PRE-SERVICE SCIENCE TEACHERS' PERCEPTIONS OF
SOCIOSCIENTIFIC ISSUES: GLOBAL WARMING AS A CASE

A THESIS SUBMITTED TO
THE GRADUATE SCHOOL OF SOCIAL SCIENCES
OF
MIDDLE EAST TECHNICAL UNIVERSITY

BY

SALİHA AL

IN PARTIAL FULFILLMENT OF THE REQUIREMENTS
FOR
THE DEGREE OF MASTER OF SCIENCE
IN
THE DEPARTMENT OF ELEMENTARY
SCIENCE AND MATHEMATICS
EDUCATION

MARCH 2015

Approval of the Graduate School of Social Sciences

_____

Prof. Dr. Meliha Altunışık
Director

I certify that this thesis satisfies all the requirements as a thesis for the degree
of Master of Science.

_____

Prof. Dr. Ceren Öztekin
Head of Department

This is to certify that we have read this thesis and that in our opinion it is fully
adequate, in scope and quality, as a thesis for the degree of Master of Science.

_____

Prof. Dr. Özgül Yılmaz-Tüzün
Supervisor

Examining Committee Members

Prof. Dr. Özgül Yılmaz-Tüzün   (METU,ELE)   _____

Prof. Dr. Jale Çakıroğlu   (METU,ELE)   _____

Prof. Dr. Semra Sungur (METU, ELE)   _____

Assoc. Prof. Dr. Yezdan BOZ (METU,ELE)   _____

Assoc. Prof. Dr. Mine Işıksal (METU, ELE)   _____

ii

I hereby declare that all information in this document has been obtained and presented in accordance with academic rules and ethical conduct. I also declare that, as required by these rules and conduct, I have fully cited and referenced all material and results that are not original to this work.

Name, Last name : SALİHA AL

Signature   :

ABSTRACT

PRE-SERVICE SCIENCE TEACHERS' PERCEPTIONS OF
SOCIOSCIENTIFIC ISSUES: GLOBAL WARMING AS A CASE

Al, Saliha

M.S., Department of Elementary Science and Mathematics Education

Supervisor: Prof. Dr. Özgül Yılmaz-Tüzün

March 2015, 129 pages

The purpose of this study was to investigate pre-service science teachers perceptions of socio-scientific issues. A total of 18 pre-service science teachers voluntarily participated in this study. To evaluate pre-service science teachers perceptions of socio-scientific issues, semi-structured interview protocol was designed. In the first part of the study, participants general perceptions of science, technology, and science-society-technology interaction was examined. In the second part of the study, one of the socio-scientific issues, global warming, was used as a case. In this part, news related to science, society, and technology aspects of global warming were shared with participants. By this way, the influence of the news framing on the participants perceptions on science, society, and technology aspects of global warming were examined. The results of this study showed that pre-service science teachers had positive perceptions of science and technology.However, their perceptions about interaction between science and society were negative in contrary to the interactions between society and technology which were positive in general. In the second part of the study, it was seen that pre-service science teachers had mostly negative perceptions of science and society aspects of global warming.

News framing had a supportive influence on their negative perceptions. On the contrary, news framing changed their perceptions of technology aspect of global warming. Results revealed the difference of pre-service science teachers perceptions of science-society and technology aspects related to socio-scientific issues.

Keywords: Socio-Scientific Issues, Global Warming, Pre-Service
    Science Teachers

ÖZ

FEN BİLGİSİ ÖĞRETMEN ADAYLARININ SOSYO-BİLİMSEL KONULARA YÖNELİK GÖRÜŞ VE YAKLAŞIMLARI: KÜRESEL ISINMA ÜZERİNE VAKA ÇALIŞMASI

