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Pre-Service Elementary Mathematics Teachers' Metaphors on Scientific Research and Foundations of Their Perceptions

Fatih BAŞ[1]

[1] Elementary Mathematics Teacher Education Department, Faculty of Education, Erzincan University, Erzincan, Turkey

Correspondence: Fatih BAŞ, Erzincan University Yalnızbağ Campus Faculty of Education 21400-Erzincan, Turkey. Tel: 90-446-224-0089/42218. E-mail: fbas@erzincan.edu.tr

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Abstract

In this study, it is aimed to investigate pre-service elementary mathematics teachers' perceptions about scientific research with metaphor analysis and determine the foundations of these perceptions. This phenomenological study was conducted with 182 participants. The data were collected with two open-ended survey forms formed for investigating the metaphors and their reasons, and the reasons which are important in shaping these perceptions. The data were analysed in descriptive and content analysis methods based on the aim of the study. The findings can be summarised as follow: The participants created 156 metaphors and the most cited metaphor is "universe". The most distinctive features of the scientific research given by the participants were its hierarchic structure in application, presenting new knowledge and requiring much effort. The least cited feature of the research was its falsibiality. In addition, it was found that though teachers, scientific research methods course and internet are very important in the process of perception creation about scientific research, the experts in the areas have little effect on this process.

Keywords: scientific research, metaphor, foundations of perceptions about scientific research, mathematics education research

1. Introduction

The scientific research is defined as the process which includes some stages as data collection with systematic processes for certain aims, analysing the data, interpreting the findings and reporting the study findings for readers (McMillan & Schumacher, 2006, pp. 11-12). The scientific research was conducted for different aims such as the desire to study unresolved questions, intellectual happiness, service to the society, gaining prestige (Kothari, 2004, p. 4), presenting the unknown and acknowledging the universe (Goddard & Melville, 2007, pp. 2-3); In the literature, there are a number of features given to this concept. These are as follow:

- empiric, systematic, replicable, falsibiality, repeatable, logical (Bhattacherjee, 2012, pp. 3-5; Bless, Higson-Smith & Kagee, 2007, p. 7),
- reductive, transmittable (Bless et al., 2007, pp. 8-9),
- infinite in other words the starting point of another study (Goddard & Melville, 2007),
- parsimony, requiring certain skills, important for the development of science (Bhattacherjee, 2012, p. 5)

Scientific research as an engine of the development has gained a great importance for societies in these days. Societies should do scientific research, produce information and follow current development in order to keep pace with scientific development processes. As a result, training individuals who shape the society on information and skills of scientific research concept in education systems is important emphasised. In this context, within the scope of educational programs in Turkey, it is intended to develop students' skills in doing research, producing and using information (MEB, 2013) and with a national ministry of education project competition named "This is My Work", it is intended to help elementary level students' producing projects in Science and Mathematics areas. To create these skills, one should firstly conduct a relevant network about science and the elements of science in students' minds. Although it is said that children's mind on these concepts were shaped in pre-school period (Güler & Akman, 2006), it was found that their mental development on these issues changed in the following ages, too (Buldu, 2006). Considering these facts, there are important duties for

teachers to create perceptions about a concrete knowledge about science, scientist, scientific research, etc. Because teacher is the foremost resource in creating these perceptions (Türkmen, 2008) and their attitudes towards science have a significant impact on their students' attitudes (Denessen, Vos, Hasselman, & Louws, 2015; Young, 1998).

Teachers' association with scientific research is much more than guiding their students to gain the concepts about scientific research. From a different perspective, constant scientific research should be conducted in education in order to increase the quality of education. Some part of this research is directly focused on teachers. For instance, 592 research articles about mathematics education published in 44 education journals during 2009-2014 in Turkey were analysed and found that 13% of the articles were directly about teachers (Baş, Sağırlı, & Işık, 2015). In addition, teachers sometimes become both the researcher and co-organizer in the research process. Collaborating with teachers in research is very important in the scientific research process (Baş, 2013; Biesta, 2007; Costa, Marques, & Kempa, 2000; De Jong, 2004; Ekiz, 2006; Hiebert, Gallimore, & Stigler, 2002; Shkedi, 1998; Wissiak-Grm & Savec, 2013; Vanderlindea & van Braaka, 2010; Yavuz, 2009).

According to the aforementioned literature review, teachers are very important and associated with the scientific research in creating scientific research perceptions in students and doing educational research. In order to teach adequate information about science to the students, teachers should accept teaching science as a main goal (Küçük, 2008), and voluntarily participate in scientific research processes as much as they can attend (Deniz & Çıtak, 2010). This case shows that attitudes have a leading effect in individuals' behaviours (Tavşancıl, 2002, p.65) and increases the importance of teachers' perceptions about scientific research. In this context, teachers' attitudes towards scientific research were studied in a number of studies (e.g., Cousins & Waker, 2000; Ekiz, 2006; İlhan, Şekerci, Sözbilir, & Yıldırım, 2013; Kayır, Bayar, Eğmir, Bayar, & Ödemiş, 2013; Korkmaz, Şahin & Yeşil, 2011b; Öztürk, 2011; Papanastasiou, 2005; Shkedi, 1998; Walker, 2010) and their awareness about the studies (e.g., Costa, Marques, & Kempa,2000; Çepni & Küçük, 2003; Ekiz, 2006) and their beliefs about the scientific research (e.g., Çepni & Küçük, 2003; Ekiz, 2006; Everton, Galton, & Pell, 2000; Günay, Hamurcu, Akmaca, & Şahbaz, 2005; Yavuz, 2009) were reviewed.

In determining teachers' attitudes and behaviours, their experiences in pre-service education period can be accepted as an invaluable resource (Baki & Gökçek, 2007). Agreeing the significant effect of pre-service education on attitudes, many studies dealt pre-service teachers' attitudes towards scientific research in different areas (Bibi, Lqbal, & Majid, 2012; Biçer, Bozkırlı, & Er, 2013; Butt & Shams, 2013; Çelik, Gazioğlu, & Pesen, 2012; Konokman, Tanrıseven, & Karasolak, 2013; Korkmaz, Şahin, & Yeşil, 2011a; Papanastasiou, 2005; Polat, 2014; Yenilmez & Ata, 2012). The relevant studies showed different findings such as pre-service teachers have positive attitudes (Konokman et al., 2013; Korkmaz et al., 2011a), moderate level of attitudes (Biçer et al., 2013; Polat, 2014), neutral attitudes (Yenilmez & Ata, 2012) and negative attitudes (Butt & Shams, 2013). In addition, some of these studies tackled different variables which can be effective on the attitudes and some of these variables and their effects were summarised in Table 1.

