A Study on Social Studies Teacher Candidates' Perception of Science, Scientific Research and Scientists [*]

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Abstract

In this study, it is aimed to determine the perceptions of social studies teacher candidates regarding the topics of science, scientific research and scientists. In the study adopting the qualitative research approach, data was gathered through both the metaphor form and interviews. The study was conducted in a university located in Ankara. Ninety-two teacher candidates participated in the metaphor stage of the study; and 45 teacher candidates participated in the interview stage. It has been concluded that metaphors developed by teacher candidates do not contain any negative perception regarding the science. When the metaphor images of teacher candidates were examined, it was determined that in general, the concept of science is perceived as guiding and indispensable for life. According to the participants, scientists are perceived as enlightening, knowledgeable, curious and hardworking. With regard to the concept of scientific research, the participants have brought to the forefront that scientific studies are difficult, they require much effort, and they are systematic. In the analysis of the interview data, it was determined that the social studies teacher candidates do not have enough information about science, scientists and scientific research. In the analysis of the interview data, it was seen that teacher candidates have some incorrect information about the science, scientific research and scientists. Some recommendations were offered in the light of the findings of the study.

Keywords: science, scientific research, scientists, social studies, qualitative research

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Introduction

In today's world, the importance attributed to science and scientific studies is increasing incrementally. The way to shape the future, beyond catching up with the present century is to give weight to scientific studies. One of the important steps taken by many countries in the name of science is to educate scientists and to provide them with suitable working environments. But these steps are not seen enough in today's conditions. Apart from these steps, it is expected that all citizens of countries internalize the importance of the concept of science at a minimum level at least and embrace scientific thought methods. This can only be done through quality education.

The method of teaching science to younger generations is a multidisciplinary concept, and it needs to be addressed with an interdisciplinary approach. When Turkish education system is examined, it is seen that different course contents (MONE, 2017; MONE, 2018a; 2018b) are thought to students in such a way that they complement each other in terms of laying and developing the bases of science on students. Social studies course is one of the most important subjects in bringing science to younger generations. Social studies is a course which came into being by collecting the scientific knowledge produced by various social science branches in order to raise active citizens by taking into consideration the levels and needs of the secondary school students (Doğanay, 2003; MONE, 2005; Kabapınar, 2012). When the curriculum of the social studies course is examined, it is seen that 2 of the 18 general aims of the course are directly related to 'science'. It is also possible to see the traces of scientific thought in the expressions of aims apart from these two general ones. In addition, the concept of scientificness has been shown as a value to be directly given in the social studies course.

In the social studies curriculum, subjects of science, scientific research and scientist are as follows from the 4th to the 7th grade: Fourth grade students are expected to comprehend the development of technology within the historical process and to know the inventors contributing to this development. It is also aimed that 4th grade students perceive the interaction of nature and technology. Fifth grade students are expected to comprehend characteristics of scientists and to be aware of the importance of reaching reliable and correct information and the importance of scientific ethics and scientific thinking. In the 6th grade; it is aimed that students get informed of social sciences working method and the effects of social sciences on community life and copyright-patent rights. In addition, they are expected to have an idea about the effect of scietific and technologic developments on future, and to use scientific research steps. At the level of 7th grade, it is aimed that students have an idea about the scientists having grown in Turkish-Islamic civilizations and their studying methods, the scientific and technological developments of Europe between 15th-20th centuries, and the scientists having contributed to these developments. Again in the 7th grade, making students comprehend the importance of free thought for scientificness is among the other purposes of the course (MONE, 2017). As is seen, the social studies is an important course addressing concept of science with 18 different outcomes.

It is seen that with the importance attributed to science, the number of studies focusing on science has also increased in the last 60 years. In the literature, it is seen that there are many studies aimed at determining the thoughts of people from various age groups on science and scientists. One of the initial studies was done by Mead and Metraux (1957) through texts written by high school students. As a result of this study, it has been determined that students have various stereotypes about science. Beardslee and O'Dowd (1961) encountered similar findings in the study where they aimed at detecting the perception of university students for scientists. One of the most remarkable studies in the literature was carried out by Chambers in 1983. According to Schibeci and Soresen (1983:18), the tool called 'The Draw-A-Scientist Test (DAST)' developed by Chamber has been frequently used for determining perceptions of people from different countries and different age intervals for science and scientists due to such advantages that it does not take too much time, it can be applied to illiterate age groups, and participants are much more willing for this study and it is more fun (Schibeci & Sorensen, 1983; Newton & Newton, 1992; Newton & Newton, 1998; She, 1998; Fung, 2002; Türkmen, 2008; Korkmaz & Kavak, 2010; Akcay 2011; Nuhoğlu & Afacan, 2011; Küçük & Bağ, 2012; Samaras,

Bonoti & Christidou, 2012; Erten, Kıray & Şen-Gümüş, 2013; Narayan, Park, Peker & Suh, 2013; Çeliker-Deniş & Avcı-Erduran, 2015; Ürey, Karaçöp, Göksu & Çolak, 2017). In the literature, there are different studies (Thomas, Pederson & Finson, 2001; Schibeci, 2006; Finson, Beaver & Cramond, 1995; Song & Kim, 1999; Güler & Akman, 2006; Oktay & Eryurt, 2012; Medina-Jerez, Middleton, & Rabaza-Orihuela, 2011) performed by using the results of DAST's analysis. Krajkovich and Smith (1982), unlike other researchers, have sought to identify people's thoughts on science by developing a quantitative scale based on the findings of Mead and Metraux. Another study encountered frequently in the literature is studies in which science and scientist perceptions of individuals from various age groups are determined by means of metaphors (Karaçam, 2015; Uslu, Kocakülah & Gür, 2016; Bıyıklı, Başbay & Başbay, 2014; Yalçın-Ağgül, 2012; Şenel & Aslan, 2014; Boyraz & Kılıçer, 2017; Kıral, 2017). These studies in general show that individuals from different age groups have some stereotypes about scientists. According to common findings of the studies, scientists are old or middle-aged people, they are men, they work in laboratory environment, they are antisocial, scattered haired and bearded people. Many people also believe that scientific studies are mostly mysterious and stand-alone activities (Barman, 1997). Again in these studies, it is emphasized that stereotyped judgements in science begin with early childhood, and that if it is not changed with development of individual they turn into stereotype judgements (Chambers, 1983; She, 1995; Newton & Newton, 1992; Fung, 2002; Güler & Akman, 2006; Ayvacı, Atik & Üreyir, 2016).