Al, Saliha

Yüksek Lisans, İlköğretim Fen ve Matematik Alanları Eğitimi Bölümü

Tez Yöneticisi: Prof. Dr. Özgül Yılmaz-Tüzün

Mart 2015, 129 sayfa

Bu çalışmanın amacı, fen bilgisi öğretmen adaylarının sosyo-bilimsel konulara yönelik görüş ve yaklaşımlarını incelemektir. 18 son sınıf fen bilgisi öğretmen adayı bu çalışmaya gönüllü olarak katılmıştır. Bu çalışmada yarı-yapılandırılmış mülakat soruları kullanılarak katılımcıların sosyo-bilimsel konulara yönelik görüşleri incelenmiştir. Bu çalışmanın ilk kısmında katılımcıların bilim, teknoloji ve bilim-toplum-teknoloji ilişkisine yönelik görüşleri incelenmiştir. Çalışmanın ikinci kısmında, sosyo-bilimsel konulardan küresel ısınma konusu vaka çalışması olarak kullanılmıştır. Bu kısımda, küresel ısınmanın bilim, toplum ve teknoloji yönlerini yansıtan haberler katılımcılar ile paylaşılmış, ardından mülakat soruları sorularak bu haberlerin onların küresel ısınma konusuna ait bilimsel, sosyal ve teknolojik yönlerine bakış açılarını nasıl etkilediği incelenmiştir. Bu çalışmanın sonucunda, katılımcıların genel anlamda bilim ve teknolojiye yönelik olumlu görüş ve yaklaşımları varken bilimin toplumla ilişkisi olumsuz, toplumun teknoloji ile ilişkisi ise olumlu olarak bulunmuştur. Ayrıca, küresel ısınma hakkında okunan haberlerin bilim ve toplum ile ilgili olumsuz görüşlerini desteklediği, teknoloji ile ilgili görüşlerini ise değiştirme etkisine sahip olduğu ortaya çıkmıştır. Sonuç

olarak, son sınıf öğretmen adaylarının bilim-toplum ve teknolojiye karşı görüş ve yaklaşımlarının farklı olduğu görülmüştür.

Anahtar Kelimeler: Sosyo-Bilimsel Konular, Küresel ısınma, Fen Bilgisi Öğretmen Adayları

To My Little Son, Mehmet...

ACKNOWLEDGMENTS

I would like to express my sincere appreciation to Prof. Dr. Özgül Yılmaz-Tüzün for her guidance, valuable contributions, suggestions, constructive criticism, encouragement and understanding throughout this study. She has supported me academically and helped me to maintain my motivation during difficult times that I have been through.

I would also like to thank to my committee members Prof. Dr. Jale Çakıroğlu, Prof. Dr. Semra Sungur, Assoc. Prof. Dr. Yezdan BOZ, Assoc. Prof. Dr. Mine Işıksal for their understanding and valuable helps.

Thanks to my parents, for their endless love, trust, support and encouragement for all my life. Thank you for everything.

I would like to thank my beloved husband Murat AL, for his encouragement, patience, and love. And also, I would like to thank to my little but strong son who has been always encouraging me with his bright and joyful smiles. Having such a family is worth everything for me.

Lastly, I can not express how thankful I feel to Allah who bestowed all these blessings and countless more on me.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS

SSIs	Socio-Scientific Issues
STS	Science-Technology-Society
STSE	Science-Technology-Society-Environment
PTSs	Pre-Service Science Teachers

CHAPTER 1

INTRODUCTION

People are not all scientists but science touches everyone's lives in some way, either by its wide range of technological applications which they use or by its side effects to the environment and the society that they live in. Some people are more conscious and curious about science which encourages them to learn more about science-related issues. Besides their positive attitudes toward learning, their reading and comprehending abilities are also important in order to better learn the topic. In this regard, some educators accept scientific literacy as the ability to read and comprehend newspaper and science journals, and some define scientific literacy as having knowledge and ability in scientific areas and attitude to be scientists (Hodson, 2003). Similarly, Durrant (1993) clearly defined 'scientific literacy' term to be what people want to know about scientific issues. It is seen that scientific literacy motivates people to read and learn science topics which are of their interests and to develop further abilities at the same time. Professional associations (e.g. AAAS, 1989, 1993) indicated the important goals of scientific literacy as developing analyzing, synthesizing and evaluating skills related to scientific information (Zeidler & Keefer, 2006). These abilities are essential for decision-making on scientific issues.

However, there are some issues where making a correct decision is not easy without any prior informing or guidance due to the uncertainties or controversies about some scientific issues. For instance, scientific concepts such as biotechnological and environmental subjects (Sadler & Donelly, 2006) require some provision to make the decision (Sadler, Amirshokoohi, Kazempour, & Allspaw, 2006). At this point, importance of science education can be accepted as developing better skills to evaluate scientific problems becomes more crucial. For some other scientific issues like stem cell research; one should also be informed about genetic engineering, cloning, and environmental problems (Sadler et al.,

2006) before making any decision. These kind of scientific issues which are characteristically seen as contentious, controversial, open-ended and ill-structured argumentative topics are defined as socio-scientific issues (SSIs) (Sadler & Donelly, 2006; King & Kitchener, 2004). SSIs, due to being controversial and open-ended, have many aspects like personal, political, ethical, social, technological and scientific (Kolsto et al., 2006). The reason behind SSIs' being regarded as controversial is differences in problem evaluation methods and solutions offered due to varying social, ethical and moral values in the society (Gardner & Jones, 2011).

