Pre-service Teachers' Metaphorical Perceptions towards the Concept of Scientist

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ABSTRACT The purpose of this study is to display pre-service teachers' perceptions towards the concept of scientist through metaphors. Phenomenology, which is one of the qualitative research designs, was used in the study. Data was collected from 154 pre-service teachers studying in different departments of Ataturk Faculty of Education at Marmara University in Turkey, in the spring semester of 2013-2014 academic year. They were asked to complete the sentence "Scientist is like ..; because..." The collected data was analyzed through content analysis technique and interpreted accordingly. The findings indicated that 87 different metaphors were generated by the pre-service teachers for the concept of scientist. These metaphors were then categorized by considering their common features and 16 categories and 8 themes were obtained. It was concluded that pre-service teachers had positive perceptions towards scientist while two negative metaphors were found among the metaphors that pre-service teachers generated for the concept of scientist.

INTRODUCTION

Metaphors are one of the forms in which individuals express themselves with other beings. Levine (2005) states that the term metaphor derives from *metapherein* in Greek. Whereas *meta* means changing, *pherein* means bearing. Metaphor is defined as using words in different meanings outside their real meaning in an authentic and poetic language (Lakoff 1993; Kovecses 2005). Metaphor is evaluated as a strong *mental device* that the individual uses in understanding and explaining a highly abstract, complex or theoretical phenomenon (Yob 2003; Semino 2008). Metaphors direct individuals to the new ways of existence and thinking. Essentially, a metaphor is influential and meaningful (Yob 2003). They may establish some realities, social realities in particular; hence a metaphor may be a guide for the actions that are likely to occur in the future (Lakoff and Johnson 1980; Deignan

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2008). Metaphors are the reflection of social reality through similes and tropes. They enable educators to compare two things, draw attention to the similarities between them or explain something by replacing it with something else (Saban et al. 2006; Gibbs and Matlock 2008).

We use metaphors when we attempt to comprehend an element of experience in terms of another element of experience. They frame the human understanding in a partial but distinctive way. Metaphor is a useful device which makes possible to talk about a new concept (Yob 2003; Cameron 2010). Something may be more or less metaphorical and more or less literary. Yob (2003) states that a metaphor is not the phenomenon attributed to itself, yet it is a symbol of that phenomenon. If a metaphor were the attributed phenomenon itself, there would be no need for that metaphor. Therefore, a metaphor is different from the attributed phenomenon even when it attributes in a strong and effective way and a metaphor identifies much less than the attributed phenomenon in some aspects. Weade and Ernst (2011) also point out that metaphors are selective and they represent some parts of the phenomenon rather than the whole. They are paradoxical in structure. They may create strong comprehension opportunities that hold a distortion attribute. The way of seeing created with each metaphor may turn into a way of *not seeing* (Fauconnier and Turner 2008).

Metaphor is one of the strongest mental devices which constructs, directs and controls our thoughts about the formation and functions of the events (Yob 2003). However, there is not a consensus in our way of defining metaphors, how we can understand them and what they serve for telling us something (Fauconnier and Turner 2008). Metaphors are usually considered as simply a figure of speech for adorning the discourse; however they are of much more importance. Use of metaphors means a way of thinking and a way of seeing that generally pervade our comprehension of the world in daily life. Metaphors create a formative influence upon expressing ourselves as well as our way of thinking, our language and science. The importance of metaphors in individuals' daily life comprises much more than this (Goatly 1997; Saban et al. 2006; Gatti and Catalano 2015).

In recent years, an increase has been observed in the studies on metaphors. Some metaphor studies conducted in the field of education focused on the concepts such as inspector (Toremen and Dos 2009; Dos 2010), school (Saban 2008; Ozdemir and Akkaya 2013), teacher (Aydin and Pehlivan 2010; Kalyoncu 2012), school director (Cerit 2008; Yalcin and Erginer 2012; Tuzel and Sahin 2014), university teacher (Tortop 2013), student (Aydin and Pehlivan 2010; Capan 2010), education (Low 2008), giftedness (Olthouse 2014), academic writing (Wan 2014), learning to teach process (Gatti and Catalano 2015)and reflective thinking (Ersozlu 2013).

