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Belgian and Turkish Pre-service Primary School Teachers' Metaphoric Expressions about Mathematics

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Abstract

Problem Statement: Recent studies in education have focused on how to handle metaphors as research and evaluation tools. Metaphors have many advantages for researchers, educators and learners with the most important being that they can help educators understand pre-service teachers' thinking and belief systems of mathematics. A study of previous literature in this area has shown that metaphors are used as explicit explorations of teachers' personal views of mathematics and their understanding of new images within mathematics, which can contribute to their own personal mathematical views. In this respect, comparing the metaphors used by teachers in different countries can yield many advantages.

Purpose of Study: This study aims to investigate Belgian and Turkish pre-service primary school teachers' metaphoric expressions about mathematics. Particularly, the focus is on what types of metaphors are used to express mathematics and whether differences exist between the two countries.

Methods: A written questionnaire was presented to 79 pre-service primary school teachers (37 Belgian and 42 Turkish). This questionnaire asked the pre-service teachers to provide a sentence explaining their own metaphor about mathematics and then draw an illustration to accompany the statement. Next, they were asked to explain the reasons for their written metaphors. The data-analysis process consisted of five sequential phases

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(listing, coding-reorganizing, categorizing, labelling and calculating inter-rater reliability). The inter-rater reliability was found to be 98%.

Findings and Results: In this study, four different categories of metaphors emerged (gesture, animate, inanimate and emotion). In addition, differences were discovered to exist between the Turkish and Belgian participants' metaphors. The range of metaphoric expressions produced by the participants was extensive. The Turkish participants mostly wrote gesture and emotion metaphors, while the Belgian participants preferred animate metaphors for expressing mathematics.

Conclusions and Recommendations: The wide range of metaphoric expressions gathered could be explained by the pre-service teachers' experiences with mathematics; the way that mathematics is taught based upon geographic location; geographic and cultural differences at the national and international level and background experiences in regard to family,; and social and educational areas of interest. After further examining the information collected, the results showed that the major reason for the differences was the pre-service teachers' background experiences in education and culture.

Keywords: Metaphor, mathematics, mathematics education, pre-service primary school teacher

In order to develop effective teacher training, the belief system of pre-service teachers needs to be investigated. Previous studies have shown that the metaphor is a cognitive tool by which to understand pre-service teachers' thinking and belief systems in regard to mathematics. To this end, it is important to answer the following questions: What is a metaphor, and what does it mean to the individual using it? Previous studies have provided several definitions of the term metaphor, each slightly different from the last. However, one point has remained consistent: the components of the word. As indicated in Presmeg's article (1998), metaphor is derived from the Greek, *metaphora,* meaning to 'transfer' or 'carry over.' She also defined metaphor as an implicit form of an analogy. On the other hand, metaphor was defined by Leavy, McSorley and Bote (2007) as:

> Metaphors have a coherence and internal consistency, which provide insights into ideas that are not explicit or consciously held. They can also be evocative, stimulating both self and others to tease out connections, which might not be made use of by direct questions (p. 1220).

Metaphors are not just figures of speech, but instead constitute an essential mechanism of the mind (Martinez, Sauleda, & Huber, 2001) pervasive in everyday life, not just in language but in thought and action as well (Lakoff & Johnson, 2003). Reasoning with metaphors is considered a fundamental method of human thinking and communication, as can be seen in our everyday use of abstract concepts, such as time and change (English, 1997). Metaphors are a type of mapping between target and source domains. They also introduce new elements into a target domain. For

example, the concept of love is known to be a partnership, which is a type of metaphor. This metaphor creates a mapping between love and partnership (Lakoff & Nunez, 2000). Demirtaş (2011) asserted that metaphor is a powerful mental tool for understanding and explaining a highly abstract, complex or conceptual phenomenon.

It can be assumed that a metaphor is employed when one wants to explore and understand something esoteric, abstract, novel or highly speculative. As a general rule, the more abstract or speculative a concept is, the greater the variety of metaphors needed to grapple with it (Yob, 2003). Our conceptual system--the terms in which we think and act--is fundamentally metaphorical in nature (Lakoff & Johnson, 2000). If our conceptual system is structured by metaphorical relationships, then it is logical that we should also understand our belief and thinking systems by means of metaphors. Saban (2004) asserted that the metaphors that we use not only represent the way that we perceive the world and reality but also shape our professional ideas, attitudes and practices. Metaphors, long thought to be figures of speech, have recently been shown to be the central process in everyday thought. They are not embellishments but are the basic means by which abstract thought is made possible (Lakoff & Nunez, 2000).

Metaphors have many advantages for learners, researchers and educators. For example, they help researchers to understand pre-service teachers' beliefs in regard to interpreting their professional world and personal lives (Mahlios & Maxson, 1998); play a central role in conceptualizing and reflecting upon the nature of teaching and learning; make connections between personal beliefs and educational theories (Leavy, McSorley, & Bote, 2007); invite researchers to explore comparisons, notice similarities and use a situation as an image of another; act as a lens, screen or filter through which a subject is (re)viewed; and become a mental model for thinking about something in light of another (Saban, Kocbeker, & Saban, 2007). As such, metaphors can be used to help teachers become aware of the questions, assumptions and values that they bring to teaching; promote a reflective approach (Michael &Katerina, 2009); exert powerful influences on the processes of analyzing and planning in education; profoundly affect teachers' thinking about teaching and learning (Martinez, Sauleda, & Huber, 2001); and show relationships between teachers and mathematics (Sterenberg, 2008).