According to Darling-Hammond (2000) and Stronge (2002), even though different factors are effective on student success, the most effective one is teachers. The qualifications of the teacher who will implement the curriculum is of key importance in ensuring the desired development of students, it does not matter how good the text books or the course materials are. Transfer of the false / incomplete cognitive or affective information from teachers to students can be an important problem (Eryaman, 2007; Rosenthal, 1993). For this reason, teachers are expected to have good content knowledge. Determining the perceptions of teacher candidates who are still in the learning process on science can give insight into both picturing their mental images and organizing the teacher education program. In this context, this study aimed to determine the perceptions of the social studies teacher candidates about science, scientists and scientific research. Studies in the field of social studies education seem to be extremely inadequate in the literature. There is no study in the literature which addresses the concepts of science, scientists and scientific research all together. Moreover, when the studies carried out in the literature are examined, it has been found out that science is mainly addressed with perspectives of natural scientists (Nuhoğlu & Afacan, 2011; Küçük, 2006; Bıyıklı et. al. 2014; Barman 1999; Kaya, Afacan, Polat & Urtekin, 2013; Uslu et. al. 2016). Limiting science to natural sciences causes the problem of limiting scientists to naturalists. The difference of this study from other studies in the literature is that in this study scientificness is described and examined in the eyes of teacher candidates who are studying social sciences which is a part of science, but usually ignored, and who will carry out their profession in this respect. In this context, it is also aimed to fill the gap in the literature with this study.

The main purpose of the research is to determine the social studies teacher candidates' perceptions on the topics of science, scientific research and scientists. In the related study, the answers to the following questions are searched:

1. Under what categories are mental images (metaphors) which social studies teacher candidates have with regard to the concepts of 'science, scientists and scientific research' collected?

2. How do social studies teacher candidates define the concept of 'science'?

3. What are the characteristics of 'the scientists' according to social studies teacher candidates?

4. Who are the "Turkish scientists" examples of social studies teacher candidates?

5. Who are the 'foreign scientists' examples of social studies teacher candidates?

6. From what sources do the social studies teacher candidates learn about examples of 'scientists'?

7. What are the most important barriers before the scientific research in Turkey according to social studies teacher candidates?

8. What is the most important course in bringing scientific knowledge and values to secondary school students according to social studies teacher candidates?

Method

Qualitative research approach has been followed in this study. Qualitative research is the studies which aim at presenting a rich and integrated picture of people's experiences and perceptions and use different data sources to achieve this aim (Miles & Huberman, 1994; Creswell, 2012).

Participants

Senior teacher candidates from the social studies teaching department in one of the universities in Ankara participated in the study. The study was conducted in two different stages. The information regarding the participants taking part in different stages of the study is shown in table 1.

Table 1. Information of participants

			f	%
1st Stage	Gender	Women	54	58
		Men	38	41
		Total	92	100
2nd Stage	Gender	Women	28	60
		Men	17	40
		Total	45	100

In the first stage of the study, a metaphor form was applied to teacher candidates. A total of 92 teacher candidates, (54 females and 38 males) participated in this study. In the second stage of the study, teacher candidates were interviewed. A total of 45 teacher candidates, (28 females, and 17 males) participated in the second stage of the study. All of the participants of this study were the last year teacher candidates.

Data Collection Tools

The data of the study was collected in the spring term of 2016-2017 academic year. In the study, the data was collected through both metaphor form and semi-structured interviews. In addition, data triangulation method was used.

The Form of Data Collection through Metaphor (Figures of Speech): The forms of data collection through metaphor used by different researches (Saban, 2008; Saban, 2009; Öztürk, 2007; Ulusoy, 2013; Kılcan & Çepni, 2015) in the literature to determine the perceptions of social studies teacher candidates for the topics of science, scientific research and scientists were examined. Upon expert opinions, three different concepts were determined and 'The Form of Data Collection through Metaphor' was created. In the first part of the form, gender and age of participants were included. The second part of the form the sentences such as *"Science is like ....."*. *Because ..... "," Scientific research is like ..... Because ..... "And" Scientist is like ..... Because ..... "* took place. Nine

teacher candidates studying in the 3rd grade participated in the pilot application of the *'Form of Data Collection through Metaphor'*.

Interview Form: A draft of interview form was developed to be used in the study as a result of literature review. The draft form contains 12 questions. Three questions of the draft form considered to have the same content and two questions considered out of context were removed from the form upon expert opinions. Four teacher candidates studying in 3rd grade of social studies department participated in the pilot study of the research. Following the pilot study, a question was revized and the interview form was finalized.

Data Analysis

The main study of the research was carried out with 92 teacher candidates studying in the department of social studies teaching in one of the university in Ankara in the spring term of 2016-2017 academic year. After informing teacher candidates about metaphors, the forms were distributed. Teacher candidates fulfilled these forms in 20-25 minutes. The method used by Saban (2008) was followed in the analysis of collected metaphor forms. In the analysis phase, all metaphor forms were first listed with a sequence number. Following the initial codings, the forms which do not generate metaphors or blank forms were excluded from the scope of the study. Metaphores were re-listed by getting classified under certain categories according to their common characteristics. Then sample metaphors representing the categories were identified. As a result of this analysis procedure, it was determined that 82 metaphors on the concept of science; 87 metaphors on the concept of scientist and 55 metaphors on the concept of scientific research were developed.