Scientist is an individual who thinks globally, has the courage of telling the truth, has high ethical responsibility and foresight, and who is objective, enlightened, open to criticism and responsible for all mankind and nature. A scientist also contributes to social production with his/her studies and aims at serving the society (Ortas 2011; Popper 2012). Scientist is the person who is educated in a field of science, able to use scientific methods, studies systematically and conducts research. A scientist acknowledges the events and phenomena as they are and respects the truth (Kuhn 1995; Erdem 2012). In this sense, Resnik (2004) points out that even if ethical, social and political values have an effect upon science, scientists always need to pay attention to being honest, clear and objective when they conduct research or they are asked about their opinions as an expert. Scientist is defined as the person who works in a scientific field (Shulman 1987; Barnett 2011).

It is significant that teachers have clear understanding of what the science is and what the scientists do, in that teachers who have clear perceptions towards the concept of scientist are likely to give a more comprehensive message concerning who can be the scientists of the future and who can produce science (Shulman 1987; Milford and Tippett 2013). Understanding science requires understanding the facts around several aspects of science (Ryder et al. 1999).

Graduate education is acknowledged as one of the most significant factors in raising scientist and conducting science policy. The main purpose of graduate education is to raise qualified manpower who produces and uses information, and will be able to solve problems with a critical and productive way of thinking (Akinoglu and Tandogan 2007; Akinoglu 2008a; Karaman and Bakirci 2010; Barnett 2011). The aim of higher education institutions and faculty members is not only "raising professionals", "conducting research" and "serving to society", but also raising "scientists" who are the prospective faculty members and will be able to conduct scientific studies in a field of science through "master's" and "doctorate" education. A scientist who has the ability to conduct experiments requiring specific skills and to construct experimental mechanism has considerably important contributions to carrying out and expanding theoretical research (Shulman 1987; Akinoglu 2008b; Barnett 2011; Ortas 2011; Erdem 2012; Usak et al. 2013; Damgaci and Aydin 2014).

Purpose

The purpose of this study is to collect the metaphors for the concept of scientist which were generated by pre-service teachers studying in different departments of Faculty of Education at a state university in 2013-2014 academic year and to determine their perceptions by classifying these collected metaphors under various categories. The question "What are the pre-service teachers' metaphorical perceptions towards the concept of scientist?"was searched for an answer and depending upon this question, the following sub-questions were asked:

1. What are the metaphors used by pre-service teachers for the concept of "scientist"?
2. Under which categories can the metaphors that were used by pre-service teachers for the concept of "scientist" be assembled?

METHODOLOGY

Research Design

This study was designed with phenomenology approach, which is one of the qualitative research methods. Phenomenology is used for examining the phenomena which the researcher actually recognizes but does not have an in-depth knowledge about (Creswell 2007). The aim of phenomenology is to focus on the phenomena that are not completely unfamiliar but are not comprehended precisely, either (Patton 2014). The phenomenon examined in this research process was how the pre-service teachers conceptualized their ideas about "scientist" by means of metaphors.

Study Group

The pre-service teachers who participated in the study were selected with purposeful sampling method based on voluntary participation and willingness. The study group consisted of the pre-service teachers studying in different departments of Ataturk Faculty of Education at Marmara University in 2013-2014 academic year. 111 of the pre-service teachers are female and 43 of them are male. Departments of the pre-service teachers are as follows:Religious Culture and Moral Education Department (n=36), English Language Teaching Department (n=24), Music Education Department (n=14), French Language Teaching Department (n=17) and Department of Guidance and Psychological Counseling (n=63).

Data Collection Instrument

Data collection instrument of the study is a fill-in-the-blanks form which was developed by the researchers. It includes a few demographic questions and a section in which the metaphors to be generated and explanations regarding the metaphors will be written down.