Table 1. Variables on pre-service teachers' attitudes, studies and their findings

Variable	Create Difference	Do not Create Difference
Major	Bibi et al., 2012; Butt & Shams, 2013	Konokman et al., 2013; Polat, 2014
Grade level	Biçer et al., 2013; Yenilmez & Ata, 2012	Polat, 2014
Taking or not taking a course related to scientific research	Yenilmez & Ata, 2012	Polat, 2014
High school graduation type*	Yenilmez & Ata, 2012	Polat, 2014
Gender	-	Bibi et al., 2012; Konokman et al., 2013; Polat, 2014; Yenilmez & Ata, 2012

*In evolution processes of these studies, high schools in Turkey differ in types as general, Anatolian (schools accepting students with a certain scores after elementary Scholl graduation and foreign language–based ones), Anatolian teacher (schools enriched with the program of training teachers), science (schools accepting students who have high scores and focused mostly teaching mathematics and science courses like physics, chemistry) and vocational high schools (schools focused on training students in vocational areas like electrics, electronics, forging, etc.). Turkish National Ministry of Education put into force some radical changes about high school types after 2013.

Table 1 indicates that there are different results about the pre-service teachers' perceptions according to the variables, major, grade level, taking or not taking a course related to scientific research. But there is not any difference in gender. In addition to these attitude studies, Küçükoğlu, Taşgın, and Çelik (2013) investigated pre-service teachers' beliefs about scientific research process and found that teachers think that they do not need to make research but scientific research will be helpful for their professional development. Another important point about the attitudes towards scientific research is the issue of how the scientific research concept is perceived. On this issue, Miller (2004) in the study about civil society reached the finding that though scientific literacy percentage of the society is only %20 of that society, scientific research is highly important for individuals' economic development and life quality. In sum, in order to increase the interest of the individuals in a society, individual should have an appropriate way of thinking, positive attitude and necessary skills for scientific literacy. Therefore, there is a heavy burden for teachers. Another issue, following educational research in their area, adopting the suggested applications in the research and taking an active role in the educational research are necessities for being up-to-date teachers. In this context, teachers' current perceptions related to scientific research have a directional impact over their attitudes. Therefore, teachers' being graduated with true perceptions related to scientific research in their pre-service period before their teaching practices has crucial importance for their following practices. During the literature review process of the study, there could not be reached enough study specifically focusing on the pre-service teachers' perceptions about the concept "scientific research". Considering above issues, this study aims to investigate pre-service elementary mathematics teachers' perceptions about scientific research with metaphor analysis and determine the reasons of these perceptions. With this aim, below research questions were asked.

1) What are the metaphors of pre-service elementary mathematics teachers' perceptions about scientific research?
2) What are the features of scientific research concept given in the pre-service elementary mathematics teachers' metaphors about scientific research?
3) What are the foundations underlying pre-service elementary mathematics teachers' forming perceptions about scientific research?

2. Method

This study aimed to present pre-service elementary mathematics teachers' perceptions about scientific research and reveal underlying foundations of these perceptions. In accordance with the aim, a phenomenological research method which attempts to reveal in detail how individuals make sense of their experience and how they turn their experience into consciousness (Patton, 2002, p. 104), was adopted in this study to research the study

aim. In this revealing processes, metaphor which is much more than a linguistics structure, imbedded in people's daily lives, thinking and actions (Lakoff & Johnson, 2003, p. 4) and also which helps to research a particular phenomenon with an authentic and creative perspective (Carpenter, 2008) was used in the study.

2.1 Participants

The participants of the study comprised of 182 pre-service teachers (59 third grade and 123 fourth grade university students) who took education in elementary mathematics teaching department of a Turkish university located in eastern part of Turkey. The participants were chosen with purposeful sampling strategies in two phases. In the first phase, typical case sampling strategy which aims to collect data by determining a typical sample which is not an extraordinary, but an average part of universe and also gives general information about the entire universe (Patton, 2002, p. 236) was used. Therefore, an average university was selected according to students' entrance scores to the education faculty, numbers of the students and student profiles by considering general universities in Turkey. In the second phase, criterion sampling strategy which aims to determine a certain group in terms of particular features of the researched issue (Patton, 2002, p. 238) was used. Then, the students in the department of Elementary Mathematics Teaching who got training on Scientific Research Methods were determined with this criterion. Scientific Research Method is a course in the mathematics programme serviced in the III. Semester of education period as a two-hour per-week course. The content of the course is as follows: Science and its fundamental concepts (phenomena, knowledge, absolute, true, false, universal knowledge etc.), fundamental details about history of science, structure of scientific research, scientific research methods and different viewpoints about these methods, problem, research design, sample, data collection, data collection methods (quantitative and qualitative), recording data, analysis, discussion and reporting.

2.2 Data Collection Instruments and Procedures

Two data collection instrument were used within the scope of the study. The structure and data collection periods of these instruments can be summarised below.

The data about the first and second problem were gathered with the Determining Metaphors Related to Scientific Research Form. The form has two sections. The first section included the intention of the form with the sentence *"In this form, you are asked to write a metaphor that you stimulated much in your life related to scientific research with its reason."* In addition, two examples from the literature review in this section to ease students' understanding of metaphor writing and which do not direct students' answers were given. These metaphor examples are as follow:

> *Global warming is like a battle of nature, because it is the struggle of nature against human destruction.*
>
> *Geography is like a pine-tree, because a pine-tree has always its leaves in all seasons like geography. Geography is always nice and enjoyable.*

In the second section, a question "*Scientific research is like .... Because ..."* was given to the students in order to write their stimulations.

After the distribution of the forms, meaning of metaphor and the metaphor examples were explained in detail to students and they were asked to write their metaphors regarding the scientific research. Then they were asked to write firstly their stimulation and in the second sentence to write their reason of their stimulation. In this process, students' influences to each others were prevented.

For the third research question, an open-end question form named "Reasons of Perceptions regarding Scientific Research Questionnaire" was used. In the questionnaire, students were asked to range their preferences about the foundations which played role in their perception creation processes related to scientific research concept by starting from the most to the least effective one. Based on experts' viewpoints, some examples like *"teacher, peer, science courses, scientific research methods course, cinemas, TV programmes, course-books, other books, etc."* Were presented to the students to clarify what means the foundations in the question.