To obtain the *'plausibility and accuracy'* of the findings, the following procedure was followed: First all processes within the research have been explained in detail. In addition, some of the metaphor examples generated by teacher candidates have been presented directly with quotations in the findings section. In order to ensure consistency between the codings in the study, the formula developed by Miles and Huberman's (1994:64) formula (Reliability: number of agreements/total number of agreements+disagreements) was used. Support of a faculty member working in the faculty of education was received with this regard. Both metaphor lists and the conceptual category lists were presented to the faculty member as a specialist. As a result of matching of both lists by the faculty member; it has been found out that the consistency rate in the coding for the concept of science is 98%, the consistency rate in the coding for the scientific research concept is 95% and the consistency rate in the coding for the concept of scientist is 96%. Number of participants with regard to metaphors developed by teacher candidates was identified (f) and presented in the findings section.

After the analysis of the metaphor data, interview data started to be collected. Semi-structured interviews were conducted with 45 teacher candidates who volunteered to take part in the research after getting informed about this stage of the research. Interviews were held in the empty classrooms and in researchers' rooms in the faculty of education. Each interview took approximately 10-15 minutes. The interviews were recorded after taking permission from the teacher candidates. In the analysis of the interview data, the content analysis technique was used. Interview data was transferred to computer environment and data was coded. Participants' explanations for research questions were grouped under certain categories according to their similar characteristics. After the analysis of the interview data, the faculty member working in the faculty of education was asked for help again. The formula developed by Miles and Huberman's (1994:64) formula was used again for the consistency rate between the codings of expert and the researcher. The consistency rate between the codings of two researchers was determined as 96%. Teacher candidates' opinions were also presented directly with quotations in findings section.

Findings

In this section of the study which tries to describe the perceptions of the social studies teacher candidates who are one of the important partners in training younger generations on science, the analysis of the metaphors developed by teacher candidates and then the opinions of the teacher candidates were presented.

The mental images (metaphors) that social studies teacher candidates have about the concepts of science, scientists and scientific research (metaphors)

Table 2. Science according to the mental images of social studies teacher candidates (f = 82)

Categories	Image and frequencies of metaphors
Science as a guiding factor:	Book (f = 5), sun (f = 4), school (f = 3), teacher (f = 2) and Atatürk (f = 1)
Science as an indispensable factor:	Water (f = 4), oxygen (f = 3), love (f = 3), lemon tea (f = 1), justice (f = 1), heart (f = 1), Vitamin D (f = 1) and brain (f = 1)
Science as eternity:	Nature (f = 3), ocean (f = 3), space (f = 3), sea (f = 1), bottomless well (f = 1), universe (f = 1), Sahara Desert (f = 1) and endless road (f = 1)
Science as a factor composed of many pieces:	Pomegranate (f = 3), human (f = 3), hodgepodge (f = 1), mixed fruit juice (f = 1), paper marbling (f = 1), pizza (f = 1), waffle (f = 1), salad (f = 1) and vegetable garden (f = 1)
Science as a questioning factor:	Curious neighbours/relatives (f = 4), child/baby (f = 4) and detective (f = 2)
Science as a changing factor:	Nature (f = 2), computer software (f = 2), trend (f = 2), evolution (f = 1), telephone (f = 1) and frog (f = 1)
Science as a factor of unknowns:	Space (f = 1), nature (f = 1), deserted island (f = 1) and women (f = 1)
Science as an entertainment factor:	Puzzle (f = 1) and game (f = 1)

It has been found out that teacher candidates generated 82 metaphors in 8 different categories regarding the key concept of *'science'*. When metaphors with the meanings attributed to the concept of science by social studies teacher candidates are examined, it is seen that one of the most generated metaphors is in the category of *'Science as a Guiding Factor'*. One of the metaphors developed in this category is as follows: "Science is like the sun. Because science, sheds light on societies like the sun that enlightens around." One of the most generated metaphors by the participants is in the category of "Science as Indispensable Factor "category. Participants in this category seem to emphasize the necessity of science for life. The metaphor that a participant has generated for this category is as follows: "Science is like a heart. Because both are necessary for survival of the society and human beings." Fourteen participants have linked the science to the notion of *'Infinity*' in the metaphor they generated. One of the metaphors generated in this category is as follows: "Science is like a bottomless well. Because it is not known where bottomless wells will end. Science is like that. Every day, every second, new things to search for come out. It is like it will never end." Thirteen of the participants made reference to the fact that science came into existence through aggregation of different pieces. One of these metaphors developed in the category of *'Science as a Factor Composed of Many Parts'* is as follows: "Science is like pomegranate. Because even though it looks like one piece, there are such fields in science like physics and chemistry like pomegranate. Because science is a whole of different branches of science." It is seen that the metaphor of the 10 teacher candidates who participated in the study paid attention to the questioning nature of the science concept. For example, a teacher candidate

expressed his thoughts for this category as follows; "Science is like a curious neighbour. Because the curious neighbor is curious about everything, just like science, it searches, questions and wants to learn everything in detail." It is seen that the 9 teacher candidates who participated in the study emphasize the change of science with metaphors they generated about the concept of science. In these categories, it is possible to see the traces of the idea that science progresses cumulatively. One of the metaphors generated under this category is as follows: "Science is like evolution. Because it has developed over time. It is shadow of itself. Everyone has added something to it." In the metaphors they generated, 4 participants referred to the fact that science contains unknown within itself. One of the metaphors generated under this category is as follows: "Science is like a woman. Because no matter how much information you have, you do not know anything about her anyway. Both have many unknowns." In metaphors developed by 2 participants, it has been found out that they perceive science as an entertaining work. The metaphor that a participant generated for this category is as follows: "Science is like a puzzle. Because puzzle and science also delight people. Both are fun. You never want to stop doing it once you start".

