Editors:
Dr. Wayne B. James
Dr. Cihan Cobanoglu
Dr. Muhittin Cavusoglu
Co-Editors

Dr. Wayne James, University of South Florida, USA
Dr. Cihan Cobanoglu, University of South Florida, USA
Dr. Muhittin Cavusoglu, Northern Arizona University, USA

ADVANCES IN GLOBAL EDUCATION AND RESEARCH: VOLUME 4


*Authors are fully responsible for corrections of any typographical, copyrighted materials, technical and content errors.
Assistant Editor

Dr. Alia Hadid, University of Rhode Island, USA

Editor Assistants

Zahra Alrushdy, Bahcesehir University, Turkey
Gokhan Sener, Necmettin Erbakan University, Turkey
Abraham Terrah, University of South Florida, USA

*Authors are fully responsible for corrections of any typographical, copyrighted materials, technical and content errors.*
Pre-Service High School Mathematics Teachers' Perceptions About Mathematics and Mathematics Teachers: A Metaphorical Approach

Yasemin Katrancı¹, Büşra Kıral², and Diler Kedikli³

¹Faculty of Education
Kocaeli University, Turkey

²Faculty of Education
İstanbul Aydın University, Turkey

³Ministry of National Education, Turkey

Abstract

This study aimed to examine the perceptions of pre-service high school mathematics teachers about the concepts of mathematics and mathematics teachers. Metaphors were used to reveal these perceptions. The study is descriptive. The study group was determined according to the convenient sampling method. In this scope, 46 pre-service high school mathematics teachers participated in the study. The data were obtained through the completion of the “Mathematics is like ..... because .....” and “Mathematics teacher is like ..... because .....” statements by the participants. In the analysis and interpretation of the data; i) naming, ii) elimination, iii) category, and iv) validity-reliability stages were followed. As a result, mathematics is mostly expressed with the metaphors of sea, people, food, and way. These metaphors revealed that pre-service high school mathematics teachers perceived mathematics as “a necessity that is difficult to understand, but in everything and everyone needs, as well as its eternity”. The concept of mathematics teacher is mostly stated with the book and mother metaphors after the compass metaphor. These metaphors showed that pre-service high school mathematics teachers perceived the mathematics teacher as "a guide and instructor needed in all areas of life".

Keywords: high school pre-service mathematics teacher, mathematics, mathematics teacher, metaphor


Introduction

The answer to "What is mathematics?" varies according to purpose of using math, the mathematics subject use for certain purpose, the experience in mathematics and the interest in mathematics (Baykul, 2019). Kurant and Robbins (1967; quoted from Nasibov & Kaçar, 2005) highlighted the idea that "It is not possible to give a one-meaning, one-valued answer to a question in this way". Burton (2012) also states that there are many ways to answer this question. In this context, it can be said that it is not possible to make a single definition of mathematics and
it may even vary from person to person. Therefore, it can be said that how an individual defines mathematics is related to how he/she perceives mathematics.

Mathematics that allows us to understand the world we live in is a number and space science. Since mathematical concepts are obtained as a result of abstraction, mathematics is also expressed as a science of abstraction (Altun, 2014). Its abstract structure causes it to be perceived as a difficult lesson by the students. Students from primary school to university see mathematics as a boring, difficult, and disliked lesson (Uçar, Pişkin, Akkaş, & Taşıçı, 2010; Yetim-Karaca & Ada, 2018). Those students see mathematics as a difficult lesson causes them to stay away from mathematics and to fear it (Dursun & Dede, 2004). It is thought that this situation is caused by the abstract structure of mathematics as well as other factors (classroom environment, teacher, etc.) in the teaching environment. Bloom (1995) states that half of the variability among individuals in learning is due to factors such as cognitive, one-fourth affective, and the remaining quarter cognitive, and non-affective learning-teaching environment. From this point of view, it can be said that one of the factors affecting students' learning is the teacher who is in the learning-teaching environment. In this context, it is thought that the perceptions, attitudes, and approaches of the teacher in the learning process can directly affect the students. As a matter of fact, a teacher's understanding and perceptions of mathematics affect the teaching her/his students receive (Hill, Shilling, & Ball, 2004).