Metaphors are forms of comparison that directly compare two unlike items. "Mathematics is a company" can be given as example of that definition (Reeder, Utley, & Cassel, 2009). In this metaphor, mathematics as a phenomenon is being explained by means of a company, which is unlike and has no prior relationship to mathematics. As summarized in a study conducted by Saban (2004), the characteristics of a metaphor are like a mirror of one's reality, a mechanism of the mind, a sense-making tool, a medium of reflection, an instructional tool, and a tool for evaluation.

Previous literature has created general metaphorical images of pre-service teachers or teachers about a concept--such as that of a student (Saban, 2009; Inbar,

1996) or teacher (Inbar, 1996; Gillis & Johnson, 2002; Saban, Kocbeker, & Saban, 2007; Cerit, 2008; Seferoğlu, Korkmazgil, & Ölçü, 2009;)--and specific content beliefs, such as mathematics (Lim, 1999; Noyes, 2004; Sterenberg, 2008; Reeder, Utley, & Cassel, 2009) and other disciplines (Güven & Güven, 2009). Several classifications of metaphors exist that are used to express mathematics. Reeder, Utley and Cassel (2009) coded metaphors as production, journey and growth. In Sterenberg's (2008) study of elementary school teachers' metaphors about mathematics, metaphors were coded as a battle, mountain, bridge and language. In a study conducted by Noyes (2004), metaphoric statements used by students were coded as language, toolkit, structure and journey. In Lim's (1999) study, they were coded as journey, skill, game and puzzle. Therefore, it can be concluded that metaphors can be used to examine pre-service teachers' content beliefs in order to better understand their mathematical belief system and compare different countries' pre-service teachers' metaphorical thinking as taught by their educational systems.

In Belgium, the primary teacher training program is a three-year program. No entrance exam exists for this program. Instead, at the end of each year, the students must take and pass an exam to advance to the next year. Within this program, mathematics is taught every year and pedagogical skills are taught in the second and third years (www.katho.be/reno/documents/Primary.pdf, 2010). In Turkey, high school students enter the university depending on their scores on the university entrance examination test (UEE), administered by the Student Selection and Placement Centre (ÖSYM). The education program is a four-year program taught based on a standardized curriculum signed into law by the Higher Education Council (YÖK, 2007). In the first term, the students take the Basic Mathematics I course. In the second term, they take the Basic Mathematics II course. In the fifth term, they take the Mathematics Teaching I course, and in the sixth term, they take the Mathematics Teaching II course. While the number of years of training is different between the countries, the mathematics courses seem similar.

The purpose of this study was to compare Belgian and Turkish pre-service primary school teachers' metaphorical thinking about specific content in mathematics. Comparing the teachers' metaphorical thinking is a good means by which to understand the differences and similarities between two countries' teacher education programs and how they affect the students' metaphorical thinking skills. The main questions presented in the study are as follows: "What types of mathematical metaphors are used by Belgian and Turkish teachers, and do any differences exist in regard to the metaphors used within each country?"

Method

Data collection

As indicated in a study conducted by Reeder, Utley and Cassel (2009), metaphors are often used as a tool by which to gain insight into pre-service teachers' conceptualizations of mathematics. For this study, data were collected in March 2010 in Belgium and, one week later, in Turkey. In this study, the data was collected via

written and visual expressions of mathematical expressions. Opinions of field experts were taken using an open-ended questionnaire, whether the answers were understandable or not.

Before beginning the data collection phase, the researchers decided that the questionnaire should contain an explanation of a metaphor, but not a definition of mathematics, in order to keep from biasing the data. Prior to giving each participant a questionnaire, metaphor examples were discussed. Then, the one-question, open-ended questionnaire was distributed. On the questionnaire, each participant was asked to construct a metaphor about mathematics in their own words and then explain their reasoning for using this metaphor. Participants were given 30 minutes to answer this questionnaire. In the questionnaire, participants were asked to construct their metaphors for mathematics and draw a picture of the metaphor that they constructed.

Participants

In this study, 79 (37 Belgian and 42 Turkish) pre-service primary school teachers were selected. Each of these participants was enrolled in mathematics methods and basic mathematics courses in their countries. These courses were chosen because we felt the participants within them could best and most easily reflect on their metaphorical thinking about mathematics.

