encompassed these three characteristics.

‘In the category of the ‘self-sacrificing or dedicated teacher’ (n = 17) were grouped metaphors that suggested that the teacher was like a family member in being patient, self-sacrificing and affectionate.

Metaphors related to students who developed negative perspectives towards mathematics teacher concepts grouped under two categories; Teacher burnout and Block to students. 17 percent of total participants were produced this type of metaphors. These prospective teachers, seen the mathematics teacher as slave or block to students engaging learning activities.

Table 1: The distribution of metaphors employed by teacher trainees studying on training courses for (the key word) 'mathematics' according to main and sub-themes

<i>Mathematics</i>	<i>F</i>	<i>%</i>	<i>Examples</i>
Not everyone is capable of doing mathematics			
Understanding	10	3.6	Mathematics is special. Everybody can't understand it, everybody can't do it, but if you understand it, it's the most enjoyable lesson. Mathematics is like art.
Study/Work	9	3.2	Mathematics is like life; it is lively, meaningful and shouldn't be neglected.
Ambiguous/uncertain	7	2.5	Mathematics is like penicillin, it may make a body/structure not ready for it ill.
Others	3	1.1	Mathematics is like magic, if you are a good mathematician, you can lend your name to wonderful discoveries/inventions It is like a building, the most important thing is the robustness of its foundations.
Sub total	29	10.3	
Mathematics within a certain form/framework/structure			
Infinite/Endless	39	14.3	Mathematics is like the ocean, it becomes deeper the more one delves into it...Mathematics is like the sea, it is an endless source of information/knowledge It is like space, its ends and depth is not certain.
Extensive/comprehensive	25	9.1	It is like a rainbow, it encompasses every color. It is like the world it absorbs everything It is like a pomegranate, when you open it up, we encounter a whole new world
Connected/Interconnected	15	5.5	It is like a brain, it is necessary to form connections between different points. It is like linguistics; there are systematic and specific rules It is like dance, when begins to learn, the body follows melodies.
Open to development	15	5.5	It is like technology, it develops constantly. It is like a brain, the more it works, the more it develops
Sub total	94	34.4	
Mathematics is a subject that is complex and difficult to understand			
Complicated	32	11.7	It is like a woman, it is difficult to predict what she is going to do. It is like a tree, it grows branches and branches out, and you can not escape from inside It is like a knotted ball of wool; to untangle it requires patience and effort
A positive attitude towards mathematics.			
Love, passion	20	7.3	It is love; once you establish a relationship, you can't leave it. It is love; the more you get to know it, the more you are committed to it. It is like a lover, the more you love it, the more love is generated.
Entertainment	12	4.4	It is like a puzzle, the more you solve it, the more taste/enjoyment you get. It is like a game, if you know how to play, it's great fun
Others	3	1.1	It is like a color, it gives meaning It is like life itself; God has decorated nature with mathematics.
Sub total	35	12.8	
The necessity of mathematics			
Without it, there is nothing.	64	23.4	It is like water, you can't live without it. It's like air, without it, you can't live. It's like oxygen, people use it in their everyday lives whether they want to or not.
Useful	20	7.3	It is like Sudoku, it works the mind. It is like a puzzle, it develops the mind. It's like a staircase; it takes you easily to your destination.
Sub total	84	30.7	
Overall	274		

Table 2: The distribution of metaphors employed by teacher trainees studying on teacher training courses according to main and sub-categories