Lee (2005) suggests that there is a strong relationship between teachers' perceptions of mathematics and their teaching mathematics. Based on this idea, it is thought that teachers who have negative perceptions about mathematics will also reflect these perceptions in the teaching process. In order to prevent this situation, the negative perceptions of teachers, if any, should be determined and eliminated. One way of detecting teachers' perceptions of mathematics is to examine their orientation towards mathematics teaching (King, 2001). Teacher education during the university, the first place where these orientations started to occur, is also the place where negative perceptions that may occur can be detected and removed (Burton, 2012). Giordano (1991) also states that the negative perceptions of teachers in their mathematics teaching are related to their negative impressions on their mathematics education at the university. In addition, it is known that many pre-service teachers have negative feelings about mathematics (Swarz, 2006). Determining the beliefs, tendencies, perceptions, and attitudes of in-service and pre-service teachers is one of the main goals of the teacher education process and is important in terms of ensuring the professional development of teachers (Noyes, 2004). For this reason, it is deemed necessary to determine the perceptions of pre-service high school mathematics teachers about mathematics and mathematics teachers.

One of the methods that can be used to determine these perceptions can be seen as metaphors. Cassel and Vincent (2011) say that metaphors are a comfortable way for individuals to express their true thoughts and feelings about mathematics. The term metaphor is widely used in mathematics education to denote our way of thinking about mathematics in terms of physical and mental actions (McGowen & Tall, 2010). Metaphors are not only auxiliary mechanisms used for visualization or ease of understanding, but are also an important part of mathematical thinking (Lakoff & Núñez, 2000). Metaphor is the narration of unknown things through known things (Perry & Cooper, 2001). Lakoff and Johnson (2005) define metaphor as tools that help people perceive the world. Botha (2009) explains the simplest definition of metaphor about education as interpreting some unfamiliar educational events or actions through familiar ones. In short,
metaphors are things constructed by our minds and help us present one thing in terms of another (Lim, 1999). Lakoff and Núñez (2000), who believe that revealing the cognitive structure of mathematics makes mathematics much more accessible and understandable, think that the use of metaphors in this process makes mathematical concepts more understandable.

When the literature is examined, it is seen that Lim (1999) examines adults' perceptions of mathematics through metaphors, based on the idea that mathematical situations are encountered in different ways in daily life. Noyes (2006) aimed to identify the metaphors that pre-service high school mathematics teachers have formed on learning and teaching mathematics. Sterenberg (2008) investigated the metaphors that classroom teachers produced regarding mathematics. In a different study, Wood (2008) determined that the university students' metaphorical perceptions regarding the "What is mathematics?" question in five different countries. Güler, Akgün, Öçal, and Doruk (2012) examined the thoughts of pre-service secondary school mathematics teachers about the concept of mathematics using metaphors in their research. Yılmaz, Göçen, and Yılmaz (2013) investigated 370 pre-service teachers' perceptions of the concept of teacher through metaphors. The aim of Reeder, Utley, and Cassel's (2009) studies is to examine pre-service teachers' perceptions about teacher, student, mathematics lesson, and school. Demirkol and Ergin (2017), on the other hand, aimed to reveal the perceptions about the concepts of mathematics and mathematics teachers through metaphors. The aim of this study is to examine the concepts of mathematics and mathematics teacher through metaphors according to pre-service high school mathematics teachers.

- What are the metaphors that pre-service high school mathematics teachers (PHSMT) have produced about the concept of mathematics?
- Under which conceptual categories are the metaphors PHSMT have produced about the concept of mathematics?
- What are the metaphors PHSMT have produced about the concept of mathematics teacher?
- Under which conceptual categories are the metaphors PHSMT have produced about the concept of mathematics teacher?

**Methods**

**Research Design**

In line with the purpose of the research, research was designed in qualitative design and phenomenological method. Events are defined according to how they are perceived by the actors in a particular situation in phenomenology. Phenomenological methods are particularly effective in bringing individuals' experiences and perceptions to the fore from their own point of view and thus challenging structural or normative assumptions (Lester, 1999).

**Study Group**

Convenient sampling method was used to determine the study group. In this method, sampling is produced with the most accessible responders in order to achieve maximum savings (Cohen & Manion, 1989; Ravid, 1994). Pre-service teachers participating in this study are also studying at the university where one of the researchers is working. For this reason, they constitute the most
accessible population. In this framework, 46 pre-service teachers studying in the fourth grade of the high-school mathematics teaching department formed the study group. 39 pre-service teachers were female and seven pre-service teachers were male.