Later, the form was given to each student and students' influence to each other in answering process was prevented. Lastly, the data taken from these two forms were transferred to computer for the analysis process.

2.3 Data Analysis

In the data analysis process, descriptive analysis method to analyse data according to reach certain conceptual structures and content analysis method to reach the relationships and concepts to describe the data (Yıldırım & Şimşek, 2008, pp. 224, 227) were used. In this process, four experts from the qualitative research area and the researcher took part in analysis. In every step, an expert (Expert A) was stabilised and others were changed in

order to gather new viewpoints and keep the older ones. Analyses were conducted in three steps based on the research questions. The content of each step was shown in Figure 1.

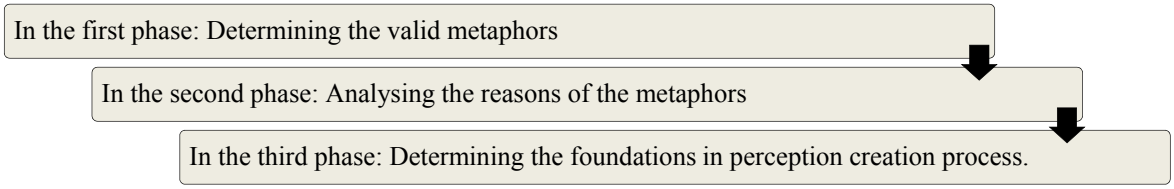
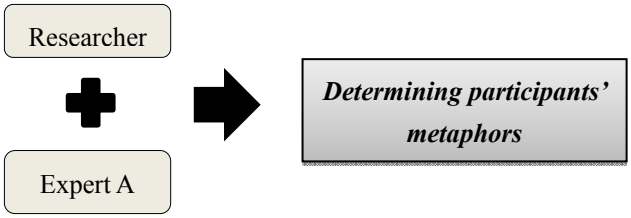


Figure 1. Data analysis process

In the first phase:



For the first question *"What are the metaphors of pre-service elementary mathematics teachers' perceptions about scientific research?",* it was aimed to determine the valid metaphors and their reasons. After the analysis, 7 of 182 metaphors were accepted as invalid one and were not considered for the main analyses. An example of invalid metaphor is below:

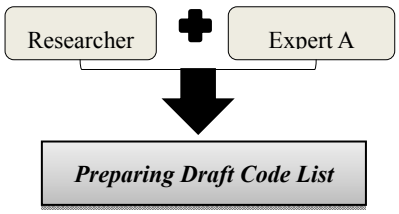
> *S67: Scientific research is like a nightmare. Because I did not understand that course, it was a very difficult course and I failed in its final exam. I took some time to pass that course. I did not like the course, too. Reading article is really difficult and understanding how to write an article is much more difficult than reading. That is why I said a nightmare, I was afraid of that course.*

In this answer, the participant associated the concept with the scientific research methods course and his/her answer was accepted as an invalid metaphor. Remaining 175 metaphors were given in table with their frequencies.

In the second phase;

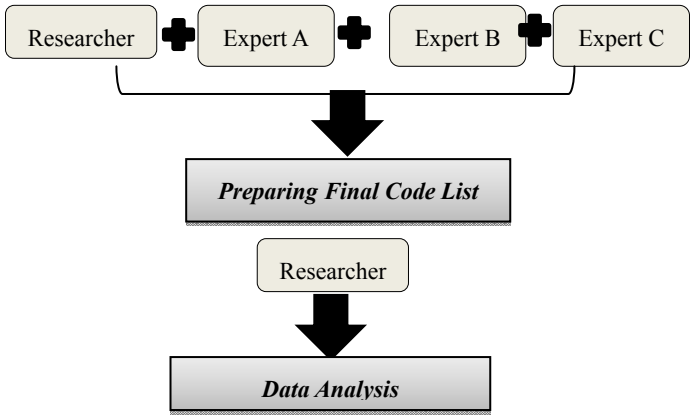
For the second question *"What are the features of scientific research concept given in the pre-service elementary mathematics teachers' metaphors about scientific research?",* it was aimed to analyse the reasons of the metaphors and these reasons in content analysis method. This analysis process took part in four steps as draft code list, final cod list, data analysis and reliability of the analysis.

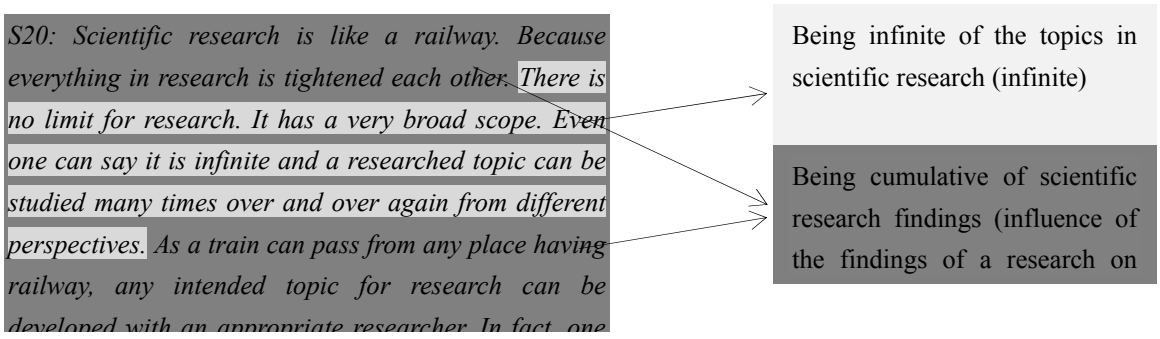
Preparing draft code list: In this step, the data were read and analysed by the researcher and Expert A. At the end of the step, 40 codes about the reasons about the scientific research were determined.



Preparing final code list: In this step, the draft code list formed and coded by the researcher and Expert A, was analysed with Expert B and C. Based on the literature 39 codes were grouped under 11 categories. The details about these categories and frequencies of each category were given in the findings section.

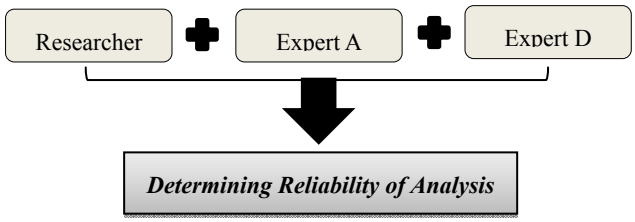
Data analysis: Based on the final code list, main analysis was conducted by the researcher. A sample of the analysis process is given below.