Data analysis

The data for this study were analyzed using a methodology of metaphor analysis. Metaphors can be used to reduce the complexity of qualitative research into clearly structured patterns (Schmitt, 2005). The metaphor analysis is based on the written and drawn discourses of participants. The data analysis process consisted of five sequential phases as shown in Figure 1. In the first phase of the data analysis, the metaphors constructed by participants are listed. Then, an initial code list is prepared by the researchers based on the participants' answers. The metaphors are then reorganized under the same category. In the second phase, the metaphors are coded by the researchers separately. In the third phase, the metaphors are categorized under the same codes. In the fourth phase, the metaphors are labelled. In fifth phase, the inter-rater reliability is calculated. For the data in this study, the inter-rater reliability was found to be 98% based on the formula presented by Miles and Huberman (1994). In this study, four dominant metaphors emerged (gesture, animate, inanimate and emotion). If the produced metaphors were related to action and game they were coded under gesture; if the metaphors contained vitality, they were coded under animate, and if not, they were coded under inanimate. If the content of produced metaphors was related to feelings of the participants, it was coded under the emotion category. The metaphors produced by the participants are presented based on their categories and subcategories in the below tables.

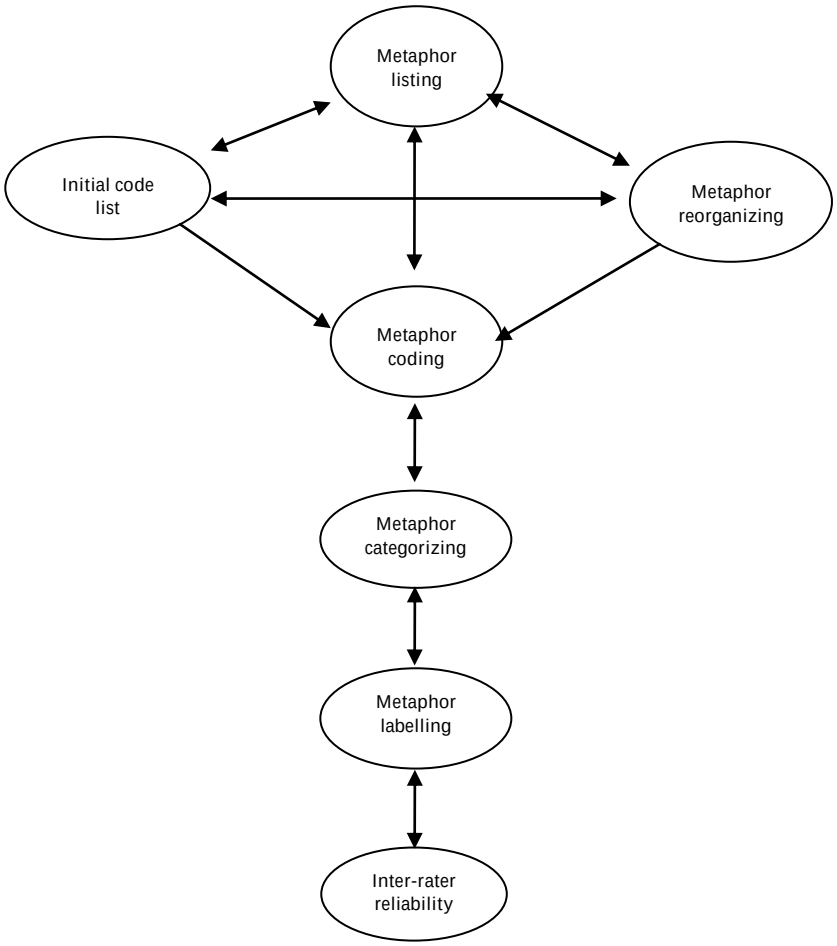

Figure 1 Metaphor analysis process

Results

In the study, four dominant metaphors emerged for expressing mathematics from the data obtained in research. These are as follows: gesture, animate, inanimate and emotion. The metaphors produced by participants are given based on categories and subcategories separately in Tables. In Table 1, Belgian and Turkish participants produced metaphors for mathematics, which were organized under categories and sub-categories.

Table 1

Metaphors Produced by Participants for Mathematics

Country	*Gesture*		*Animate*			*Inanimate*		*Emotion*	
	Action	*Game*	*Animal*	*Human*	*Plant*	*Place*	*Object*	*Abstract*	*Concrete*
Belgium	2	5	1	4	6	3	6	4	5
Turkey	8	6	-	-	3	3	4	6	10

As seen in Table 1, metaphors that fell into the action and game category are coded under the gesture category. The metaphors containing animals, humans or plants were categorized under the animate category. The metaphors containing places and objects were categorized under the inanimate category, and those metaphors containing abstract and concrete ideas were categorized under the emotion category. Two participants of both countries did not construct any metaphors related to mathematics.

Gesture

Within the gesture category, game and action were found to be sub-categories. The following examples are for the game sub-categories: game, maze and puzzle. In the gesture category, the Belgian participants expressed two action and five game metaphors. The maze metaphor was the dominant metaphor among the Belgian students. The results show that the game metaphors were more often used among the Belgian students than the action metaphors. The Turkish students produced eight action and six game metaphors. The students provided an equal number of game, puzzle and maze metaphors. However, action metaphors were used mostly among Turkish students under the gesture category. Table 2 shows the Belgian participants' metaphors for mathematics under the gesture category. Table 3 shows the same information for the Turkish participants.

Table 2

Belgian Participants' Metaphors for Mathematics and Reasoning under the Gesture Category.