<i>The mathematics teacher</i>	<i>f</i>	<i>%</i>	<i>Examples</i>
The constructive teacher	28	11.6	Like a mind; (he) shows the wayLike a study guide; he shows the way to students lost inside questions and who are trying to find their wayHe is like a life coach; he shows how we may find solutions to problems.
One who shows the way			
One who develops	9	3.7	He is like tree; he comes to life the more he shares his knowledgeHe is like a driver; the more he drives along the road, he more he becomes an expert. He is like a student; his learning process never comes to an end.
One who helps others to develop	31	12.7	He is like a torch; he opens/extends the horizons of students He is like water; he is an essential factor in transforming a seed into a shoot.
Sub- total	68	28.2	
The self-dedicated mathematics teacher	17	7.0	He is like an elder brother or sister; he should teach with patience, sincerity and affection.
The mathematics teacher with negative characteristics			
Teacher Burnout	14	5.8	He is like a jet plane; he must always teach every subject to a high level.He is like a stress ball; it is a coercive profession for himHe is like a madman; it is as if there is no more troublesome profession
Block to students	27	11.2	It is like a form of revenge because he is the least-loved and most-feared teacher. He is like a maze, it is difficult to understand himHe is like a military commander; he gets students to memorize formulae in a strict way; he shouts anf explains; forcibly pushing his students.
Sub total	41	17.0	
The mathematics teacher with super powers.			
The teacher with superior qualities.	46	19.1	He is like a creature, a creature that never makes mistakes ; he has enhanced powers, he holds a magic wand in his hands.He is like a work of science fiction; he possesses superior qualities and an endless imagination.He is like an arrow; audaciousHe is like a Ferrari; charismatic.
Someone who we need	19	7.9	He is like water; nothing can exist without him.He is like a tree trunk;a tree cannot exist without a trunk.
Sub-total	65	27	
Behaviorist teacher			
Mouldingformative	13	5.4	He is like fire; he has both the power to burn and to form.He is like a calligrapher; every line he draws has a different meaning and exerts a different effort.He is like a gardener; he gives shape to our knowledge and makes sure than we grow and mature in an upright fashion.
A provider of knowledge	9	3.73	He is like a pocket calculator; he teaches every process..He is like the solution to a puzzle; he gives results to problems that we have been unable to find.He is like a translation; for many people mathematics is incomprehensible as a foreign language, and need an interpreter to explain it.
Sub-total	22	9.1	
Others			
The teacher who changes according to chance	21	8.7	He is like chance, if someone comes who teaches well you love mathematics, if someone who teaches badly comes you hate it.He is like a doctor, he can either darken/blacken life in school or turn it into heaven He is like a symbol; he can be the reason for us liking or not liking mathematics.
Sugar-sweet	5	2.1	He is like a strawberry, my favourite fruit.He is like sugar, he teachers the sweetest thing(s)
-	2	0.8	He is like a lightning rod; every student comes and finds him.He is like bitter chocolate, not everybody likes it, but those who do, can't live without it.
Sub- total	28	11.6	
Overall total	241		

Metaphors regarding another conceptual category, “a teacher with super powers” were separated into two categories. In the category, “a teacher with superior powers” focused on thoughts that symbolized that mathematics teachers possessed different and higher characteristics that differentiated him from other people, while the category “one who we need” contained metaphors submitted by participants that the mathematics teacher was important to such an extent that without him, life would not exist as we know it.

‘The Main Category of ‘Behaviorist Teacher’ (n=22) consisted of answers submitted by participants who, considered the role of the teacher in classrooms arranged/organized in accordance with the behaviorist approach with particular regard to the mathematics teacher. ‘Under the category of ‘a person who moulds’, ‘someone who shapes’ were included metaphors generated by the participants that envisaged the student as a resource that was to be shaped by the teacher so as to transform him into a similar ‘product’. In addition, the sub- category of the ‘provider of knowledge’ that perceives the teacher as a person who conveys knowledge to the student was included in the category of ‘behaviorist teacher’. Here we find metaphors that indicate that the teacher is the source or transmitter of knowledge, while the student is perceived as a passive recipient.

Finally, in addition to the above categories, were a number of other metaphors that could not be grouped under any heading or for which there were insufficient numbers of metaphors to create a new category. These metaphors that did not fit were collected under a heading entitled ‘other’ (n=21). Here under the heading of ‘chance’, were collected metaphors in which it was seen that perceptions of a good or bad teacher (with special regard to mathematics) did not conjure up a particular type of character, changed from person to person, and were merely connected to a matter of luck on the part of the student. It was seen as more appropriate to analyze these metaphors in a separate category, in the sense that they did not reveal the clear thoughts of the participants, Furthermore, five teachers employed ‘sugar-sweet’ metaphors implying that they really liked their mathematics teachers. Two metaphors were not included into any of these categories.