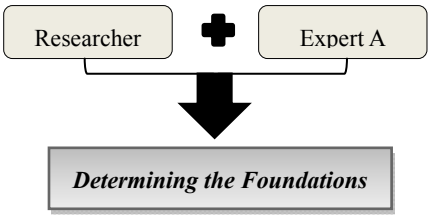
Student 20's reasons for the railway metaphor analysed with two codes. In valid 175 metaphors, it was seen that 3 students associated the scientific research with scientific articles. From the remaining 172 metaphors, 344 codes were developed.

Determining reliability of analysis: In this step, reliability of the analyses was tested. Then, the analyses were investigated by the experts A and D. Based on the Miles and Huberman (1994), firstly agreement and disagreement on each concept were determined, and later the reliability was calculated with the formula (Reliability =Agreement / (agreement + disagreement) and found as 77.9%. Later, 16.5% of the codes were accepted and 5.5% were refused in the disagreed codes. In qualitative studies being agreement percentage over 70 is enough for the reliability criterion (Miles & Huberman, 1994). The reliable findings were presented in tables and figures with frequencies and percentages.



<u>In the third phase</u>;

For the third question *"What are the foundations underlying pre-service elementary mathematics teachers' forming perceptions about scientific research*?", students' answers in the second data collection instrument about underlying foundations in the perception creation process were descriptively analysed. In this phase, students wrote totally 924 foundations as follow: 9 participants (2), 17 participants (3), 50 participants (4), 41 participants (5), 25 participants (6), 28 participants (7), 7 participants (8), 2 participants (9), and 3 participants (10). In the analysis process some of the foundations in the example "school" were disregarded as the school can contain some elements from courses, teacher and peer, and it does not emphasizes a certain resource. Then, 78 answers were accepted as invalid and the analysis conducted with 847 answers. From these valid answers 9 categories were created with 40 codes. The findings related to these codes and categories were presented with their frequencies and percentages in tables and graphics.



3. Findings

This section respectively presented the findings related to three research questions.

3.1 Findings of the First Research Question "What Are the Metaphors of Pre-Service Elementary Mathematics Teachers' Perceptions about Scientific Research?"

After the content analysis, 7 metaphors of 182 participants were accepted as invalid and the remaining 175 metaphors accepted as valid metaphors. From the valid metaphors 156 different metaphors were determined and they were shown in the Figure 2 below.

Figure 2. Metaphors stated by the participants

Within the metaphors in the Figure 2, universe (7), human (3), trip (3), mathematics (2), human brain (2), tree (2), ocean (2), soil (2), heart (2), love (2), sea (2), baby (2) and detective (2) were stated more than one time. The other 143 metaphors stated only one participant. Some examples about the reasons of these metaphors are below:

S36: Scientific research is like a universe. Because it develops constantly. There is not a limit about the research topic. The more are there different living organism in the universe, the much topic difference is there in the scientific research.

S138: Scientific research is like love. Because interest towards science can not be developed without love. In order to succeed a job, firstly you need passion and later you should show your passion with your attitudes and behaviours. Then, the scientific research is love.

S175: Scientific research is like a lizard tail. Because it is always renewed. Data analyses soft-wares used in the scientific research are replaced with newer ones when they become inefficient or useless in need. In other words, a lizard escaping form illiteracy has to renew its tail.

In the Figure 2, the metaphors "Beşiktaş and KPSS" are country specific metaphors. Beşiktaş is a famous football team in Turkey and the participant S174 associated the happiness when his/her football team wins a football match with the happiness felt when s/he reaches the findings of a scientific study.

KPSS is a national exam for selection of teachers who will work in state school in Turkey and this metaphor

symbolises a student studying for this exam. S77 associated studying for KPSS with the scientific research as both concepts have achieved by following certain steps and need much effort.

3.2 Findings of the First Research Question "What Are the Features of Scientific Research Concept Given in the Pre-Service Elementary Mathematics Teachers' Metaphors about Scientific Research?"

In order to determine the participants' reasons in giving justification their metaphors to the features of scientific research, the data were subjected to content analysis. Analysis findings showed that three participants associated the scientific research concept with the article. The remaining 172 participants' reasons of their metaphors were analysed with 39 codes. 344 codings were categorised under 11 categories such as systematic, repeatable, requiring and supporting motivation, having a certain purpose, contributing to human development, falsibiality, unpredictable, infinite in subject areas, necessary for science, constantly changing and cumulative structure in findings. These categories were shown below in Figure 3.

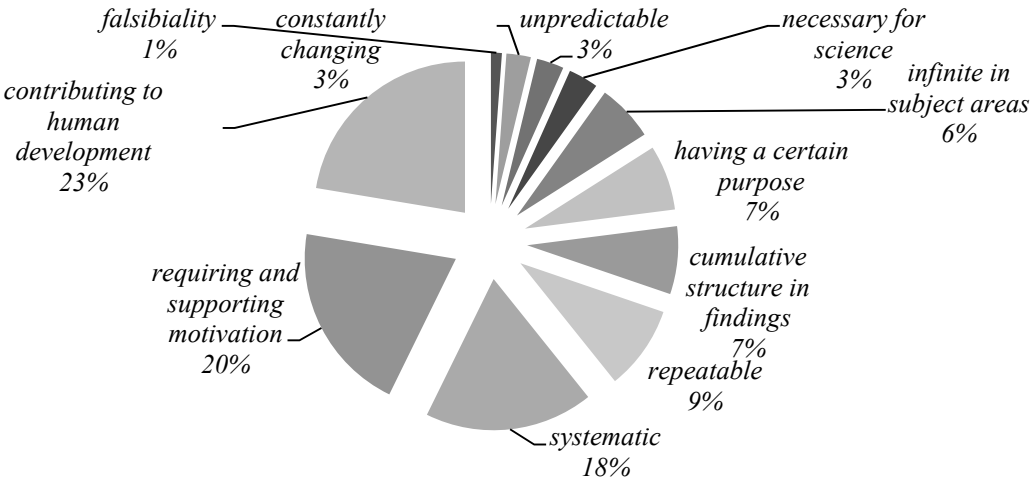


Figure 3. The features of scientific research according to categories

As presented in the Figure 3, contributing to human development" (22%), requiring and supporting motivation (%20) and systematic (18%) are mostly cited features of the scientific research. The least cited ones are necessary for science (3%), constantly changing (3%), unpredictable (%3) and falsibiality (1%). Codes used in categorization and examples to these codes were given below.