Data Collection

In this study, metaphors were collected based on the relation between what was like and what was liken, and pre-service teachers were then requested to define the relation of likeness in accordance with their own way of perception ("Scientist is like…….; because…….."). The main power in metaphors is in the questions about adjectives. Every individual may attribute a different meaning to the same metaphor. It is important to ask the question "why" in understanding these different attributed meanings and the reason why the metaphor is used (Creswell 2007; Yildirim and Simsek 2013). Data for gender and departments of the pre-service teachers were also taken as demographic data.

Data Analysis

Content analysis, which incorporates the phases of coding, finding the themes and organizing the data into codes and themes, was used in the data analysis. Content analysis is implemented when the research is not theoretically stated in an explicit way or a further in-depth analysis is needed (Creswell 2007; Yildirim and Simsek 2013). The metaphors and answers that were provided by the participants to the question in the fill-in-the-blanks form were analyzed in four phases: (1) coding data, (2) forming the categories, (3) organizing data into codes and categories and (4) ensuring validity and reliability. Data was analyzed with NVIVO 10 program. Each participant was also provided with a number and a code representing female pre-service teachers with "F" and male pre-service teachers with "M". For instance, 37F means the thirty seventh female participant.

Validity and Reliability

Reporting the collected data in a detailed way and explaining how the researcher has reached the conclusion are among the important criteria for validity in a qualitative research (Creswell 2007; Yildirim and Simsek 2013). The data collected in this study was attempted to be presented as in detail as possible including frequency, number of participants, direct quotations and codes of participants, conceptual categories and themes.

Considering the reliability of the study, opinions of three experts were asked in order to find out whether the obtained metaphors represented the themes or not. As a result of the researchers and experts' evaluations, agreement and disagreement values were calculated (Miles and Huberman 1994). This calculation indicated the proportion of reliability at a level of 93 percent.

RESULTS

This section includes the metaphors generated by pre-service teachers for the concept of scientist. Categories which were comprised of the metaphors and characteristics of them were then explained by drawing on the metaphors generated by the participants and quotations.

When the metaphors for the concept of scientist were evaluated, 150 valid metaphors and 87 different metaphors were obtained from 154 pre-service teachers. According to the obtained data, 16 conceptual categories were determined. These conceptual categories were presented with raw metaphors without examining the causal clauses in Table 1. As presented in the table, the metaphors for the concept of scientist are collected under the following categories: nature (43), object (28), profession (22), individual (21), animal (16), body (3), adjective (3), setting (3), body condition (3), proper noun (2), time (1), country (1), vehicle (1), clothing (1), entertainment (1) and search engine (1). It can be observed from the table that pre-service teachers mostly associated the concept of scientist with nature and this is followed by object, profession, individual and animal categories that embodied more metaphors than others respectively.

Pre-service Teachers' Reasons for Associating the Concept of Scientist with Metaphors

Pre-service teachers' reasons for associating the concept of scientist with certain metaphors were demonstrated in Table 2 under the following themes: the person who contributes to society (n=56), knowledgeable person (n=22), inquisitive, interested and inquiring person (n=22), undaunted person (n=17), explorer (n=15), person with strong creativity (n=11), sophisticated person (n=4) and unbiased person (n=3). The themes were presented by examining the reasons for the obtained metaphors.

Some of the participant statements about the themes presented in Table 2 are as follows:

Table 1: Metaphors and categories for the concept of scientist

Categories	Metaphors	Total number of metaphors	Number of different metaphors
Nature	color (2), alive, star (2), garden, sun (5), tree (6), cloud, moon (5), light (4), soil, beach, sea (2), ocean (3), seed (2), water (2), pomegranate, planet, pearl, rain, universe	43	20
Object	lantern (4), projection lens, book (6), candle (5), magic box, glass, tool, lamp (2), pencil, fishing rod, plug, chip, water hose, robot, mirror	28	16
Profession	sportsman, author, painter, artist, treasure hunter, astronaut (3), teacher (2), guide, explorer, diver (2), master, magician, sculptor, gardener, conductor, farmer, architect, soldier	22	18
Individual	child (7), baby (3), mother (4), beloved (2), student, human (2), gladiator, father	21	8
Animal	bird(3), ant(4), monkey, mole, bee (3), turtle (2), fish (2)	16	7
Body	brain, sense cells, heart	3	3
Adjective	thoughtful, curious, hardworking	3	3
Setting	factory (2), library	3	2
Body Condition	tiredness, patience (2)	3	2
Proper Noun	Fatma Sahin, Einstein	2	2
Time	era	1	1
Country	Turkey	1	1
Vehicle	bus	1	1
Clothing	pyjamas	1	1
Entertainment	movie	1	1
Search Engine	Google	1	1
Total		150	87