Gesture	*Mathematics is like .....*	*Because…..*
Action	a chemical experiment.	you don't always find the right combination of things to solve a problem. It takes a little while to find the right way to solve it.
	learning how to walk.	you have to learn step-by-step.
Game	a maze.	you find the right way in a maze.
	a maze.	sometimes it is hard to begin, but once you know the way, it is easy.
	a maze.	it is difficult to learn, at least in the beginning, but once you learn it, you understand the way to work it, and it becomes easy. After a while, you will find your way.
	a puzzle.	it is difficult to understand all of the parts and make them fit, but when you get it or understand it, you are happy and can make new exercises
	the game of uno.	you have to think a lot. For example, you have to throw the right card in. You have to do a lot of exercises.

As seen from Table 2, Belgian participants produced action and game metaphors under the gesture category.

Table 3

Turkish Participants' Metaphors for Mathematics and Reasoning under the Gesture Category.

Gesture	*Mathematics is like …..*	*Because…..*
Action	making a decoration.	every part of is connected and fits together.
	playing a game.	mathematics is the most funny lesson. You play numbers. Addition, subtraction, multiplication and division are the phases of the game.
	recognizing life.	mathematics is a necessity. In order to adapt to life and society, we must use mathematics.
	suffocating in an ocean.	mathematics is large and difficult. When faced with a difficult problem, learners can feel as if they are suffocating in an ocean.
	climbing an orthogonal mountain.	when we encounter problems in real life, we benefit from mathematics. We calculate, collect data, compare and apply mathematical operations.
	walking on a pebbly road that, at the end, leads to entertainment.	the way is long and complicated, but when you finally figure it out, it becomes fun.
	knowing an unknown in a space.	it is a well-known point in a lost order.
	making an embroidery	everything is connected with each other.
Game	a game.	you play the numbers and discover a new world.
	a game.	mathematics is an instrument. When you play with it, it becomes fun.
	a maze.	every part is connected. When you find a maze, you find another maze, and it becomes an endless maze.
	a maze.	mathematical topics are connected. You cannot grasp a concept before you grasp another concept. Either you reach for the next concept or you lose your way.
	a puzzle.	once you solve one problem, you will want to solve more.
	a puzzle.	when you solve it, it becomes a total like mathematics.

As seen in Tables 2 and 3, differences exist in the ways by which the teachers expressed their metaphors. For example, although the Turkish participants expressed eight action metaphors, the Belgian participants only produced two action metaphors. In the game sub-category, game and maze emerged for both groups, but the Belgian students expressed five, while the Turkish students expressed six metaphors.

Animate

Within the animate category, three sub-categories emerged: animal, human and plant. Table 4 presents the Belgian participants' metaphors for mathematics under the animate category and the participants' reasoning. Table 5 presents the same information for the Turkish participants.

Table 4.

Belgian Participants' Metaphors for Mathematics and Reasoning under the Animate Category.

Animate	*Mathematics is like …*	*Because…*
Animal	all the different fishes in the sea.	all fishes are different, but we can find some groups of fishes who have the same habits. In mathematics, we also have problems that we can solve the same way.
Human	someone who is washing the dishes.	it is fun to watch, but it is not fun to do.
	all the different people in the world.	every person is different, just like every number is different in mathematics. When people come together, you have a new relationship just like when numbers come together for different exercises.
	a human.	everyday you learn something new and your knowledge grows everyday. A human also grows everyday.
	your hair.	it grows everyday.
Plant	a tree.	you start with a small, basic sampling, and you make it grow.
	a piece of a tree	İt is difficult to go to a leaf from thr bottom of a tree [RAA1].
	a tree.	there are a lot of branches that you have to learn in order to understand it.
	a tree.	you can always use different ways to solve mathematical problems. We learn to solve problems one way, and we can use shorter ways to solve the same problems.
	a forest.	it is very difficult to understand and use structure to make exercises.
	a tree.	it is very difficult. It is complicated.

The Belgian students produced animal, human and plant metaphors within the animate category. In the animal sub-category, they produced one metaphor; in the human sub-category, they produced four metaphors; in the plant sub-category, they produced six metaphors; within the plant sub-category, the Belgian pre-service primary school teachers expressed mathematics as tree, forest and piece of a tree. Therefore, the tree metaphor was the dominant metaphor. In the animate category, the plant sub-category was used the most. The Turkish participants produced only one plant sub-category and three metaphors within the animate category.

Table 5.

Turkish Participants' Metaphors for Mathematics and Reasoning under the Animate Category.

Animate	*Mathematics is like…*	*Because…*
Plant	a complicated creeper.	it is firmly interwoven.
	a flower.	mathematics needs nurture like a flower. In order to develop your knowledge, it is necessary to think deeply.
	a leaf of the golden daisy.	it consists of leaves that come together.

In the animal sub-category, Turkish participants produced three metaphors. As seen in Tables 5 and 6, differences exist between the Belgian and Turkish participants' metaphoric expressions in the animate category. Although the Belgian participants used the animal, human, plant and object sub-categories, the Turkish pre-service primary school teachers did not construct any metaphors about animals and humans.