- Category: Contributing to human development; Scientific research produces new information (n=37), supports useful information (n=17), gives exact results (n=11), presents valuable products (n=9) and interesting findings (n=3),

S32: ... By researching an unknown concept, it presents very different findings. This surprises people. Sometimes it yields a very simple fact that we cannot figure out. At that time we wonder why we have not realised so far. Sometimes it yields very interesting results and this really surprises us. ... [code: presenting interesting findings]

- Category: Requiring and supporting motivation; Scientific research has two motivational types. The first one is processed based with the features requiring effort (n=27), needing wonder (19) and interest (9); the other one is result-based with the features giving happiness (11), increasing desire to learn (1), giving enjoyment after success (1), gaining positive emotions (1) and increasing self-esteem (1).

S106: ... Human explores and discovers something with wonder. Scientific study is an outcome of the feeling of wonder. ... [code: needing wonder]

- Category: Systematic; Scientific research is conducted by following certain steps (56), has different methods based the subjects (5) and needs expertness (1),

S118: In order to move hands, legs, firstly human brain controls nervous systems about these organs and later the movement occurs. In a scientific research firstly a problem is presented, and later it works like nervous system between brain and body parts. [code: conducted by following certain steps]

- Category: Repeatable; Scientific research conducts detailed analysis (n=13); uses valid measurements (n=7), needs accurate research process (n=4), is objective (n=2), contains subjectivity (n=2), uses different data collection instruments (n=2) and can be generalised (n=1),

S86: Photograph does not reflect the reality. Some photographs can be misinterpreted by other and interpretation changes from individual to individual. Though a photograph is single object, it can have very different interpretations according an ivory tower perception.… [code: containing subjectivity]

- Category : Cumulative structure in findings; Scientific research is a starting point of another study (n=13) and has cumulative effect on other studies (n=12),

S133: When we dig a hole, we come across new items. In a scientific research we conduct exploration, each new finding introduces new research topics and this process has no ending. [code: starting point of another study]

- Category: Having a certain purpose; Scientific research aims to produce new things (n=7), ease human life (n=6); understand world (n=5), meet generated needs (n=5), gain respect (n=1),

S119: … When considered the necessities of the life, absent features appear and requirements for life increase. Therefore we need further exploration. … [code: meeting generated needs]

- Category: Infinite in subject areas; Scientific research is limitless (n=16) and has numerous topics (5),

S3: Universe is so board that each edge needs exploration. It is limitless. Scientific research is like universe, both of them are limitless. … [code: limitless]

- Category: Necessary for science; Scientific research is necessary for science development (n=7) and understanding science (n=4),

S145: When scientific research stops, scientific development stops, too. This is like someone who breaks his backbone, loses his flexibility in life. … [code: necessary for science development]

- Category: Constantly changing; Scientific research renews itself (n=6) and has continuity (n=3),

S103: … scientific research is like infinite years, it is everlasting. It does not have an end. … [code: continuity]

- Category: Unpredictable; Scientific research has unpredictable outcomes (n=5), can present harmful results (n=3) and is unclear about reaching results (n=2),

S141: … One does not know what s/he will come across. Sometimes one meets a great surprise by finding something unknown and becomes happy. But sometimes it makes unhappy by yielding nothing or any important result. … [code: unpredictable outcomes]

- Category: Falsibiality; Scientific research can yield wrong results (n=4)

S6: … The first finding may be wrong. One reaches the truth with different studies by getting help from false attempts. [code: yielding wrong results]

In addition to general distribution of the categories, distribution of codes were determined and given for more detailed findings in the Figure 4.

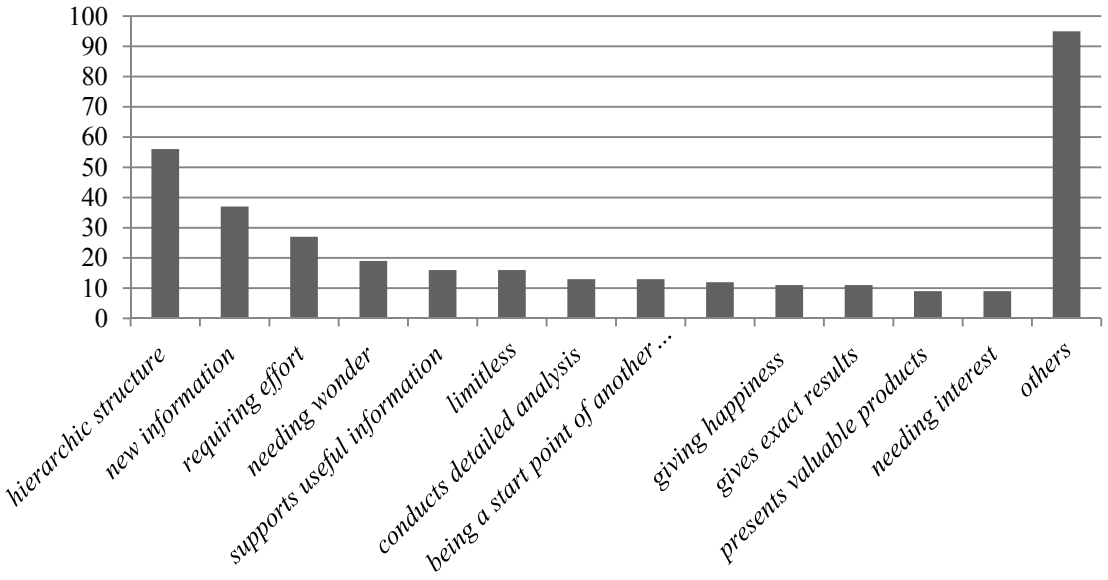


Figure 4. Distribution of the features of scientific research according to codes

As seen in the Figure 4, the frequency of codes changed between 1 to 56 and average frequency was approximately found 8.40. The codes having higher frequency rate than the average were as follow: hierarchic structure in application (56), presenting new knowledge (37), requiring much effort (27), needing wonder (19), presenting useful results (16), being infinite in subject areas (16), having detailed analysis (13), being a start point of another study (13), having cumulative effect on other studies (12), tasting happiness at the end (11), producing valuable outcomes (10), yielding exact results (10) and requiring interest (9).