Table 2: Reasons for associating the concept of scientist with metaphors

Themes	N
Person who contributes to society	56
Knowledgeable person	22
Inquisitive, interested and inquiring person	22
Undaunted person	17
Explorer	15
Person with strong creativity	11
Sophisticated person	4
Unbiased person	3
Total	150

a. Scientist as a person who contributes to society

The theme, scientist as a person who contributes to society, was attained from the obtained metaphors. Some of the participant statements related to this theme are presented as follows:

"He/she contributes to education, namely science by conducting research" (17M)

"He/she contributes to himself/herself and humanity" (23F)

"He/she enables us to see new horizons by illuminating around" (5F)

"He/she takes a research subject from every science like a bee which takes pollen from every kind of flower, internalizes and presents it to humanity" (89M)

"He/she tries to meet all of our need. By inventing something continuously, generating solutions to the problems…" (34M)

b. Scientist as a knowledgeable person

The theme, scientist as a knowledgeable person, was attained from the obtained metaphors. Some of the participant statements related to this theme are presented as follows:

"He/she constantly renews himself/herself" (46M)

"He/she makes progress by drawing on science" (74M)

"He/she is an infinite sea" (139F)

"He/she "continually develops, makes progress and produces" (103M)

"He/she has profound knowledge on science" (19F)

c. Scientist as an inquisitive, interested and inquiring person

The theme, scientist as an inquisitive, interested and inquiring person, was attained from

the obtained metaphors. Some of the participant statements related to this theme are presented as follows:

"He/she asks 'What is this?', 'What is this?'" (147F)

"He/she always inquires" (13F)

"He/she is suspicious, inquisitive and investigative" (27M)

"He/she is always inquisitive, studies hard and is hardworking. An ant works for living and a scientist attempts to perform his/her vital activity since he/she needs science and research for living," (141F)

"He/she has curiosity and eagerness to learn like that of a new-born baby. A new-born baby always wonders and looks around until he/she becomes one or two years old or for a longer time. Just like a scientist…" (9F)

d. Scientist as an undaunted person

The theme, scientist as an undaunted person, was attained from the obtained metaphors. Some of the participant statements related to this theme are presented as follows:

"He/she should study, be inquisitive and interested in different fields, and meddle in everything like a bee. He/ she may not obtain a result, but will get more experience" (26F)

"He/she sometimes flows over with excitement, sometimes calms down when he/she gets tired and gives in, sometimes cleans around and sometimes leads to information pollution" (121M)

"He/she burns the midnight oil for illuminating individuals who need knowledge"(85M)

"He/she attempts to achieve what is difficult" (81F)

"He/she makes progress through the goal slowly with patience" (29F)

e. Scientist as an explorer

The theme, scientist as an explorer, was attained from the obtained metaphors. Some of the participant statements related to this theme are presented as follows:

"He/she uncovers treasure (science)" (67M)

"He/she discovers, invents, builds and illuminates many things" (107F)

"He/she reaches the sand by diving deep oceans" (49F)

"He/she wishes to reach space" (71M)

"He/she illuminates us within such ignorance that we may call darkness" (38M)

f. Scientist as a person with strong creativity

The theme, scientist as a person with strong creativity, was attained from the obtained metaphors. Some of the participant statements related to this theme are presented as follows:

"He/she creates paintings with new colors by combining different colors" (18F)

"He/she has a wide imaginary world…can reflect himself/herself about any issues" (59M)

"He/she integrates the relevant/irrelevant instruments, and introduces a product that is easy to understand and that creates a change. There may be various reflections and individual perceptions of a field / work / period" (138F)

g. Scientist as a sophisticated person

The theme, scientist as a sophisticated person, was attained from the obtained metaphors. Some of the participant statements related to this theme are presented as follows:

"He/she examines and evaluates all the events around" (88F)

"He/she considers everything at the same time" (20M)

"He/she regards the events as a whole" (4M)

h. Scientist as an unbiased person

The theme, scientist as an unbiased person, was attained from the obtained metaphors. Some of the participant statements related to this theme are presented as follows:

"He/she utilizes the knowledge in hand in an appropriate way" (76M)

"He/she should tell the truth precisely" (93F)

"He/she is reliable" (133M)

DISCUSSION

This study concluded that almost all of the 87 different metaphors generated by pre-service teachers for the concept of scientist were positive, which indicated that pre-service teachers had positive perceptions towards scientist. The study shows similarity with the studies conducted by Yalcin (2012), Tortop (2013) and Senel and Aslan (2014) within this respect. Among the metaphors generated by pre-service teachers for

scientist, there are only two negative ones which are "gladiator" and "tiredness". Studies such as Narayan et al. (2007) and Bang et al. (2014) also demonstrated some negative images of scientist.

When the metaphors generated in the present study were analyzed, it was indicated that scientists were perceived as knowledgeable, thoughtful, inquisitive and hardworking individuals. Huang et al. (2014) found a similar result in their study which showed that Chinese college students regarded scientists as knowledgeable, intelligent, committed and hardworking. However, Bang et al. (2014) presented that students' stereotypic images about the characteristics of scientists indicated a person working alone in the laboratory, having magic, and being shy, dangerous and mysterious. Their study displayed a different result with the present study in this respect. This case can be explained with the differences between the participants who were high schools students in the study conducted by Bang et al. (2014) and pre-service teachers in the present study.Characteristics of scientists can be perceived differently according to different variables such as level of education or experience.

Narayan et al. (2007) demonstrated in their study that a group of third grade students from India, South Korea and Turkey identified scientists as Einstein, Newton, Edison, Bell and Pasteur. Einstein is one the metaphors generated in the present study, as well. Their study also showed that some students from both the third and the seventh grades drew scientists as scary figures by labelling them as Evilla (evil), Cruella (cruel) and Witch (witch). Gladiator was one of the negative metaphors generated in the present study. It is worth to indicate that both students and pre-service teachers may have some negative perceptions towards scientists depending on various factors such as culture.

The theme "scientist as an explorer"was one of the themes in the present study. This finding shows a similarity with the studies conducted by Balki et al. (2003) and Guler and Akman (2006). Pre-service teachers' perceptions towards "scientist" can be considered as realistic in this sense. This situation may result from the fact that scientists have an image of a person who reads, investigates and invents something in daily life. Basic task of a scientist is to investigate and find out the unknown, or rather to explore.

Kaya et al. (2013) stated in their study that students generally considered scientists as a person who makes discoveries and inventions, engages in science, seeks to be helpful for humanity and works hard. The themes, scientist as "a person who contributes to society" and scientist as "an explorer" were also attained in the present study and these two studies can be regarded as similar in this respect. The results are considered to be related to the view that "Scientist should produce science not for the sake of science, but for the sake of society".

Bora et al. (2006) pointed out in their study that majority of students (85.3%) shared the same opinions about successful scientists in terms of their always being so open-minded, logical, unbiased and objective in their research. The theme, scientist as "an unbiased person" was obtained in the present study, which leads to a similarity between the two studies. One of the characteristics of scientists is to maintain an objective stance, to consider events and phenomena objectively and to explain results in an objective way.

CONCLUSION

The present study was conducted to investigate pre-service teachers' metaphorical perceptions towards the concept of scientist. The results demonstrate that pre-service teachers have generated mostly positive metaphors for the concept of scientist and they have positive perceptions towards scientists. They perceive scientists as individuals who are knowledgeable, inquisitive, undaunted, creative, sophisticated and unbiased and have contributions to society.

RECOMMENDATIONS

The study group consisted of pre-service teachers in the present study. Future studies can be conducted with faculty members and their metaphorical perceptions towards scientist can be investigated.

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