Inanimate

In this category, place and object sub-categories emerged. In the place sub-category for the Belgian teachers, three metaphors were produced, while in the object sub-category, six metaphors were produced. In the place category, house, desert and country metaphors emerged. Within the object sub-category, a box of chocolates, a clock, a shuttle, a web and an alphabet emerged. Among these metaphors, shuttle was the dominant metaphor. The Belgian students produced more object metaphors than place metaphors. Table 6 presents the Belgian participants' metaphors for mathematics and reasoning under the inanimate category, while Table 7 presents the Turkish participants' results.

Table 6.

Belgian Participants' Metaphors for Mathematics and Reasoning under the Inanimate Category.

Inanimate	*Mathematics is like …*	*Because…..*
Place	a house.	a house is built with a lot of stones. It is built stone-by-stone, step-by-step. It is the same with mathematics. You start with the fundamentals and build up from there. Mathematics is also large, and every stone is another part of another mathematical concept.
	a desert	there is no end.
	a country	there is so much to talk about. It is big.
Object	an alphabet.	once you know it and understand it, it is easy.
	a clock.	it keeps going on just like time that does not have an end.
	a web.	sometimes it is complicated.
	a space shuttle.	it is difficult.
	a shuttle.	you must know the basics; then you can learn more mathematics.
	a box of chocolates.	there are different tastes. One you like, and one you dislike. One part you like to do and find it easy; one you won't understand and may dislike.

Table 7.

Turkish Participants' Metaphors for Mathematics and Reasoning under the Inanimate Category.

Inanimate	*Mathematics is like …*	*Because…*
Place	a world.	the more you enter it, the more you discover.
	a paradise-hell cave.	the important thing is to find the solution of the problem like finding the exit of a cave.
	a mountain	it has a lot of roads on it.
Object	a lamp.	when you switch it on, it becomes lighter and lighter. As in mathematics, when you learn more, it becomes brighter.
	color.	you see it everywhere, and without it, life would be boring.
	furniture that you use everywhere.	you see the it everywhere like mathematics.
	an empty plate.	when you learn mathematics, you make the empty plate a full plate.

The Turkish participants only had three metaphors for place within the inanimate sub-category but four for the object sub-category. Therefore, they produced more object metaphors than place metaphors. The following emerged in the place category: world, paradise-hell cave and mountain. In the object category, the following emerged: lamp, colour, furniture and plate.

As seen from Tables 6 and 7, the place and object sub-categories were used by both the Belgian and Turkish participants. The Belgian participants produced more metaphors related to the object sub-category than did the Turkish participants.

Emotion

In the emotion category, abstract and concrete sub-categories emerged and were produced by both groups. Table 8 presents the Belgian participants' metaphors for mathematics and reasoning under the emotion category, while Table 9 presents the Turkish results.

Table 8.

Belgian Participants' Metaphors for Mathematics and Reasoning under the Emotion Category.

Emotion	*Mathematics is like …*	*Because…*
Abstract	a UFO.	it is a very difficult word; it sounds like something outside the atmosphere.
	a treasure.	if you have the key, you can solve the exercise. Sometimes, people can discover a lot with mathematics, but you need the key.
	space.	the stars are part of math. For example, one star means limit, another star means logic, another star means logaritma. Space is unending like mathematics.
	medicine.	it solves pain or trouble. When you do mathematics, you have to solve problems too.
Concrete	a circle.	even when you think you know all about it, there are always new things to learn.
	a human brain.	it is difficult, but somewhere there is logic.
	the universe.	it is endless. You can calculate stuff into infinity. It is amazing what you can do when calculating.
	A sea.	it is full of wonders. Just when you think you know everything, you learn something new.
	A light	you have to think straight and bright. It can be very difficult if you are tired.

As seen from Table 8 in the abstract sub-category, medicine, space, treasure and UFO metaphors were found. In the concrete sub-category, five metaphors were produced (circle, human brain, light, sea and the universe) by Belgian participants.

Table 9.

Turkish Participants' Metaphors for Mathematics and Reasoning under the Emotion Category.

Emotion	*Mathematics is like …*	*Because…*
Abstract	a long journey.	both of them are so long.
	an endless path and separation.	everybody chooses his own way.
	an endless road.	as in other diciplines, there is always more knowledge to learn.
	an extreme way of thinking.	it is not the movement of numbers. It requires us to think about our thinking abilities.
	Philosophy.	it requires you to look at things in new and meaningful ways.
	A poem.	a poem includes many different emotions, thoughts and messages that are connected to each other.
Concrete	A map.	every subject is sub-divided but connected to everything else. If a part of the map is missing, then it is much harder to get where we want to go.
	a novel.	a novel is complete. It consists of an introduction, middle and conclusion.
	A river.	when you look at a river from a distance, it seems fuzzy, but when you get close, you realize that it is not fuzzy. If you do not spend time with math, you feel you are suffocating in math, but when you understand math or spend time with math, you understand that it is funny and enjoyable.
	a snowslide which raises human awareness.	being aware of humans in society is a basic foundation for world society.
	air.	Just as we need air, we need mathematics in every moment of our lives. We need mathematics from the begining of our lives to the end of our lives.
	a life.	in order to achieve things in life, sometimes you need mathematics.
	a life.	what we see in nature is connected to mathematics.
	a life.	there are always problems. You solve a problem, but then another problem occurs. As in life, problems are never completely finished.
	water dew.	the droplets come together to form a pool. In mathematics, small parts come together, and meaningful events happen.
	an appetizer.	mathematics is pleasant, like an appetizer. When you get bored if you occupy mathematics, and at the end, when you get the solution, it is the same as the appetizer.