3.3 The Findings of the Third Research Question "What Are the Foundations Underlying Pre-Service Elementary Mathematics Teachers' Forming Perceptions about Scientific Research?"

The data gathered with open-ended question form which is related to underlying foundations in the perception creation were descriptively analysed. The analysis showed that 846 valid answers from 182 participants were categorised under 9 categories (teachers, courses, films and TV programmes, books, social environment, computer-internet, faced scientific events and presentations, experts and others) with 40 codes. Distribution of these categories was shown below in Figure 5.

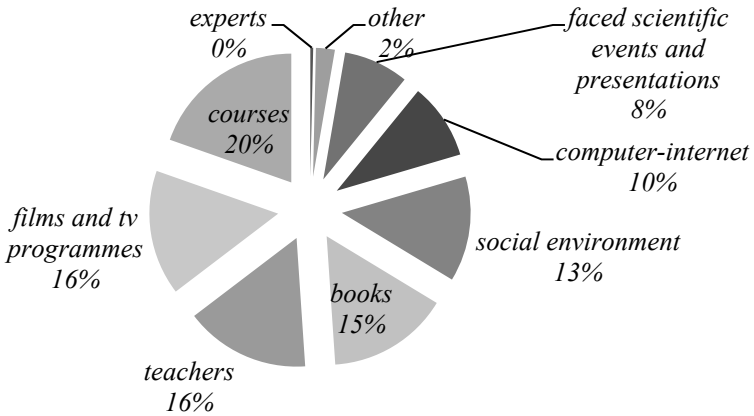


Figure 5. Distribution of underlying foundations in perception creation process

As shown in the Figure 5, while the participants stated most *courses (%20), teachers (%16), films and TV programmes (%16) and books (%15), they stated the categories the others (%2)* and experts *(%0)* the least. The

codes in these categories were as follow:

- Category: Courses; scientific research methods (103), science course (53), other course in the curriculum (5), research homework (4), other (1),
- Category: Teachers; teacher (n=133),
- Category: Films and TV programmes; TV programmes (78), films (42), documentaries (12), scientific videos (1),
- Category: Books; course-books (84), various books (35), encyclopaedias (6), scientific research books (4),
- Category: Social Environment; peers (93), family (10), society (9),
- Category: Computer-internet; internet (65), computer (16),
- Category: Faced scientific events and presentations; articles (31), dissertations (6), scientific journals (5), projects (6), research (5), experiments (3), exhibitions (2), conferences (2), trips (2), technology magazines (2), technological developments (2), scientific writings (1), posters (1), , science and technology clubs (1),
- Category: Experts; lives of scientists (2), field experts (1),
- Category: Others; individual observations (9), news (4), newspaper (4), radio (1), TÜBİTAK (The Scientific and Technological Research Council of Turkey) (1), museum (1).

In addition to these findings, a detailed table was created according to importance rate of these categories. When considered the frequencies of the codes, 8 highly stated codes in almost each category were determined and the rest 32 codes were given under the category "other codes". The findings were shown in Table 2.

Table 2. Importance rate of the underlying foundations in perception creation process

Foundation / Foundation Rate	*1. Foundation*	*2. Foundation*	*3. Foundation*	*4. Foundation*	*5. Foundation*	*6. Foundation*	*7. Foundation*	*8. Foundation*	*9. Foundation*	*10. Foundation*	Total
Teachers	49	36	27	14	3	3	-	1	-	-	133
Scientific research methods course	43	24	12	12	9	2	1	-	-	-	103
Peers	4	17	18	27	9	10	5	2	1	-	93
TV programmes	6	8	11	17	13	15	5	3	-	-	78
Course-books	9	-	19	18	21	1	6	-	-	-	74
Internet	22	9	13	9	7	2	1	1	-	1	65
Science courses	5	10	15	12	5	4	1	-	-	-	52
Films	2	7	2	5	14	5	6	1	-	-	42
Other codes	40	68	52	38	24	23	8	5	2	2	262

Table 2 indicated that many foundations specifically teachers, scientific research methods courses, peers, TV programmes, course-books, internet, science courses and films have a great impact in pre-service teachers' perception creation process.

According to the importance rate in the table, the most important ones were teachers, scientific research methods course in the curriculum and internet. In addition, course-books in their undergraduate years, peers and TV programmes were also effective in this process.

4. Conclusion and Discussion

In this present study conducted with 182 participants and aiming to analyse metaphors of pre-service elementary mathematics teachers' perceptions about the scientific research and determine the underlying foundations in the perception creation process, below findings were found.

The participants formed 156 valid metaphors. The most cited metaphor of the participants is the universe which indicates being limitless of scientific research, cumulative structure of the findings of the research and producing new products. In addition to this metaphor, metaphors human and trip were given three participants; mathematics, human brain, tree, ocean, soil, heart, love, sea, baby and detective were given two participants, the remaining 143 metaphors were given once by each participant. Metaphors in this study such as soul, geographical discoveries, teacher, road, rain, mathematics, new born baby, nature, puzzle, cook, past days, snowball (A. Derman & S. Derman, 2015), tree roots, alive, exploration, ladder, journey, path, meal and journey (Şenel & Arslan, 2014) and universe, ladder, food, world, human, sun, tree, sea, sky, ocean, river, life (A. Derman & S. Derman, 2015; Şenel & Aslan, 2014) are similar to other studies conducted with students' metaphors in different majors and also their reasons of their metaphors have similarities. In these studies, the universe is associated with scientific research with its infinite structure. Very little proportion of the participants associated the scientific research with the scientific article. In addition, being close of the valid metaphors (n:175) to the numbers of the participants shows that students have adequate level of perception towards scientific research and numerous metaphors indicate that they have various associations about the structure.