**Data Collection Tools**

The data for this study were obtained through the "Mathematics and Mathematics Teacher Metaphors Questionnaire (MMTMQ)" that were prepared by the researchers. The questionnaire consists of three parts. In the first part, the gender information of participants was asked. In the second part “Mathematics is like ..... because .....” was included. In the third part, “Mathematics teacher is like ..... because .....” sentence was included.

Participants were asked to write a metaphor expressing mathematics and the mathematics teacher in the first gap in the statements given in the second and third sections. They were asked to explain why they wrote this metaphor in the second space. In addition, the same metaphors can be produced by different pre-service teachers. Yıldırım and Şimşek (2008) stated that this is due to the individual's attribution of different meanings to the same metaphor. Therefore, the purpose of writing the produced metaphor can only be obtained from the answers given to the question of why. Therefore, in order to understand why the produced metaphors were produced, it was expected to write the reason why the metaphor was produced after the "because" statement.

These questionnaires, filled out by the participants, constituted the basic data sources of the researchers as documents. Although the completion of the questionnaire may vary according to variables such as the rate of thinking of the participants, creativity, semantic information for explaining the meaning attributed to the metaphor, the participants were given 20 minutes to fill out the questionnaire. In future studies, this period can be changed in accordance with the participants and the data collection tools to be used.

**Collection of Data and Data Analysis**

First of all, the collected questionnaires were listed. Then the questionnaires were coded as PHSMT1, PHSMT2 as Pre-Service High School Mathematics Teacher = PHSMT. After this coding, the content analysis of the data was completed. In this analysis, the main purpose is to obtain concepts and relationships in order to explain the data obtained. The process for this purpose involves gathering similar data under certain concepts and themes, organizing and interpreting them in a way that readers can understand (Yıldırım & Şimşek, 2008). In this process; i) naming, ii) elimination, iii) category, and iv) validity-reliability stages were followed (Saban, 2009). The operations performed at these stages are presented in detail below.

**Naming Stage**

All the data obtained at this stage of the analysis should be listed regardless of their validity. All metaphors obtained in this context are listed. It was determined that 46 metaphors were produced for mathematics and 44 for mathematics teachers. Although the number of participants was 46, the reason for having 44 metaphors for mathematics teacher is that two pre-service teachers did not produce metaphors for mathematics teacher.
Elimination Stage

At this stage, invalid metaphors and data with valid metaphors and invalid explanations should be eliminated. In this framework, the metaphors produced for both mathematics and mathematics teacher were examined one by one and it was checked whether they were valid in both metaphor and justification contexts. After the examination, it was decided that all the metaphors produced and their justifications were valid. As there was no metaphor eliminated at the end, the other stages were passed with the produced metaphors.

Category Stage

At this stage, metaphors about both mathematics and mathematics teacher concepts are examined in terms of common features and gathered under conceptual categories. When creating conceptual categories, the point taken into consideration is the category under which the metaphor and the thought attributed to the subject from the source of the metaphor should be included. One of the metaphors is "Mathematics is like a calculator because it makes operations easier." In this metaphor, while the source of the metaphor is "calculator", the thought attributed to its subject from the source is "facilitating operations". From this expression, it is thought that mathematics facilitates operations. As in this example, the researchers examined the metaphors produced for both mathematics and mathematics teacher separately. Each researcher gathered the metaphors under conceptual categories they determined. Afterwards, they came together and decided under which conceptual categories metaphors should be included. The determined categories are presented in the findings section.

Validity-Reliability Stage

In order to ensure this stage, all other stages must be handled by researchers separately. For this reason, the data obtained by all researchers were analyzed separately. Afterwards, the reliability for the obtained results was calculated with the formula (Reliability = Consensus/Agreement+Disagreement x 100) presented by Miles and Hubermann (1994). As a result, the agreement rate between researchers for the reliability of the data about metaphors for mathematics was 82.61% and the agreement rate for the reliability of the data about the metaphors for mathematics teacher was 88.64%.

Findings

The first sub-problem of this research was determined as "What are the metaphors that pre-service high school mathematics teachers (PHSMT) have produced about the concept of mathematics?" Pre-service teachers produced 46 metaphors about the concept of mathematics. These metaphors are shown in the mathematics metaphor cloud presented in Figure 1 below.