DISCUSSION

This study aimed to examine the perceptions of mathematics trainee teachers studying on teacher training courses with regard to the most essential constituent parts of their professional life: ‘the mathematics’ and ‘the mathematics teacher’ by employing metaphorical method .

According to the results of the study the metaphors created by teacher trainees on the topic of ‘mathematics’ that are thought to be most necessary in the creation of individuals who are able to become successful maths teachers are ‘not everyone is capable of doing mathematics’ (10.3%) and ‘mathematics is a subject that is complicated and difficult’ (11.7%). ‘The sub-category of ‘work/effort’ that was included within the category of ‘everyone is not able to do mathematics’ in its emphasis that one must constantly study and apply oneself to become successful at mathematics also emerged in Guner’s study of high school students (2013). Guner stated that as a reflection of the Turkish educational system that values adherence to rules and the teaching of solutions to routine problems, there is still a thought that pervades that the more problems that a student solves, the more successful he will become, and this particularly affects students’ perceptions with regard to mathematics. Furthermore, the thoughts that everybody is not able to do mathematics and that the subject is complicated and difficult, suggests individuals who will later become teachers who will be likely to convey this message to teachers and will be incapable of presenting an effective teacher profile to students. When we take into consideration that one of the goals of mathematics lessons is the development of a positive attitude towards the subject, the large number of teacher trainees who produced negative metaphors is disappointing. The fact that the participants who submitted metaphors indicating that mathematics ‘was complicated and difficult’ with respect to the department they had graduated from may be an indication of the fact they were not content with the department (and the way that mathematics was taught there).

The metaphors that were generated by the majority of participants were included under the category “mathematics that assumes a particular form”. The great majority of the participants perceived mathematics as possessing specific properties or characteristic (it was a branch of knowledge that was infinite, comprehensive and in a

constant state of development). The interconnected and comprehensive nature of mathematics, corresponds with the study carried out by Noyes (2006) involving mathematics teachers. Furthermore, the categories revealed similar results to those studies carried out with the participation of teacher trainees (Guler et al. 2012) and mathematics teachers (Guner 2013).

'When one examines the metaphors generated with regard to 'the mathematics teacher', the metaphors most widely employed were grouped under the category of 'the constructivist teacher' (28.2%). It was nice to see that this category included more metaphors than that of the behaviorist teacher (9.1%). When one looks at the studies carried out in this regard, it can be seen that the metaphors that teachers used with regard to learning concepts were in keeping with the principles of constructivism (Fleener et al. 1995; Hamilton 2016; Martinez et al. 2001). In the contemporary age, it is thought that more metaphors need to be collected under these categories. The responsibility that has fallen on teachers is to discover students' skills and areas at which they succeed present them with new opportunities and offer them encouragement (Dunkake and Schuchart 2015; Page 2015). Clements and Battista (1990) stressed that there was no such thing as good teaching mathematics well; rather the effective mathematics teacher was one who encouraged students to learn mathematics. However, it has been argued that one of the reasons for the lack of success of curricula that have been prepared in accordance with the constructivist approach, is that teachers do not know how students learn mathematics. For this reason, the changing of teachers' perceptions with regards to the (role and position of the) mathematics teacher so as to bring them more into line with scientific constructivism, will lead the way to more effective teaching.

It is thought that students' creative and critical thinking skills may be developed with ease within the setting of the mathematics lesson. A great responsibility therefore falls on the shoulders of the mathematics teacher with regard to developing the individual student in a variety of ways (Dietiker 2015). As stated above, studies carried out on the topic have revealed that the belief systems of the mathematics teachers is one of the most important factors influencing the teaching process (Paolucci 2015; Toluk et al. 2010). For that reason, if the perceptions of ev-

ery one of the teacher trainees who participated in the study were separated and evaluated under the six sub categories found under the heading of constructivist teacher, then it could be said that the perception(s) of the ideal mathematic teacher(s) had been found/created.