Table 3. Scientists according to mental images of social studies teacher candidates (f = 87)

Categories	**Image and frequencies of metaphor**
Scientist as an illuminating person:	Sun (f = 4), teacher (f = 4) school (f = 3), library (f = 3), Google (f = 2), torch (f = 2), book (f = 2), educated person (f = 1), lamp (f = 1), star (f = 1) and compass (f = 1)
Scientist as a hardworking person:	Ant (f = 5), robot (f = 2), bee (f = 2), machine (f = 2), watch (f = 2), long marathon runner (f = 1), cow (f = 1), smart phone (f = 1) and atom ant (f= 1)
Scientist as a curious person:	Baby/child (f = 5), mother (f = 5), curious neighbours (f = 1), lie detector (f = 1), judge (f = 1) and younger sister (f = 1)
Scientist as a wise person:	Book (f = 5), computer (f = 3), encyclopedia (f = 2), sea (f = 1), smart phone (f = 1), Newton (f = 1) and Albert Einstein (f = 1)
Scientist as a leader:	Queen bee (f = 2), captain (f = 2), class president (f = 1), president (f = 1), shepherd dog (f = 1) and tourist guide (f = 1)
Scientist as an objective person:	Robot (f = 4) and mirror (f = 2)
Scientist as a determined person:	Goat (f = 1), Turkish people (f = 1), very patient person (f = 1) and high flow river (f = 1)

When we look at table 3, it is seen that the participants generated 87 metaphors in 8 different categories regarding the key concept of *'scientist'*. When metaphors with the meanings attributed to the concept of scientist by social studies teacher candidates are examined, it is seen that one of the most generated metaphors is in the category of '*Scientist as an illuminating person'*. One of the metaphors developed in this category which emphasizes that scientist informs and guides society is as follows: "The scientist is like a book. Because it enlightens humanity with its content." It is seen that 17 of the participants emphasizes in their metaphors that scientists work hard. One of the metaphors in question is as follows: "The scientist is like a long marathon runner. Because both of them keep working without ceasing. Lazy people are not interested in marathon, they cannot also run marathon." The 14 teacher candidates who participated in the study seem to pay attention to the concept of curiosity, one of the characteristics of scientists, in the metaphors they generate. A teacher candidate for this category says; "The scientist is like curious neighbours. Because they follow everything around them with great curiosity and try to learn and find out everything. It is their duty to ask, examine, investigate and disseminate their findings with great pleasure. Just like a scientist." According to the 14 teacher candidates, scientists should have a good knowledge of different branches of science. One of the metaphors generated under the relevant category is as follows: "The scientist is like Albert Einstein. Because all the scientists have to be as wise as him. Astronomy, mathematics, physics, chemistry ... They need to know about everything." One of the metaphors in the category of '*Scientist as a Leader*' developed by 8 participants emphasizing leadership characteristics of a scientist is as follows: "Scientist is like a queen bee. Because she manages all the bees. Scientists also manage society through their inventions." Six participants emphasized in their metaphors that the scientists should carry out their studies objectively without being affected by the society, the point of view of life, and

the age they live in. One of these metaphors expressing that the scientist should be objective is as follows: "Scientist is like a mirror, because he conveys what they find and say to other people as is. Neither more nor less! Although it is against the religion and values of his country, he acts as a mirror in their studies." It is seen that in the expressions of the four teacher candidates who generate metaphor for the concept of the scientist, teacher candidates have pointed out that scientists focus on completing their studies in the face of the challenges they face. One of the examples of the relevant category is as follows: "Scientists are like high flow rivers. Because they will arrive the point they desire in the end last. High flow river will overcome even the hardest rocks just like scientists with constant work. Both of them have endless effort."

Table 4. Scientific research according to mental images of social studies teacher candidates (f= 55)

Categories	**Image and frequencies of metaphor**
Scientific research as a challenging field of work:	Climbing Everest (f = 3), walking on icy road (f = 3), finding the way in maze (f = 1), exercising (f = 1), searching for a needle in a haystack (f = 1), picking raspberry from bush (f = 1) and weaving rug (f = 1)
Scientific research as a field of work requiring labor:	Raising children (f = 6), doing project homework (f = 2), embroider (f = 1), painting an art of picture (f = 1) and writing a novel (f = 1)
Scientific research as a systematic field of work:	Cooking (f = 3), Earth revolution (f = 1), mother (f = 1), human body (f = 1), constitution (f = 1), elevator (f = 1), engineering work (f = 1) and old men (f = 1)
Scientific research as a universal field of work:	Music (f = 4), Decleration of Human Rights (f = 1), body language (f = 1) and paintings of Picasso (f = 1)
Scientific research as an uncertainty factor:	Game of chance (f = 3), easter egg (f = 1), meeting the lover in the story (f = 1) and stairs (f = 1)
Scientific research as a factor of passion:	Smoking (f = 3), losing weight (f = 1), love (f = 1) and cooking (f = 1)
Scientific research as a field of work requiring attention:	Brain surgery (f = 1), juggler (f = 1) and driver (f = 1)
Scientific research as a field of work with different solutions:	Rubik's Cube (f = 1)