In the abstract sub-category, the Turkish participants created six metaphors, while they created ten metaphors in the concrete sub-category. The following metaphors were found in the abstract sub-category: long journey, road, path, philosophy, poem and extreme way of thinking. In the concrete sub-category, the following metaphors were created: map, novel, river, snowslide, air, life, water dew and appetizer. Belgian participants produced nearly the same number of abstract and concrete metaphors for expressing mathematics. As seen in Tables 8 and 9, the Belgian and Turkish students created different metaphors within this category. The Turkish participants expressed more concrete metaphors than abstract metaphors.

Conclusion and Recommendations

Metaphors are powerful research and cognitive tools that can be used to gain insight into pre-service teachers' metaphoric expressions and provide opportunities to educators to evaluate them. In this study, we investigated Turkish and Belgian pre-service primary school teachers' metaphors relevant to mathematics. The data obtained from the study revealed four metaphor categories: gesture, animate, inanimate and emotion. As indicated by other studies (Reeder, Utley, & Cassel, 2009; Sterenberg, 2009; Noyes, 2004; Lim, 1999), the metaphors used varied greatly. Our findings are parallel to those presented by Lim (1999), Noyes (2004) and Sterenberg (2009).

Even though the Belgian and Turkish participants all took similar mathematics and methods courses, the metaphors that they produced varied. The metaphors that participants produced varied in terms of number and content. In fact, the range of the metaphoric expressions produced was extensive. The Turkish participants mostly created action and emotion metaphors, whereas the Belgian participants preferred animate metaphors. However, some of the participants (both Belgian and Turkish) used similar metaphors, especially in the game sub-category with metaphors about mazes, puzzles and games.

Among the four metaphor categories, emotion was used predominantly by the participants. This result occurred, because, according to Lakoff and Nunez (2000), participants often explain abstract concepts like mathematics by using feelings. One of the principal results in cognitive science is that abstract concepts are typically understood via metaphors of more concrete concepts.

The wide range of metaphoric expressions produced could be explained via pre-service teachers' previous experiences with mathematics (Schinck et al., 2008). As indicated in a study conducted by Noyes (2004), the way that mathematics is taught varies depending upon location, both geographically and culturally at the international and national levels (citied in Stigler & Hiebert, 1999). Noyes (2004) indicated that children have different experiences growing up, in school, and in learning mathematics. Soto-Andrade (2007) asserted that the diversity of metaphors depends upon the participant's previous background on the subject. It can be concluded that the differences in the metaphors created by the pre-service primary school teachers stem from their cultural and educational backgrounds.

In addition to a specific concept, like a student (Saban, 2009; Inbar, 1996), teacher (Seferoğlu, Korkmazgil, & Ölçü, 2009; Cerit, 2008; Gilis & Johson, 2002; Saban, Kocbeker, & Saban, 2007; Inbar, 1996) or specific content belief, like mathematics (Reeder, Utley, & Cassel, 2009; Sterenberg, 2009; Noyes, 2004; Lim, 1999) and other disciplines (Güven & Güven 2009), the processes used in learning and teaching mathematics can be studied, and comparative studies can be completed on extensive samples from a number of countries. Different data collection methods, such as interviews, could be implemented in order to better understand the pre-service teachers' metaphorical thinking in different countries. Furthermore, the content of the courses that participants take can be investigated.

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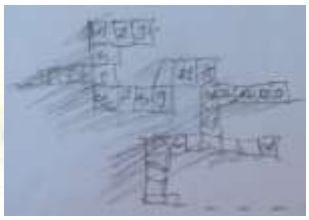
Appendix

Metaphor examples are given as category and sub-categories

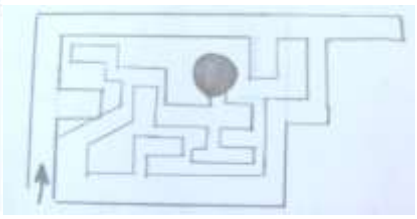
Metaphors for mathematics under gesture category

"Knowing an unknown in a space" *(action)*



"A maze" *(game)*

"A chemical experiment" *(action)*



"A maze" *(game)*

Metaphors for mathematics under animate category

"A human" (human)

"A tree" (plant)

"Your hair" (object)

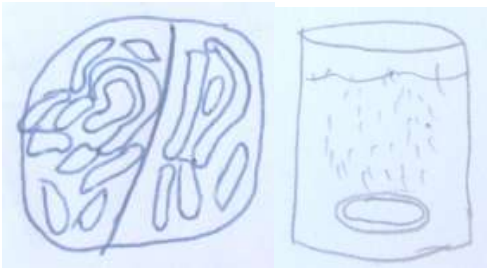
Metaphors for mathematics under inanimate category

"A desert" (place)

"A web" (object)

Metaphors for mathematics under *emotion* category

"An endless path separation" (abstract)



"A human brain" (concrete) A medicine

Belçikalı ve Türk Sınıf Öğretmeni Adaylarının Matematik ile İlgili Metaforik Anlatımları

Atıf:

Kilic, C. & Yelken Yanpar, T. (2013). Belgian and Turkish Pre-Service Primary School Teachers' Metaphoric Expressions about Mathematics. *Egitim Arastirmalari-Eurasian Journal of Educational Research*, 50, 21-42.