The sub-category of the mathematics teacher that 'shapes' or 'moulds' was included under the category of the 'behaviorist teacher'. In many studies "shaping of students" was characteristics of behaviorist teacher (Dunkake Schuchart 2015; Paolucci 2015). The essence of this approach is that the teacher forms the student according to his/her own wishes and aims and places him into a mould to be shaped in accordance with the teaching program in his hands.

A seventeen (17%) percent of total metaphors were seen to be negative towards mathematics teacher concepts. Prospective teachers that created these metaphors unfortunately, seen the mathematics teacher as slave or block to students engaging learning activities. This situation, may be an indication of participants' past experiences and forces us to think about the profile of the mathematics teacher. 'The inclusion of the category of the 'mathematics teacher who displays negative attitudes and behaviors' under the 'behaviorist teacher category' reminds us of the fact that one in four of the participants employed negative metaphors.

CONCLUSION

In this study, when one examines the metaphors used for both mathematics and for the mathematics teacher in general, it is concluded that more negative metaphors are encountered. The negative metaphors used by the participants indicate that they have not been able to escape from the effect of past experiences, and that the profession that they are embarking on does not represent one in keeping with the nature of their characters/personalities. Although it is concluded that, teacher trainees' metaphorical perceptions about 'mathematics' is more affirmative than 'mathematics teacher'

RECOMMENDATIONS

This study was conducted to identify the perceptions of teacher trainees studying on teacher training courses with regard to their careers through the use of a metaphor analysis

method. A similar study may conduct a comparison between teachers and teacher trainees' perceptions. Furthermore, interview techniques may be conducted teacher trainees studying at faculties of education and those studying on teacher-training courses and teachers that may assist in revealing different viewpoints on the topic. Moreover, studies may be conducted that aim to determine the perceptions of trainee teachers in different fields towards their own study disciplines. The reasons for the negative metaphors generated by teacher trainees and the underlying causes of negative elements may be researched by employing smaller sample groups and various qualitative methods. Finally, examining the perceptions of teacher trainees studying on teacher training programs may reveal the what teachers' perceptions are regarding their professions, once they have embarked on their teaching careers.

NOTE

Some part of this article was presented at the II. International Eurasian Journal of Education Research Congress (EJER) on June, 2015, Ankara.