When we examine table 4, it is seen that the teacher candidates developed 55 metaphors related to the key concept of *'scientific research'* in 8 different categories. It has been determined that 11 teacher candidates participating in the research perceive the concept of scientific research as a challenging field of work. One example of a metaphor representing this category is as follows: "Scientific research is like picking raspberries from the bush. Because it is like reaching sweet and correct knowledge through thorny and difficult paths." Again, the same number of the participants described the scientific research as a field of work requiring intensive study and labor in the metaphors they developed. One of the metaphors generated in this category is as follows: "Scientific research is like raising a child. Because it requires a lot of effort and sacrifice. It requires much effort. It requires working insistently." One of the metaphors developed in this category by 10 participants who perceive the concept of scientific research as a systematic field of work is as follows: "Scientific research is like an elevator. Because the elevator has to pass each and every floor one by one. It cannot omit 2nd, 3rd and 4th floors when going up from 1st to 5th floor. There is time and place for everything in scientific research. Scientific researches are systematic." It has been determined that the 7 teacher candidates participating in the study perceive the concept of scientific research as a universal work. One of the metaphors representing this category is as follows: "Scientific research is like music. Because it is universal. It is valid everywhere in the world. Scientific researches are also like that, it is valid everywhere in the world." Six of the participants referred in their metaphors they generated to the fact that that scientific research results do not always give desired results. One example the metaphors in question is as follows: "Scientific research is like a game of chance. Because you play one game and you win. Another day you play 100 games, you cannot win. The result will never be clear beforehand. You either loss or win ... Scientific research is also like that. You hit the road with

great enthusiasm without knowing the result. Sometimes you get happy and sometimes disappointed." Six of the participants emphasized in their metaphors they developed that scientific research turns into a passion for scientists. One of the metaphors developed under the category of *'Scientific Research as a Factor of Passion'* is as follows: "Scientific research is like smoking. Because cigarette attracts you such that you cannot even notice. Scientific researchers cannot let themselves go, once they lose themselves in the study, they become like smokers. One study ends, and they start another study like lighting another cigarette..." It has been determined that some of the teacher candidates (f = 3) refer in their metaphors they develop to the necessity that scientific research needs to be done with care. One such metaphor example is as follows: "Scientific research is like brain surgery. Because neither of them accepts the slightest mistake. Both of them requires being very careful and attentive." One teacher candidate who participated in the research emphasized that various solutions are found in scientific studies. A metaphor developed in the category of *'Scientific Research as a Field of Work with Different Solutions*' is as follows: "Scientific research is like a Rubik's cube. Because there is a number of different ways to solve it. Many research types and methods can be used in a study; but some are useful and some are useless. It is necessary to find the right path for the solution."

The following is the results of semi-structured interview data.

Social studies teacher candidates' definitions of science

In the study, firstly, teacher candidates were asked 'How do you define the concept of science?' It has been found that 27 of the teacher candidates could not give any definition about science. In this regard, it has been determined that 17 of the interviewed teacher candidates explain the features of science instead of defining it. For example, a participant defines science as follows: "If the outcomes are applicable in different places, at different times, it is a science." However, the expression of this participant is the repeatability of the feature of science. It has been found out that 3 teacher candidates defined science as the concept of technology and listed its features. One of the participants who expressed their views on this issue says: "It is the tools we use everyday as a part of life. In other words, it is like a television in a house and like a mobile phone used by a person." As it is understood from this statement, it has been determined that the participant perceives technology products produced in a serial manner based on scientific knowledge as science. For the same question seven teacher candidates reported that they cannot make any definition. Only 18 of the teacher candidates were able to define science. When the definitions are analyzed, it is seen that the positivist approach is dominant in the mental structures of the teacher candidates. The science definition of a teacher candidate is as follows: "Science is the study of an event as a result of experiments or observations and manifestation of facts."

Characteristics of scientists according to social studies teacher candidates

The question of "What are the characteristics of the scientists?" was asked to teacher candidates as the second question. The answers of the participants are shown in table 5. Since some of the teacher candidates gave more than one answer to this question, percentage scores were not calculated.

Table 5. Characteristics of scientists according to social studies teacher candidates:

Characteristics	**f**	**Characteristics**	**f**
Hardworking	42	Empathic	2
Curios	39	Being cultured	1
Objective	27	Perfectionist	1

Being inquisitive	17	Role model	1
Patient	15	Good commenter	1
Have a good command of experiment and observation methods	14	Thinks faster than other people	1
Determined	10	Confident	1
Open to innovation	9	Enterprising	1
Wise	7	Have a great imagination	1
Logical	7	Honest	1
Sharer	5	Skillful for everything	1
Have multi-perspective point of view	4	Loves his country	1
Devoted	4	Has teamwork skills	1
Positive	3	Creative	1
Produce solutions	3	Helpful	1
Disciplined	2	Ambitious	1
Consistent	2	Secretive	1
Careful	2	Responsible	1
Being crazy	2	Uses technology efficiently	1
Hyperactive	2	Does not suffer any allergic disease	1

When answers of the participants are examined, we see that everybody (93%) except 3 participants stressed the *'hardworking'* characteristics of a scientist. When we look at the other answers, another most frequently expressed characteristic of scientists is being *'curious'* (87%). When the answers to this question are examined, the effects of the positivist approach are found in the mental images of some teacher candidates. Science is carried out by experiment and observation method according to the teacher candidates shaping their scientist perceptions with the influence of positivist approach. For this reason, scientists must have a good command of experiment and observation methods. In the same way, a teacher candidate has stated that a scientist must have allergy tests in order to be able to carry out his or her studies. According to this teacher candidate, someone with an allergic disease will not be able to do experiment in the laboratory. Again, according to this teacher candidate, science takes place in the fields of natural science such as physics and chemistry. When the answers given by teacher candidates to the same question were examined, some participants expressed qualities not included in the literature such as being '*perfectionist, thinking faster than other people, being hyperactive, being skillful for everything, loving the country, being ambitious, being crazy, enterprising and being cultured'* have also been stated.

Social studies teacher candidates' examples about Turkish scientist

Another question for teacher candidates was "Can you give examples about Turkish scientists?" In this question, percentage calculation could not be done because some of them gave more than one answer. The answers of the participants are shown in table 6.