According to the mathematics metaphor cloud presented in Figure 1, the metaphors highlighted by pre-service teachers are road, sea, people, food, water, and phone metaphors. Findings regarding all these metaphors presented in Figure 1 are as presented in Table 1 below on frequency basis.
According to Table 1, it was seen that pre-service high school mathematics teachers have produced 35 different metaphors related to the concept of mathematics. As seen in Figure 1, the most frequently repeated metaphors by pre-service teachers are way, sea, human, food, water, and phone. The way metaphor was produced by four, and the metaphors of sea, people, and food were produced by three pre-service teachers each. Examples of these metaphors and their reasons are as follows.

Mathematics is like the way because everything in life passes through math. (PHSMT12)

Mathematics is like the sea because it has no end. (PHSMT28)

Mathematics is like a human because it is so difficult to understand. (PHSMT33)

Mathematics is like food because it appeals to everyone in all areas of life. Everyone needs it. (PHSMT35)

These metaphors are followed by water and phone metaphors produced by two pre-service teachers. Other metaphors were produced by one pre-service teacher. Some of these metaphors are bee, friend, house, etc. Examples of these metaphors and their related facts are presented below.
Mathematics is like water because it is always needed everywhere. (PHSMT37)

Mathematics is like a phone because it has multifunctional features inside. (PHSMT31)

Mathematics is like a maze because no matter how many ways you try, the result is unique. (PHSMT12)

The second sub-problem of this research was determined as, "Under which conceptual categories are the metaphors PHSMT produced about the concept of mathematics?" The aim here is to show how the pre-service teachers see mathematics in more detail. As a result of the evaluation made in this context, it was found that the metaphors produced regarding the concept of mathematics were collected in six different conceptual categories. These categories are Everything, Infinity, Necessity, Yield/Benefit, So-So, and Other. Findings related to these categories are as follows.

**Everything**

It has been determined that there are seven metaphors in the conceptual category of everything. These metaphors are handbag, way, phone, democracy, mother-in-law, clock, and pi. When these metaphors are examined, it is stated that mathematics is included in everything and that everything is in mathematics. For instance;

Mathematics is like a handbag because everything you're looking for always comes out of that bag. (PHSMT3)

Mathematics is like the way because everything in life passes through math. (PHSMT11)

**Infinity**

It has been determined that there are a total of nine metaphors in six different categories in the infinity category. These metaphors are bird, blank paper, sea, way, ocean, and deserted island. When these metaphors and their explanations were examined, it was determined that mathematics had an endless structure that always contained new things to be learned. For instance;

Mathematics is like the sea because it has no end. (PHSMT27)

Mathematics is like the ocean because it never ends. There are always new things to be learned. (PHSMT35)

**Necessity**

It was determined that a total of nine different metaphors were produced regarding the necessity category. These metaphors are healthy food, water, traffic, way, food, oxygen, human, and atom. When the explanations of these metaphors were examined, it was revealed that mathematics is necessary for life and a life without it is unimaginable. For instance;

Mathematics is like water because it is life. It is a basic need in all areas of our life. (PHSMT10)

Mathematics is like oxygen because life without it is unimaginable. (PHSMT40)
Yield/Benefit

It was found that four different metaphors were produced regarding the Yield/Benefit category. These metaphors are book, friend, phone, and calculator. In the explanations of the metaphors, it was seen that mathematics is expressed “the one that helps to change the perspective by facilitating the operations by expanding our horizons from which we get efficiency”. For instance;

Mathematics is like a friend because it broadens my horizons, can change my perspective. (PHSMT8)

Mathematics is like a calculator because it simplifies operations. (PHSMT39)

So-So

It was determined that six different metaphors were written about the So-So category. These metaphors are frame, rain, tune, human, picture, and bee. When the explanations of the metaphors were examined, it was seen that mathematics was complex/difficult and easy, bitter and sweet at the same time. For example;

Mathematics is like a bee because we taste its both bitterness and sweetness. (PHSMT43)

Other

In the other conceptual category, there were metaphors that did not match the categories specified above. In this context, 10 different 11 metaphors in total are included in this category. These metaphors are play dough, food, house, labyrinth, factory, poem, human, duster and pen, watercolor, and brother. According to the explanations of the metaphors, it was seen that the following features of mathematics were mentioned. Mathematics;

- is enjoyable if taught in judgment.
- is indispensable.
- includes one solution.
- inputs are important for the quality of the outputs.
- is difficult.
- is colorful

The third research problem was determined as "What are the metaphors PHSMT developed about the concept of mathematics teacher?" It was observed that the pre-service teachers produced 44 metaphors for the concept of mathematics teacher. These metaphors are firstly presented in the mathematics teacher metaphor cloud in Figure 2 below.