The participants have different associations about scientific research in their minds and their reasons of these associations were categorised under 11 categories. Among these categories contributing to human development is the most cited one. This finding is consistent with the result of Miller (2004) which says that scientific research is important for increasing economic development and quality of life. The other categorised emphasised are requiring and supporting motivation, and its systematic process. This much emphasis on its systematic structure may result from much emphasis on being systematic of scientific research process (e.g. determining problem, hypothesising, etc.) in the scientific research methods course and the resources. Other features stated by the participants are its repeatable, cumulative structure in findings, having a certain purpose and infinite in subject areas. Necessary for science, constantly changing, unpredictable and falsibiality are the least stated features

With a more detailed expression, the features of scientific research given by the pre-service teachers are hierarchic structure in application, presenting new knowledge, requiring much effort, needing wonder, presenting useful results, being infinite in subject areas, having detailed analysis, being a start point of another study, having cumulative influence of each study on others, tasting happiness at the end, producing valuable outcomes, yielding exact results and requiring interest. When investigated these features, almost all features given by the participants were cited in the introduction part of this study and the studies of Bless et al. (2007), Bhattacherjee (2012), Goddard and Melville (2007), and Kothari (2004). In addition, in different sections of A. Derman and S. Derman's (2015), and Şenel and Aslan's (2014) studies, similar results about pre-service teachers were given. Having some similarities of metaphors and their reasons with others can result from the close relationship of science and scientific research. In fact, the science is developed and understood with the results of scientific works, this issue was also stated by some parts of the participants. In the study of Şenel and Aslan (2014), science was associated with a puzzle and scientific study was associated with the pieces of a puzzle in this study. Even this finding is a good example of the relationship between science and scientific study. In addition to these findings, there was not any negative idea about scientific study in the metaphors and given reasons about the associations.

Table 2 indicated that many foundations specifically teachers, scientific research methods courses, peers, TV programmes, course-books, internet, science courses and films have a great impact in pre-service teachers' perception creation process.

It was found that there were 40 effective foundations in the participants' expression about the underlying foundations in the perception creation process and these foundations were categories under 9 categories. The most influential foundations are course, teachers, films and TV programmes and course-books. Other foundations are social environment, computer-internet, faced scientific events and presentations. In this process, the others category which is composed mostly of news and individual observations is the least effective one. With a detailed waypoint, a range can be given according to frequency of expression as follow: teachers, scientific research methods course, peers, TV programmes, course-books, internet, science courses and films. Primary resources in these foundations are teachers, scientific research methods course and internet. This finding is consistent with the finding of Türkmen (2008) which found that teachers are the most effective factor in students' perception creation process towards scientists. In addition, pre-service teachers' placing internet near the top is another important finding. However, other resources placed in after these resources are as follow: course-books in the education, peers and TV programmes.

In sum, this study showed that the participants' had different associations about the scientific research in their

minds and there were accurate perceptions regarding scientific research in underlying foundations of the perception creation process. In this perception creation process different resources such as peers and internet were effective in addition to expected resources such as teachers and scientific research methods course. These findings can contribute to pre-service teachers' in other words future teachers' having accurate perception about scientific research or the studies aiming to support perceptions about scientific research. In addition, if one wants to proceed on developing pre-service teachers' perceptions about relevant issues, effective use of internet can be helpful. For instance, pre-service teachers can be guided for visiting scientific contented web-pages like TUBITAK, NCTM etc.

References

Baki, A., & Gökçek, T. (2007). Some clues regarding to teacher model adopted by preservice mathematics teachers. *Hacettepe University Journal of Education, 32*, 22-31.

Baş, F. (2013). *The evaluation of ınformation sharing processes of primary mathematics teachers and academicians in face to face and web-based contexts* (Unpublished Doctoral Dissertation, Atatürk University: Institute of Educational Sciences).

Baş, F., Sağırlı, M. Ö., & Işık, A. (2015). Analysing of mathematics education research in Turkey: 2009-2014. *International Journal of Review in Applied and Social Sciences, 1*(8), 31-56.

Bhattacherjee, A. (2012). *Social science research: principles, methods and practices*. Textbooks Collection. Book 3.

Bibi, F., Lqbal, H. M., & Majid, N. (2012). Attitude of prospective teachers towards research: Implications for teacher education in Pakistan. *Contemporary Educational Researches Journal, 1*, 8-14.

Biçer, N., Bozkırlı, K. Ç., & Er, O. (2013). Evaluation of attitudes towards scientific research of Turkish language prospective teachers. *Journal of Turkish Research Institute, 50*, 327-342.

Biesta, G. (2007). Bridging the gap between educational research and educational practice: The need for critical distance. *Educational Research and Evaluation: An International Journal on Theory and Practice, 13*(3), 295-301. http://dx.doi.org/10.1080/13803610701640227

Bless, C., Higson-Smith, C., & Kagee, A. (2007). *Fundamentals of social research methods: An African perspective* (4th ed.). Lusaka: Juta and Company Ltd.

Buldu, M. (2006). Young children's perceptions of scientists: A preliminary study. *Educational Research, 48*(1), 121-132. http://dx.doi.org/10.1080/00131880500498602

Butt, I. H., & Shams, J. A. (2013). Master in education student attitudes towards research: A comparison between two public sector universities in Punjab. *South Asian Studies, 28*(1), 97-105.

Carpenter, J. (2008). Metaphors in qualitative research: shedding light or casting shadows? *Res Nurs Health, 31*(3), 274-282. http://dx.doi.org/10.1002/nur.20253

Çelik, H. C., Gazioğlu, S., & Pesen, C. (2012). Development of a scale to measure teacher candidates' attitudes toward research. *Journal of Educational Sciences Research, 2*(2), 105-121.

Çepni, S., & Küçük, M. (2003). Eğitim araştırmalarının fen bilgisi öğretmenlerinin uygulamaları üzerindeki etkilerinin belirlenmesi: Bir örnek olay çalışması. *Eurasian Journal of Educational Research, 4*(2), 75-84.

Costa, N., Marques, L., & Kempa, R. (2000). Science teachers' awareness of findings from education research. *Research in Science and Technological Education, 18*(1), 37-44.

Cousins, J. B., & Walker, C. A. (2000). Predictors of educators' valuing of systematic inquiry in schools. *The Canadisn Journal of Program Evaluation, Special Issue*, 25-52.

De Jong, O. (2004). Mind your step: Bridging the research-practice gap. *Australian Journal of Education in Chemistry, 64*, 4-9.

Denessen, E., Vos, N., Hasselman, F., & Louws, M. (2015). The relationship between primary school teacher and student attitudes towards science and technology. *Education Research International, 2015*, 1-7. http://dx.doi.org/10.1155/2015/534690

Deniz, K. Z., & Çıtak, G. G. (2010). The investigation of factors affecting university students' attitudes towards participation in scientific research. *Procedia Social and Behavioral Sciences, 2*, 5183-5189. http://dx.doi.org/10.1016/j.sbspro.2010.03.843

Derman, A., & Derman, S. (2015). Prospective teachers' metaphorical perceptions on the concept of science.