Table 6. Social studies teacher candidates' examples about Turkish scientist

Scientists	f	Scientists	f
Aziz Sancar	43	El Cezeri	2
Mehmet Öz	41	Gazi Yaşargil	2
Ali Kuşçu	18	İhsan Sıtkı Yener	2
İbni Sina	18	Ibni Rushd	1
Cahit Arf	17	Mimar Sinan	1
Farabi	14	Uluğ Bey	1
Ibni Khaldun	13	Feza Gürsey	1
Oktay Sinanoğlu	6	Gökhan Hotamışlıgil	1
Hazarfen Ahmet Çelebi	6	Harezmî	1
Mustafa Kemal Atatürk	3	Halil İnalcık	1
İlber Ortaylı	3	Gazali	1
Ömer Hayyam	3	Mustafa İnan	1
Akşemşeddin	2	Hulisi Behçet	1
Ekrem Akurgal	2	Mimar Sinan	1
Şerif Mardin	2	Cezmi	1

When we look at Table 6, it is seen that the participants gave names of 30 different Turkish scientists as an example. Particularly, a large majority of participants focused on Aziz Sancar (95%) and Mehmet Öz (91%), who perform their duties as medical doctors in the United States. It is seen that Ali Kuşçu and İbni Sina are given as examples by 18 different teacher candidates. Cahit Arf, having important studies the field of mathematics, has been given as an example by 17 different participants. One of the interesting findings of the study is that participants did not give place to female scientists in their examples of Turkish scientists. When table 6 is examined, it is seen that the scientists working on the field of social sciences remain much more in the background than those working in natural sciences.

Sources of social science teacher candidates' when giving examples of Turkish scientists

The participants were also asked about the sources of information they used when giving examples for scientists. According to teacher candidates, the media (f = 23) is very effective in acquiring information about scientists. Again, according to participants teachers (f = 12) and textbooks (f = 10) are effective in acquiring knowledge about scientists.

Social studies teacher candidates' examples about foreign scientist

Another question for the teacher candidates was 'Can you give examples about foreign scientists?' In this question, percentage calculation could not be done as some teacher candidates gave more than one answer. The answers of the participants are shown in table 7.

Table 7. Foreign scientist examples from social studies teacher candidates:

Scientists	f	Scientists	f
Albert Einstein	36	Ibni Rushd	3
Isaac Newton	28	Bill Gates	3
Thomas Edison	25	Marie Crue	4
Alexander Graham Bell	15	Neil Armstrong	2
Nikola Tesla	14	Hipokrat	2
Farabi	11	Henry Ford	2
Lois Pasteour	4	Aristoteles	2
Stephen Hawking	4	Steven Paul Jobs	1
Ibni Khaldun	4	Gregor Johann Mendel	1
Johann Wolfgang Von Goethe	3	Charles Robert Darwin	1
Galileo Galilei	3	Stephen King	1
Archimedes	3	Johannes Kepler	1

When the examples given by participants for 'foreign scientists' are examined, it is seen that, in total, they offered examples of 24 different scientists. It has also been found out that the participants did not give examples of female scientists other than Marie Crue. It is seen that Albert Einstein (36 different participants), Isaac Newton (28 different participants) and Thomas Edison (25 different participants) are the most given examples. Steven Paul Jobs, Gregor Johann Mendel, Charles Robert Darwin, Stephen King and Johannes Kepler were given as an example by 1 participant in the study. In the question of foreign scientist, it is seen that the participants gave examples of scientists mostly working in the field of natural sciences.

Social studies teacher candidates' sources of information that they used when giving examples about foreign scientists

The question of "Where did you learn the information you gave about the foreign scientists" was asked to teacher candidates as another question. In this regard, all teacher candidates pointed to media (f = 45) and textbooks (f = 45). According to the participants, teachers (f = 33) are also an important source of information about foreign scientists.

The most important barriers for the scientific studies in Turkey according to social studies teacher candidates

The question of “the most important barriers for the scientific researches in our country” asked to the social studies teacher candidates. In this question, percentage calculation could not be performed, as some teacher candidates gave more than one answer. The answers given by teacher candidates are shown in table 8.

Table 8. The most important barriers before the scientific researches in our country according to social studies teacher candidates

Features	f
Required Financial Support cannot be Received	28
Dogmatic Thoughts	25
Institutions Supporting Science Deviate from their Aim	23
Limited number of institutions supporting science	17
Scientists are not respected	17

Foreign Powers	12
Insufficient creative thoughts	11
Limited number of scientists	4
Bureaucratic barriers	3
Laziness	3
Insufficient competition	1
War/Terrorist Incidents	1

According to the participants, one of the most important barriers for the scientific researches in our country is that the financial support cannot be transferred to the research. The limited number of institutions supporting science, and institutions supporting so called scientific studies rather than quality scientific studies were the most important problems for the participants. Some participants comparing the number of scientists in our country with the number of scientists in western countries have pointed out insufficient number of scientists as one of the barriers for the scientific research. Another issue raised by 12 different participants is that foreign powers do not want Turks to advance in the field of science. Eleven participants expressed that as a result of spreading of repetitive studies, original and creative ones lose their importance, and this is a barrier for the scientific studies. The lack of competition and the geographical proximity to war zones were expressed by the participants as a barriers to the development of scientific studies.

The most important course according to social studies teacher candidates to bring scientific knowledge and values to secondary school students

Finally, the participants were asked "Which is the top priority course in bringing scientific knowledge and values to secondary school students?" In this respect, 35 (78%) of the teacher candidates said science course, 5 (11%) said mathematics course and 5 (11%) said social studies course as the most priority course on science. It has been shown that this course is directly related to science on the grounds of the participants who primarily explain the science course.