According to the mathematics teacher metaphor cloud presented in Figure 2, the metaphors highlighted by the pre-service teachers are compass, book, mother and clock. Findings regarding all these metaphors presented in Figure 2 are as presented below in Table 2 on frequency basis.
When Table 2 is examined, it is seen that pre-service high school mathematics teachers have produced 34 different metaphors about mathematics teachers. Compass metaphor was produced by five and book metaphor by four pre-service teachers. Examples of these metaphors and their reasons are as follows.

Mathematics teacher is like a compass because he/she shows our way. (PHSMT14)

Mathematics teacher is like a book because he/she teaches us new things as we read. (PHSMT17)

Three pre-service teachers produced the mother metaphor and two produced the clock metaphor. Other metaphors were produced by one pre-service teacher. Examples of these metaphors and their reasons are as follows.

Mathematics teacher is like a mother because mothers teach life. (PHSMT11)

Mathematics teacher is like a clock because we need him/her in every hour of the day. (PHSMT42)

The fourth and final sub-problem is "Under which conceptual categories are the metaphors PHSMT produced about the concept of mathematics teacher?" The aim here is to reveal in more
detail how pre-service teachers see the mathematics teacher. In this context, it was determined that the metaphors produced about the mathematics teacher were grouped into five different conceptual categories. These categories are Guide, Indispensable person, Tutorial, Wisdom, and Other. Findings about these categories are as follows.

**Guide**

It was determined that a total of eight different metaphors were produced in the Guide category. These metaphors are in the form of compass, navigation, road banner, and first aid kit. When the explanations of the metaphors were examined, it was determined that the guiding side of the mathematics teacher was emphasized. For instance;

- Mathematics teacher is like a road banner because he/she guides you in achieving your goals. (PHSMT12)
- Mathematics teacher is like a compass because he/she shows our way. (PHSMT13)

**Indispensable Person**

It was determined that there are three different metaphors associated with the indispensable person category. These metaphors are the cell phone, roof, and clock. When the explanations of the metaphors were examined, it was determined that the sine qua non characteristic of a mathematics teacher that we need at all hours of the day is emphasized. For example;

- Mathematics teacher is like a clock because we need him/her in every hour of the day. (PHSMT43)

**Tutor**

It was determined that there were 10 different, a total of 12 metaphors in the tutor conceptual category. These metaphors are mother, chef, book, versifier, sports trainer, rose, psychologist, painter, candle, and pen. According to the explanations, it was determined that informative role of a mathematics teacher was focused on. For example;

- Mathematics teacher is like a mother because mothers teach life. (PHSMT10)
- Mathematics teacher is like a candle because he/she gives information to students and enlightens them. (PHSMT39)

**Wisdom**

It has been determined that there are a total of nine metaphors in eight different concepts in the category of wisdom. These metaphors are novel, open buffet, Google, yellow pages, book, clock, box, and sunflower. According to the explanations of the metaphors, it was stated that the mathematics teacher has various information and everything that is sought can be found in him/her. For example;

- Mathematics teacher is like an open buffet because it has a wide variety of information. (PHSMT8)
- Mathematics teacher is like Google because you can find everything you're looking for in it. (PHSMT9)
Other

This category contains metaphors that do not match the above categories. In this context, it was determined that 12 different metaphors are included in this category. These metaphors are medicine, color, mother, tape, loadstar, painter, ocean, pirate, umbrella, a little boy, diamond, and idol. According to the explanations, the following features about the mathematics teacher are revealed.

- Mathematics teacher repeats the same things all the time.
- He/she is the brightest among all teachers.
- His/her glow brightens his/her surroundings.
- Everyone wants to be like them.

Conclusions, Discussion, and Suggestions

In this research, 35 different metaphors were produced by pre-service high school mathematics teachers to explain the concept of mathematics. Through these metaphors, it has been determined that mathematics is perceived by pre-service high school teachers as "in addition to its eternity, it is difficult to understand, but a need that is in everything and everybody needs". This result showed that more than one metaphor is needed to express mathematics. Lim (1999) concluded that adults use more than one metaphor to express mathematics. Noyes (2006) in his study with pre-service high school mathematics teachers and Sterenberg (2008) with pre-service classroom teachers found that mathematics was explained using more than one metaphor. Wood (2008) concluded in his study with university students in five different countries that mathematics was expressed using various metaphors. Güler et al. (2012) found that pre-service teachers tried to explain mathematics with 28 different metaphors. Demirkol and Ergin (2017) also stated in their research that pre-service teachers stated mathematics with various metaphors. The results of all these studies are similar to the result of this research producing more than one metaphor about mathematics. This may be due to the fact that a single definition of mathematics cannot be made. This shows that mathematics is a rich and comprehensive science.