REFERENCES

- Ak S, Yenice N 2009. An Examination of Teacher Trainees Perceptions Regarding (Concept of) the Internet. 3rd International Computers and Teaching Technologies Symposium, Verbal Statement. From <<https://www.pegem.net/akademi/sempozyumbildiridetay.aspx?id=107743>> (Retrieved on 15 January 2015).
- Aydin IS, Pehlivan A 2010. The metaphors employed by Turkish teacher trainees with regard to the concepts of "the teacher" and "the student". *Turkish Studies*, 5(3): 818-842.
- Baydar SC, Bulut S 2002. The importance of teachers' beliefs concerning the nature of mathematics and teaching. *Hacettepe University Faculty of Education Journal*, 23(23): 62-66.
- Battista MT 1999. The mathematical miseducation of America's youth: Ignoring research and scientific study in education. *Phi Delta Kappan*, 80(6): 425-433.
- Boero P, Bazzini L, Garuti R 2001. Metaphors in Teaching and Learning Mathematics: A Case Study Concerning In Equalities. *Paper Presented in Pme Conference*, Utrecht/Netherlands, July, 12-17, 2001.
- Carreira S 2001. Where there's a model, there's a metaphor: Metaphorical thinking in students' understanding of a mathematical model. *Mathematical Thinking and Learning*, 3(4): 261-287.
- Carter S, Pitcher R 2010. Extended metaphors for pedagogy: Using sameness and difference. *Teaching in Higher Education*, 15(5): 579-589.
- Clements DH, Battista MT 1990. Constructivist learning and teaching. *Arithmetic Teacher*, 38(1): 34-35.
- Cerit Y 2008. Views of students, teachers and administrators with regard to metaphors concerning the concept of the teacher. *Turkish Journal of Educational Sciences*, 6(4): 693-712.
- Dietiker L 2015. Mathematical story: A metaphor for mathematics curriculum. *Educational Studies in Mathematics*, 90(3): 285-302.
- Dolphin GR, Tillotson JW 2015. Uncentering teacher beliefs: The expressed epistemologies of secondary science teachers and how they relate to teacher practice. *International Journal of Environmental and Science Education*, 9(3): 329-345.
- Dundar H, Karaca ET 2013. Metaphors held by students on training courses regarding teacher training programs. *Gazi University Journal of the Education Faculty of Industrial Arts*, 30: 19-34.
- Dunkake I, Schuchart C 2015. Stereotypes and teacher characteristics as an explanation for the class-specific disciplinary practices of pre-service teachers. *Teaching and Teacher Education*, 50: 56-69.
- Eraslan L, Cakici D 2011. Attitudes of students on teacher training programs with regard to the teaching profession. *Kastamonu Journal of Educational Sciences*, 19(2): 427-438.
- Font V, Bolite J, Acevedo J 2010. Metaphors in mathematics classrooms: Analyzing the dynamic process of teaching and learning of graph functions. *Educational Studies in Mathematics*, 75(2): 131-152.
- Guhe M, Smaill A, Pease A 2009. A formal cognitive model of mathematical metaphors. In: Bärbel Mertsching Marcus Hund and Zaheer Aziz (Eds.). *Advances in Artificial Intelligence*. Paderborn, Germany: Springer Berlin Heidelberg, pp. 323-330.
- Guler G, Akgun L, Ocal, MF, Doruk M 2012. The metaphors held by mathematics teacher trainees with regard to the concept of mathematics. *Journal of Research in Education and Teaching*, 1(2): 12-36.
- Gultekin M 2013. The metaphors that primary education teacher candidates use regarding curriculum. *Education and Science*, 38(169): 126-141.
- Guner N 2013. Metaphors held by teacher trainees regarding mathematics. *Education and Sciences*, 8(4): 428-440.
- Guveli E, Ipek AS, Atasoy E, Guveli H 2011. The perceptions of class teacher trainees with regard to the concept of mathematics. *Turkish Journal of Computer and Mathematics Education*, 2(2): 140-159.
- Hall N, Quinn R 2014. Parental involvement at the high school level: Parents' perspectives. *Journal of Ethnic and Cultural Studies*, 1(1): 13-21.
- Hamilton ER 2016. Picture this: Multimodal representations of prospective teachers' metaphors about teachers and teaching. *Teaching and Teacher Education* 55: 33-44.
- Kaya Y. 2015. Teachers' perceptions on culturally responsiveness in education. *Journal of Ethnic and Cultural Studies*, 2(2): 33-46.
- Knowles JG 1994. Metaphors as windows on a person's history: A beginning teacher's experience. *Teacher Education Quarterly*, 21(1): 37-66.
- Lai MY 2013. Constructing meanings of mathematical registers using metaphorical reasoning and models. *Mathematics Teacher Education and Development*, 15(1): 29-47.