Conclusion, Discussion and Recommendations

In this study, it is aimed to determine the perceptions of the social studies teacher candidates regarding the concepts of science, scientists and scientific research. For the detection of the perceptions, firstly teacher candidates were asked to generate metaphors for the relevant concepts. It has been concluded that metaphors developed by teacher candidates do not contain any negative perception. When metaphor images are examined, it has been concluded that the concept of science is generally perceived as guiding spirit and indispensable for life. For the concept of the scientist, the features that scientists enlighten around, work hard, being wise and curious are the categories emphasized by the participants. In the concept of scientific study, the categories that scientific research is difficult, it requires intensive labor and it is systematic has been brought to the forefront. These findings overlap with the findings of previous studies (Şenel & Aslan, 2014; Karaçam, 2015; Bıyıklı et. al. 2014; Boyraz & Kılıçer, 2017; Kıral, 2017).

It is believed that this study has revealed some important results. The first result is the science definitions of participants. When the answers to the question of "How do you define the concept of science" were examined, it was determined that 60% could not define science. It has been found that some of the participants described features of science and some of them described features of technology as science instead of defining science. This finding is similar to the findings of the study conducted by Köksal and Çınar (2012). It has been concluded that those who define science made a definition in line with the positivist concept that is shaped by the principles of natural sciences. According to some participants science is the studies with invariable qualities, that can be repeated under any circumstance and where only experimental and observation methods are used. Similar findings are also seen in the answers given by the teacher candidates to the question of "What are the

characteristics of scientists?" Some of the participants stated that scientists should have a good command of experiment and observation methods and that they should not have any allergic disease in order to be able to carry out experimental studies. In the study carried out by Boyraz and Kılıçer (2017) studying in the Faculty of Economics and Administrative Sciences, it has been found out that that the perception of science is positivist. This result is consistent with the results of previous studies in the literature (Terzi, 2005; Çeliker-Deniş & Avcı-Erduran, 2015; Türk-Eyceyurt & Tüzün, 2017). According to positivist understanding, human behaviours can be explained by adapting principles and methods of natural sciences to social sciences. However, subjects covering dynamic human and its interactions are often too complex to be explained by the principles and methods of natural sciences. For this reason, positivist understanding is not considered appropriate for the structure of social sciences. According to Terzi (2005), the textbooks are effective in shaping science perception of participants studying social sciences in line with the positivist understanding. That is, concepts, theories and scientist examples presented in textbooks are suitable for positivist understanding. In the study conducted by Topçu and Karatekin (2017), the scientists given in textbooks of 4th, 5th, 6th and 7th grade published by different publishing houses were examined. It has been determined that only 20 of the 116 different scientists presented in the books are social scientists. In the same study, it has been determined that examples of scientific people and scientific expressions given in social studies textbooks are presented from the point of view of natural scientists who are compatible with positivist understanding. This finding also shows that reflection of social scientists and the scientists working in this field on the textbooks is also insufficient. It can be said that these inadequacies cripple importance of social sciences for the society and the recognition of social scientists. It may be suggested to give the concepts and examples of different disciplines in order to eliminate this situation arising from the textbooks (Rubin, Bar & Cohen, 2003). Just as social studies textbooks offer natural scientists as scientists, social science scientists and their studies can be included in science textbooks. Thus, the required social awareness in the field of social sciences can be increased.

The second important result of the study comes out in scientist examples of the participants. In fact, it is also thought that the scientist examples of the participants give important clues about the science, scientific research and scientist images. The most given examples for scientists by participants are Aziz Sancar (f = 43), Mehmet Öz (f = 41), Albert Einstein (f = 36), Isaac Newton (f = 28) and Thomas Edison (f = 25). In other studies carried out in the literature (Demirbaş, 2009; Kıral, 2017; Boyraz & Kılıçer, 2017), we see that these scientists are on the foreground. Aziz Sancar, who is the most exemplified scientist by the teacher candidates, received the Nobel Prize in Chemistry in 2015 and he continues to work in the field of medicine. However, it can be said that his reputation in our country increased with the Nobel Prize in Chemistry. As a result of the study, it has been found out that Sancar was perceived by some teacher candidates (f = 29) as working in chemistry rather than medicine. Aziz Sancar also stated in interviews that he was surprized to receive a prize in the field of chemistry while he was expecting a prize in the field of medicine. It has been found out that even though both Aziz Sancar's awards and his statements took place in media he has not been properly positioned by the teacher candidates. Boyraz and Kılıçer (2017) states that rewarding is effective in increasing the recognition of scientists. However, it can be said that the rewarding is accompanied by some mistakes even though it increased recognition of Aziz Sancar. Again, in the study some of the participants were found to be confused about the origins of scientists such as Farabi, Ibni Rushd and Ibni Khaldun. For example, Ibni Rushd was presented by 3 participants as foreign and 1 participant as a Turkish scientist. Likewise, Farabi has been stated by 14 participants as Turkish and 11 participants as foreign scientist. It is thought that such confusion is caused by conflicting knowledge presented in different textbooks. From the examples of foreign scientists given by teacher candidates, it is understood that such entrepreneurs as Steven Paul Jobs, Bill Gates and Henry Ford; and such litterateurs as Stephen King and Geothe are also perceived as scientists. These findings suggest that social studies teachers candidates have insufficient knowledge of scientists. The knowledge level of the participants was also found to be quite inadequate in the study conducted by Şimşek-Laçin and Şimşek (2010) with social studies teacher candidates.