Educational Research and Reviews, 10(2), 161-176. http://dx.doi.org/10.5897/ERR2014.1997

Ekiz, D. (2006). Primary school teachers' attitudes towards educational research. *Educational Sciences: Theory & Practice, 6*(2), 395-402.

Everton, T., Galton, M., & Pell, T. (2000). Teachers' perspectives on educational research: Knowledge and context. *Journal of Education for Teaching, 26*(2), 167-182. http://dx.doi.org/10.1080/02607470050127081

Goddard, W., & Melville, S. (2007). *Research methodology: an introduction* (2nd ed.). Landsowne: Juta and Company Ltd.

Güler, T., & Akman, B. (2006). 6 year old children's views on science and scientists. *Hacettepe University Journal of Education, 31*, 55-66.

Günay, Y., Hamurcu, H., Akmaca G. Ö., & Şahbaz, Ö. (2005). Milli Eğitim Bakanlığı'na bağlı okullarda yürütülen lisansüstü çalışmalara yönelik öğretmen görüşleri. *Buca Faculty of Education Journal, 17*, 177-185.

Hiebert, J., Gallimore, R., & Stigler, J. W. (2002). A knowledge base for the teaching profession: What would ıt look like and how can we get one? *Educational Researcher, 31*(5), 3-15. http://dx.doi.org/10.3102/0013189X031005003

İlhan, N., Şekerci, A. R., Sözbilir, M., & Yıldırım, A. (2013). The development of teachers attitude scale towards educational research: the validity and reliability study. *Western Anatolia Journal of Educational Sciences, 4*(8), 31-56.

Kayır, G., Bayar, V., Eğmir, E., Bayar, S. A., & Ödemiş, İ. S. (2013, May). *Teachers' attitudes towards graduate researches done at schools: Eskişehir sample*. Paper presented at VI. National Graduate Education Symposium. Sakarya University, Sakarya.

Konokman, G. Y., Tanrıseven, I., & Karasolak, K. (2013). Examining prospective teachers' attitudes towards educational research according to several variables. *Journal of Kırşehir Education Faculty, 14*(1), 141-158.

Korkmaz, Ö., Şahin, A., & Yeşil, R. (2011a). Candidate teachers' attitude toward scientific research. *International Online Journal of Educational Sciences, 3*(3), 1169-1194.

Korkmaz, Ö., Şahin, A., & Yeşil, R. (2011b). Teachers' opinion regarding scientific researches and researchers. *Journal of Theoretical Educational Science, 4*(2), 109-127.

Kothari, C. R. (2004). *Research methodology: methods &techniques* (2nd revised ed.). Delhi: New Age International (P) Ltd., Publishers.

Küçük, M. (2008). Improving preservice elementary teachers' views of the nature of science using explicit-reflective teaching in a science, technology and society course. *Australian Journal of Teacher Education, 33*(2), 16-40. http://dx.doi.org/10.14221/ajte.2008v33n2.1

Küçükoğlu, A., Taşgın, A., & Çelik, N. (2013). An investigation of prospective teachers' perceptions toward scientific research process (the case of educational science department). *Turkish Journal of Social Research, 17*(3), 11-24.

Lakoff, G., & Johnsen, M. (2003). *Metaphors we live by* (2nd ed.). London: The university of Chicago press.

McMillan, J. H., & Schumacher, S. (2006). *Research in education: Evidence-based inquiry* (6th ed.). USA: Pearson Education, Inc.

MEB. (2013). *Middle school mathematics course curriculum*. Ministry of National Education.

Miller, J. D. (2004). Public understanding of, and attitudes toward, scientific research: What we know and what we need to know. *Public Understanding of Science, 13*(2), 273-294. http://dx.doi.org/10.1177/0963662504044908

Öztürk, M. A. (2011). Confirmatory factor analysis of the educators' attitudes toward educational research scale. *Educational Sciences: Theory & Practice, 11*(2), 737-747.

Papanastasiou, E. C. (2005). Factor structure of the attitudes towards research scale. *Statistics Education Research Journal, 4*(1), 16-26.

Patton, M. Q. (2002). *Qualitative research & evaluation methods* (3th ed.). USA: SAGE Publications, Inc.

Polat, M. (2014). Students' attitudes towards scientific research in the faculty of education. *Pamukkale University Journal of Social Sciences Institute, 18*, 73-86.

Şenel, T., & Aslan, O. (2014). The metaphoric perceptions of preservice early childhood teachers conceptions on science and scientist. *Mersin University Journal of the Faculty of Education, 10*(2), 76-95.

Shkedi, A. (1998). Teachers' attitudes towards research: A challenge for qualitative researchers. *International Journal of Qualitative Studies in Education, 11*(4), 559-577. http://dx.doi.org/10.1080/095183998236467

Tavşancıl, E. (2002). *Tutumların ölçülmesi ve spss ile veri analizi*. Ankara: Nobel Publisher.

Türkmen, H. (2008). Turkish primary students' perceptions about scientist and what factors affecting the image of the scientists. *Eurasia Journal of Mathematics, Science & Technology Education, 4*(1), 55-61.

Vanderlindea, R., & Braaka, J. V. (2010). The gap between educational research and practice: Views of teachers, school leaders, intermediaries and researchers. *British Educational Research Journal, 36*(2), 299-316. http://dx.doi.org/10.1080/01411920902919257

Walker, D. A. (2010). The attitudes toward research scale. *Multiple Linear Regression Viewpoints, 36*(1), 18-26.

Wissia-Grm, K. S., & Savec, V. F. (2013). Bridging the gap between educational research and school practice through cooperation of university and primary school teachers. *Procedia-Social and Behavioral Sciences, 106*, 576-584. http://dx.doi.org/10.1016/j.sbspro.2013.12.066

Yavuz, M. (2009). An analysis of thought of teachers and principals on educational research. *Ahmet Kelesoglu Education Faculty (AKEF) Journal, 27*, 143-158.

Yenilmez, K., & Ata, A. (2012, June). *Matematik öğretmeni adaylarının bilimsel araştırmalara yönelik tutumlarının incelenmesi*. Paper presented at National Science and Mathematics Educational Congress. Niğde University, Niğde.

Young, T. (1998). Student teachers' attitudes towards science (STATS). *Evaluation & Research in Education, 12*(2), 96-111. http://dx.doi.org/10.1080/09500799808666934