The second result obtained from the study is that mathematics is explained with different conceptual categories by pre-service high school mathematics teachers. These conceptual categories are Everything, Infinity, Necessity, Yield/Benefit, So-So, and Other. The results obtained from the explanations of the metaphors in these categories are as follows. Mathematics;

- is connected with everything in life.
- contains infinite information.
- is a basic need.
- offers a different perspective.
- provides efficiency and benefit in different jobs.
- depends on the situation.
- is difficult and indispensable.
- contains one solution.

Lim (1999) found in his study that mathematics was addressed under the travel, skill, and game/puzzle categories. Noyes (2006), Sterenberg (2008), and Wood (2008) found that four
different conceptual categories related to mathematics were formed in their studies. The categories obtained in Noyes' (2006) research are language, toolkit, journey, structure, and the categories obtained in Wood's (2008) research are techniques, applications, life/career, and creativity. Güler et al. (2012) determined in their study that mathematics was explained by pre-service teachers in five different conceptual categories. The categories created are guide, need, perspective, eternity, and life itself. Demirkol and Ergin (2017) found that the metaphors produced were grouped under six different categories in their research. The results of all studies are in line with the result of this study that mathematics is explained with different conceptual categories. In all of the studies, the concept of mathematics has been discussed under conceptual categories, although there are different numbers of categories.

In the context of these results, a scale can be developed to determine the perceptions of pre-service high school mathematics teachers towards mathematics. By applying this developed scale in different samples, the states of perceptions towards mathematics can be determined. Thus, the direction of the perceptions can also be determined, and if there are negative perceptions, studies can be done to correct them.

The third result obtained from the research is explained by pre-service high school mathematics teachers using 34 different metaphors of the concept of mathematics teacher. These metaphors showed that the pre-service teachers perceived the mathematics teacher as “a guide and instructor needed in all areas of life”. Reeder, Utley, and Cassel (2009) also found in their study that there is no focus on a single metaphor for the concept of teacher. Similarly, Yılmaz et al. (2013) determined that pre-service teachers who study in different branches formed different metaphors about the concept of teacher. Demirkol and Ergin (2017) found that 46 different metaphors related to the concept of mathematics teacher were produced. The results of all the studies are similar to the result of this study explaining the mathematics teacher with more than one metaphor. It is thought that this situation may be due to the differences in the lives of all pre-service teachers with mathematics teachers in the past.

In the context of these results, it is recommended to carry out studies examining the effect of mathematics teachers on mathematics perception by repeating the study in different samples and comparing the obtained results.

The fourth result obtained from the research is that the concept of mathematics teacher is grouped under five different conceptual categories according to pre-service high school mathematics teachers. These categories are Guide/Guiding, Must-have, Tutorial, Wisdom, and Other. The results obtained from the explanations of the metaphors in these conceptual categories are as follows. Mathematics teacher;

- is a guide.
- is indispensable.
- is instructive, and is educative.
- is wise.

Reeder, Utley, and Cassel (2009) also determined that the mathematics teacher was explained by three different conceptual categories by pre-service teachers. These categories are journey, production, and growth. Yılmaz et al. (2013) found that the concept of teacher is expressed in
seven different conceptual categories. These categories are guiding, shaping, non-status, source of information, flexible, holy work, and model. Demirkol and Ergin (2017) found that the metaphors produced were grouped under five different categories. Although the categories differ in number and context, the results are similar.

On the basis of these results, the question "How should a mathematics teacher be?" can be asked to pre-service high school teachers. Thus, the link between pre-service high school teachers' perception of mathematics teachers and their expressions of how a mathematics teacher can be examined. It can be investigated whether their perceptions, influenced by their past experiences, describe the mathematics teacher they aim to become. This research may be seen as limited in terms of sample selection method and size. In this context, the research can be applied to larger samples.

References


https://digitalcommons.usf.edu/m3publishing/vol3/iss2021/50
DOI: https://www.doi.org/10.5038/9781955833042