Another interesting finding of the study is that none of the participants gave examples of Turkish female scientists. An example of a foreign female scientist is the Nobel Prize-winning Marie

Curie, stated by only four participants. In studies carried out in the literature, it is revealed that the perception of female scientists is similar among individuals of different age groups (Chambers, 1983; Fort & Varney, 1989; Barman, 1997; Barman, 1999; Narayan et. al., 2013; Finson et. al., 1995; Fung, 2002; Samaras et. al., 2012; Medina-Jerez et. al., 2011; Losh, Wilke & Pop, 2008; Newton & Newton, 1998; Rodari, 2007; She, 1998; Demirbaş, 2009; Küçük & Bağcı, 2012; Türkmen, 2008; Ürey, et. al., 2017; Karaçam, Aydın & Digilli, 2014; Aycay, 2011; Toğrul, 2000; Nuhoğlu & Afacan, 2011; Boyraz & Kılıçer, 2017; Kıral, 2017). It has also shown by different research results that women's visibility in terms of scientists is either too little or they are invisible at all. Moreover, it is thought that the concept of '*man of science'*, which has been used for many years either in the national or international levels, is also effective in the formation of this stereotype (Türk-Eyceyurt & Tüzün, 2017).

Teacher candidates who indicated that their views came from the media, textbooks and teachers as sources of information on scientists. This result is consistent with the literature (Losh, et. al., 2008; Newton & Newton, 1998; Rodari, 2007; She, 1995; Song & Kim, 1999; Steinke, 1997; Schibeci & Sorasen, 1983; Güler & Akman, 2006; Türkmen, 2008; Küçük & Bağcı, 2012; Şenel & Aslan, 2014; Karaçam, 2015; Demirbaş, 2009). In the literature, it is thought that the media is effective in raising awareness about scientists, but it also causes some misconceptions (Güler & Akman, 2006). The fact that scientist typology given in movies, series or advertisings which is marginalized, naturalist and male is at the forefront of the most criticized topics. On the other hand, marginalized, naturalist and male gender perceptions found in the participants' mental images in this study support this criticism. In addition to all these, it is thought that the media has an important function in both positioning and marketing (Boyraz & Kılıçer, 2017). The best proof of this is the example of Aziz Sancar, Mehmet Öz and İlber Ortaylı. It is also seen that the scientists doing well in their own fields find more space in the media and this increases the people's interests in scientists.

Textbooks, considered as one of the most important cornerstones in the science perception, have been focus of intense debates recently. Topçu and Karatekin (2017) conducted studies examining social studies textbooks, and Şimşek-Laçin (2011) conducted studies that examine science course textbooks. Both studies have criticized the fact that the perception of science presented in the books is Western-style and books contain incorrect content. In this context, it is thought that the adequate and correct positioning of the science by media, textbooks and teachers in cooperation is important.

The third important outcome of the study came out from the answers of participants to the question of "What are the characteristics of the scientists?" Two studies conducted by Toğrul (2000, 2013) revealed that scientist perception of individuals turns into a more realistic structure over time. However; some characteristics attributed to scientists by teacher candidates participating in the research such as *"being crazy, being secretive, being hyperactive, thinking faster than other people, being perfectionist, being skillful in every subject"* show that they are still far from realistic perception. On the other hand, characteristics such as *'being hardworking, being curious, questioning, being patient and being creative'* show parallelism with the findings of previous studies (Boyraz & Kılıçer, 2017; Fidan-Kurtdede & Konak, 2016; Türk-Eyceyurt & Tüzün, 2017; Kaya, et. al. 2013; Nuhoğlu & Afacan, 2011).

The fourth and most important result of the study is that social studies teacher candidates, who will be a teacher of a social science focused more on science and gave priority to sciences course (78%) rather than social studies course. It is thought that this situation should be emphasized and investigated in depth. Because, this result also shows that social studies teacher candidates ignore the Science Technology and Community learning field presented with 18 different objectives from the 4th to the 7th grade. In some of the studies carried out in the literature, it is seen that science is related to pure natural sciences (Beardslee & O'Dowd, 1961; Chambers, 1983; Barman, 1999; Narayan et. al, 2013; Samaras et. al, 2012; Medina-Jerez, et. al., 2011; Küçük, 2006; Newton & Newton, 1998; Rodari, 2007; Song & Kim, 1999; She, 1998; Nuhoğlu & Afacan, 2011; Uslu, et. al., 2016; Kaya, et.al., 2013). Ağlarcı and Kabapınar (2016) have found out in their study that the chemistry teacher candidates relate science to the natural sciences. The researchers have also made room for social

scientists in the minds of chemistry teacher candidates with the activities they have carried out. Similar studies will also be useful in the field of social studies teaching.

The social studies teacher candidates participating in this study took ‘Essentials of Social Studies', 'Archeology', 'Sociology', 'Social Psychology', 'Economics', 'Anthropology', 'Scientific Research Methods', 'Science, Technology and Social Change' and 'Data Analysis in Social Studies' respectively during their education. However, the results of this study also show that teacher candidates have some deficiencies and mistakes in the abovementioned issues. Therefore, it can be suggested that the relevant courses should be strengthened in the context of social sciences so that relevant courses can achieve their goals better.

This study was conducted with the final year undergraduate teacher candidates continuing their education in Ankara. Similar studies can be designed to be conducted by recruiting the first and final years of the teacher candidates so that the results can be compared. In this way, the effectiveness of the education process can be evaluated. In addition, the science, scientist and scientific research perceptions of the teachers who are currently working in the branch of social studies can also be determined. The findings of this research reveal that social studies teacher candidates do not have sufficient and correct perception in the subjects of science, scientists and scientific research. Similar studies can also be conducted with teacher candidates studying history, geography, literature and philosophy who will serve to bring social sciences to future generations. The results can be compared and required arrangements can be made in teacher education in the field of social sciences.

There is no doubt that it is wrong to perceive science as two different poles in the form of social and natural sciences. It is thought that it is important to research and understand the people living in this nature as much as researching and interpreting the nature (Boyraz & Kılıçer, 2017). As mentioned in the introduction section of the study, in the literature, there is a lack of social science perspective on science. This research is thought to contribute to this absence. It is also thought that it will give idea to social scientist to study science, scientists and scientific research in the future. As a result, there is no defense of a sole scientific field in this research; on the contrary, it is emphasized that science should be perceived as a whole, and social sciences should be given the value it deserves.

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