(Özet)

Problem Durumu

Metafor Yunanca Metaphora *kelimesinden gelmekte olup, anlamı aktarmak ya da nakletmek anlamına gelmektedir. Düşünme ve hareket etme bakımından kavramsal sistemimiz temelde metaforiktir. Eğer bizim düşünce sistemimiz metaforik ilişkilerle yapılandırılıyorsa bundan dolayıdır ki inanç ve düşünme sistemimizi metaforlarla daha kolay anlayabiliriz.Metaforlarla akıl yürütme insan düşüncesinin temel bir yolu ve iletişim biçimi olarak ifade edilmektedir.*

Metaforların araştırmacılar, eğitimciler ve öğrenenler için pek çok yararları bulunmaktadır. Metafor, soyut düşüncelerle somut görüntüler arasında bağ kurar, bir araştırma aracıdır, araştırmacılara öğretmen adaylarının kendi yaşamlarını ve dünyalarını yorumlamalarını anlamalarına yardım eder. Metaforlar doğrudan birbirine benzemeyen şeyleri karşılaştırmada kullanılan formlardır. Örneğin,*matematik bir şirkettir* buna bir örnek olarak verilebilir. Bu örnekte matematik ona benzemeyen şirket kavramıyla açıklanmıştır. Alan yazına baktığımızda, öğretmen adaylarının ya da öğretmenlerin öğrenci, öğretmen ve matematik gibi özel konu alanlarında ve diğer disiplinlerdeki kavramlara yönelik metaforik düşünmelerine bakılmıştır. Matematikle ilgili olan metaforik anlatımlar ürün, yolculuk ve büyüme ya da savaş, dağ, köprü ve dil olarak sınıflandırılmıştır. Bunların yanı sıra matematik için kullanılan metaforlar dil, takım çantası, yapı ve yolculuk olarak belirlenmiştir.

Araştırmanın amacı

Öğretmenlerin inançlarının sınıf etkinliklerini şekillendirdiği göz önüne alındığında, öğretmen adaylarının düşüncelerini öğrenmek önem taşımaktadır. Araştırmalarda da vurgulandığı gibi metaforlar güçlü araştırma araçlarıdır. Bu araştırmanın amacı

farklı iki ülkedeki (Belçika ve Türkiye) sınıf öğretmeni adaylarının matematikle ilgili metaforik anlatımlarını belirlemektir. Belçika ve Türkiyedeki sınıf öğretmeni adaylarının matematikle ilgili metaforik anlatımlarına bakmak iki ülkenin öğretmen yetiştirmedeki benzerlik ve farklılıklarını ve bunun metaforik düşünme becerilerine etkisine bakmaya yardımcı olacağı düşünülmüştür. Bu amaçla aşağıdaki şu soruya yanıt aranmıştır;

Belçikalı ve Türk öğretmen adayları matematikle ilgili ne tür metaforik anlatımlar kullanmaktadırlar? İki ülkedeki katılımcıların kullandıkları metaforlar farklılık göstermekte midir?

Araştırmanın yöntemi

Araştırmada betimsel yöntem kullanılmıştır. Veriler metafor anketi ile toplanmıştır. Araştırmaya, 37 Belçikalı ve 42 Türk olmak üzere toplam 79 sınıf öğretmeni adayı katılmıştır. Araştırmada, matematik ve öğretimi derslerini almış olan öğrenciler seçilmiştir. Bu öğrencilerin seçilmesinin nedeni bu dersleri almış olan öğrencilerin matematikle ilgili metaforik anlatımlarını kolayca yansıtabilecekleri düşünülmüştür.

Araştırmanın Belçika'daki verileri Mart 2010, Türkiyedeki verileri ise Nisan 2010 aylarında toplanmıştır. Veri toplamaya geçmeden once, metaforun ne olduğu örnekler verilerek katılımcılara anlatılmıştır. Daha sonrasında Matematik ...gibidir. Çünkü.... yazılı formu doldurmaları ve matematik ile ilgili metaforik anlatımlarını görsel olarak çizmeleri istenmiştir. Soruların uygunluğu konusunda uzman kanısı alınmıştır. Bunun için katılımcılara 30 dakika süre verilmiştir.