- Lakoff G, Johnson M 1980. *Metaphors We Live By*. Chicago: University of Chicago Press.
- Martinez MA, Saulea N, Huber GL 2001. Metaphors as blueprints of thinking about teaching and learning. *Teaching and Teacher Education*, 17: 965-977.
- Noyes A 2006. Using metaphor in mathematics teacher preparation. *Teaching and Teacher Education*, 22(7): 898-909.
- Ozdemir S, Akkaya E 2013. An analysis of the perceptions of high school students and teachers perceptions regarding school(s) and ideal school(s). *Educational Administration in Theory and Practice*, 2(2): 295-322.
- Ozkan HH 2012. An examination of the attitudes of teacher trainees towards the teaching profession. *Ahi Evran University Journal of the Faculty of Education*, 13(2): 29-48.
- Paolucci C 2015. Changing perspectives: Examining the potential for advanced mathematical studies to influence pre-service teachers' beliefs about mathematics. *Teaching and Teacher Education*, 49: 97-107.
- Page TM 2015. Common pressures, same results? Recent reforms in professional standards and competences in teacher education for secondary teachers in England, France and Germany. *Journal of Education for Teaching*, 41(2): 180-202.
- Saban A 2004. Metaphors for forward by class teacher trainees at entry level regarding the concept of 'the Teacher'. *Turkish Journal of Educational Sciences*, 2(2): 131-155.
- Saban A 2008. Metaphors regarding school. *Educational Administration Journal in Theory and Practice*, 55(55): 459-496.
- Saban A 2010. Computer teacher candidates' metaphors about the internet. *Education and Science*, 131(1): 93-105.
- Saban A, Kelesoglu A 2011. The cognitive images of Information technology teacher trainees regarding the concepts of school and information technology education. *Education in Theory and Practice*, 11(1): 423-446.
- Saban A, Koçbeker BN, Saban A 2014. Competing in a marathon and making a journey to a mysterious place: The perceptions of class teacher trainees regarding the experiences and ideals of learning. *Education Sciences in Theory and Practice*, Educational Sciences: Theory and Practice, 14(3): 995-1030.
- Saban A, Koçbeker BN, Saban A 2006. An examination of the perceptions of teacher trainees with regard to the concept of the teacher. *Educational Sciences in Theory and Practice*, 6: 461-522.
- Sahin A, Cermik H, Dogan B 2010. To write on water or to let a 'Lucky Bird' land on your head? Experiences of teacher trainees with respect to search engines. *Educational Sciences in Theory and Practice*, 10: 1-32.
- Sahin S, Baturay MH 2013. Evaluation of the secondary school students' perceptions regarding the concept of Internet: A metaphor analysis study. *Kastamonu Journal of Education*, 21(1): 177-192.
- Sahin M, White AL 2015. Teachers' perceptions related to characteristics of a professional environment for teaching. *Eurasia Journal of Mathematics, Science and Technology Education*, 10(3): 559-575.
- Senemoglu N 2007. *Gelisim Ogrenme ve Ogretim: Kuramdan Uygulamaya*. Ankara: Gonul Publishing.
- Sun J, van Es EA 2015. An exploratory study of the influence that analyzing teaching has on preservice teachers' classroom practice. *Journal of Teacher Education*, 66(3): 201-214.
- Tang SY, Wong AK, Cheng MM 2015. The preparation of highly motivated and professionally competent teachers in initial teacher education. *Journal of Education for Teaching*, 41(2): 128-144.
- Toraman C, Acar F, Aydin H 2015. Primary school teachers' attitudes and knowledge levels on democracy and multicultural education: A scale development study. *Revista De Cercetare Si Interventie Sociala*, 49: 41-58.
- Torman C, Aydin H, Ulubey O 2016. Teaching Candidates Attitudes towards Teacher Training and Certification Program in Turkey. *International Educational Studies*, 9(4): 151-163.
- Turkish National Ministry of Education, Middle School Mathematics Lesson (5th, 6th, 7th and 8th grades), Teaching Program, Ankara. From <<http://ttkb.meb.gov.tr/program2.aspx>> (Retrieved on 10 January 2015).
- Ucar ZT, Demirsoy NH 2010. A dichotomy of old and new: The mathematical beliefs and applications of mathematics teachers. *Educational Sciences Journal, Hacettepe University*, 39(39): 321-332.
- Van De Walle JA, Karp KS, Bay-Williams JM 2009. *Elementary and Middle School Mathematics: Teaching Developmentally*. Boston: Allyn and Bacon.
- Yapici M, Yapici S 2013. The metaphors of teacher trainees regarding teacher training. *Electronic Turkish Studies*, 8(8): 1421-1429.
- Yildirim A, Simsek H 2005. *Sosyal Bilimlerde Nitel Arastirma Yontemleri*. Ankara: Seckin Publishing.
- Yurtseven N, Altun S 2015. Intercultural sensitivity in today's global classes: Teacher candidates' perceptions. *Journal of Ethnic and Cultural Studies*, 2(1): 49-54.