Araştırma elde edilen verilerin analizinde metaphor analizi yöntemi benimsenmiştir. Metaphor analizi öğretmen adaylarının yazılı ve çizimlerine dayalı olarak gerçekleştirilmiştir. Veri analizi birbirini takip eden 5 aşamadan oluşmuştur. Ilk aşamada katılımcıların oluşturdukları metaforlar listelenmiştir. Araştırmacılar tarafından katılımcıların oluşturdukları metaforlara bağlı olarak bir başlangıç kodlama listesi geliştirilmiştir ve metaforlar organize edilmiştir. Üçüncü aşamada metaforlar kodlanmıştır. Kodlanan metaforlar kategorilere ayrılmıştır ve daha sonra bu metaforlara genel bir isim verilmiştir. Analizler araştırmacılar tarafından ayrı ayrı gerçekleştirilmiştir. En son aşamada ise kodlayıcılar arası güvenirliğe bakılmıştır. Kodlayıcılar arası güvenirlik %98 olarak bulunmuştur. *Analiz sonucunda metaforlar canlı, cansız, hareket ve duygu olarak belirlenmiştir.*

Araştırmanın bulguları

Hareket kategorisinde oyun ve eylem olmak üzere iki ayrı alt kategori bulunmuştur. Belçikalı katılımcılar iki eylem ve beş oyun metaforu kullanırken, Türk katılımcılar ise sekiz eylem ve altı oyun metaforunu kullanmışlardır. Eylem kategorisinde oyun metaforu daha çok kullanılmıştır. Canlı metafor kategorisinde ise insan, hayvan ve bitki alt kategorileri bulunmuştur. Türk katılımcılar yanlızca bitki alt kategorisinde metafor üretirken, Belçikalı katılımcılar her üç alt kategoride de metafor üretmişlerdir. Cansız metafor kategorisine bakıldığında ise nesne ve yer metaforlarını kullandıkları görülmektedir. Belçikalı ve Türk katılımcılar yer metaforunu aynı sayıda kullanırlarken, nesne metaforunu farklı kullanmışlardır.

Matematik gibi soyut bir olguyu açıklarken katılımcılar hem soyut, hem de somut duygu metaforlarından yararlanırlarken, ağırlıklı olarak somut duygu metaforlardan faydalanmışlardır.

Araştırmanın sonuçları ve öneriler

Metaforlar eğitimcilere ve araştırmacılara özellikle öğretmen adayları ile ilgili bilgiler sunan güçlü ve yararlı araştırma ve bilişsel araçlardır. Türk ve Belçikalı sınıf öğretmen adaylarının matematikle ilgili metaforik anlatımlarının araştırıldığı bu araştırmanın sonuçlarına bakıldığında, dört farklı metafor kullanıldığı görülmektedir. Yapılan araştırmalarda da benzer sonuçlar çıkmıştır. Her iki grupta yer alan katılımcılar matematik ve matematik öğretimi derslerini almalarına rağmen matematiği anlatmak için kullandıkları metaforlarda farklılıklar görülmektedir. Belçikalı katılımcılar canlı metaforları daha çok kullanırlarken, Türk katılımcılar ise eylem ve duygu metaforları kullanmışlardır. Öğretmen adaylarına Matematik ...gibidir. Çünkü....biçiminde sorulduğundan ve bu durum seçmeye dayalı olduğu için katılımcıların metaforları birbirinden farklı olmuştur.

Araştırmada benzer metafor kullanılan durumlar da olmuştur. Bu duruma oyun alt kategorisinde rastlanmıştır. Her grupta yer alan katılımcılar matematikle ilgili oyun bulmaca ve labirent metaforlarını kullanmışlardır. Bunun yanı sıra, metaforlar arasında en çok duygu metaforunun kullanıldığı göze çarpmaktadır. Katılımcılar soyut bir kavram olan matematiği hem soyut, hem de somut duygu metafor kullanarak anlatmışlardır. Katılımcıların farklı metafor kullanmalarının bir nedeni de, öğretmen adaylarının matematikle ilgili olan deneyimleridir. Bu konu ile ilgili yapılan çalışmalara bakıldığında, matematikle ilgili metaforik anlatımların bireylerin farklı büyüme biçimlerine, okul yaşantılarına, matematik öğrenmelerine ve bireyin önceki deneyimlerine bağlı olduğu ortaya konulmuştur. Araştırmadan elde edilen sonuçlara bakıldığında, Belçikalı ve Türk öğretmen adaylarının matematikle ilgili metaforik anlatımlarının katılımcıların kültürel geçmişlerine ve eğitim sistemlerine bağlı olduğu sonucuna ulaşılabilir. Metaforlar ne kadar çok kullanırsa, bireylerin o konu ile ilgili görüşleri daha iyi anlaşılabilir. Bu hem araştırmacılara, hem de eğitimcilere yararlar sağlayacaktır. Öğrenci, öğretmen ve matematik gibi konuların yanı sıra, öğrenme ve öğretme ile ilgili de çalışmalar yapılabilir. Görüşme gibi farklı veri toplama yöntemleri kullanılarak bireylerin metaforik düşünmeleri de araştırılabilir. Her iki ülkenin öğretmen yetiştiren programlarında yer alan matematik ve öğretimi derslerinin içeriği araştırılabilir.

Anahtar sözcükler: Metafor, matematik, matematik eğitimi, sınıf öğretmeni adayı