At this point, SSIs curricula become very important. SSIs curricula should integrate controversial scientific issues in science classrooms and provide an opportunity to deal with decision-making and practicing in lessons (Sadler, Barab, & Scott, 2007). By this way, objectives of scientific literacy such as analyzing, synthesizing and evaluating scientific information can be applicable via SSIs curricula. Students can use these abilities in order to make the decision on controversial SSIs in science education. Importance of teacher factor is observed here since teachers are responsible for socio-scientific lesson plans, educational materials, and time spending, etc. However, according to Sadler et. al. (2006), teachers can feel some difficulties while adapting these topics into science lessons. They can feel like unprepared to engage SSIs to students for not having enough resources or stressed for falling back in time management. In addition to Sadler et. al. (2006), Gardner and Jones (2011) also presented same concerns in their study. According to these authors, SSIs were complex and ill-structured issues so science teachers sometimes had difficulties in terms of lack of pedagogical knowledge or content knowledge. For this reason, using SSIs as a tool in science lessons is related to the teachers' personal experiences on SSIs (Lee & Witz, 2009). In addition to these factors, teachers' beliefs, attitudes, perceptions of SSIs become important in teaching socio-scientific issues. As seen in the literature, teachers design their lesson plans, prepare educational materials, or spend time based on their perceptions, attitudes, beliefs on SSIs (Sadler et. al., 2006; Gardner & Jones, 2011; Lee & Abd-El-Khalick, 2006). Teachers' perceptions, attitudes and beliefs

2

about SSIs are shaped by their education. In many studies, researchers expressed the importance of mass media influence on individuals' perceptions (Condit & Parrott, 2004; Nisbet et. al, 2002; Nisbet & Lewenstein, 2002; Steward, Dickerson, & Hotchkiss, 2009). However, the number of studies related to influence of media on teacher perceptions is limited. In one of those studies done in the United States, Corbett and Durfee (2004) founded the influence of certainty of the news on the perceptions of pre-service science teachers according to the controversy and context of the news. Another study conducted in the Unites States by Steward, Dickerson, and Hotchkiss (2009) revealed the influence of news on undergraduate science students' perceptions in terms of ethics, credibility, and usefulness of embryonic and stem cell research. It is seen that, studies on mass media influence of teacher perceptions are crucial, but this area is in need of new research. Therefore in this study we aimed to examine the influence of media on pre-service science teachers' perceptions.

1.1. SSIs in Literature

Socio-scientific issues (SSIs) are defined as scientific issues related to society (Sadler, 2009). SSIs are ill-structured and they do not have a single solution (Sadler, Barab, & Scott, 2007; Sadler et. al., 2006; Sadler & Donelly, 2006; King & Kitchener, 2004; Abd-El-Khalick, 2006; Topcu, Sadler, & Yilmaz-Tuzun, 2010; Gardner & Jones, 2011). Moreover, SSIs are controversial issues in nature since they include many moral, ethical, social, political, personal, and economical aspects. Due to controversy of SSIs (i.e. stem cells, genetic engineering, cloning, environmental problems, genetically modified foods, and nuclear power plants, etc.) solutions related to these issues are not absolutely correct (Gardner & Jones, 2011).

In the past, the science, technology, and society (STS) approach was used to address these controversial scientific issues (Hanegan, Price, & Peterson, 2008). STS constructed a link between science, society and technology in science lessons (Zeidler & Keefer, 2006). However, by the time, STS education was required to be revised. Zeidler, Sadler, Simmons and Howes (2005) stated that STS was not

related to students' daily life experiences. According to researchers, despite STS being defined as scientific and technologic issues and being related to society, STS did not express ethical concerns of issues and did not include moral developments of students. Therefore, STS was revised into the new form of science-technology-society-environment (STSE) education. Although STSE was the revised form of STS, STSE did not directly indicate the ethical and moral concerns. In addition, the main purpose of STS(E) was to gain students' interest into the science-related societal issues, but it is lacking in consideration of psychological and epistemological development of students. Due to these deficiencies revision of STS(E) education resulted in SSIs, which was the social constructivist scientific view. Contrary to the purpose of STS(E), SSIs education aims to provide developments in ethics and morals, through which issues are understood via connecting scientific and societal aspects. The main goal is not only explaining scientific-societal issues; but also, obtaining pedagogical strategies. By this way, SSIs would address controversial, ill-structured and society related daily life issues by means of moral and ethical concerns.

Since SSIs are characteristically controversial and do not have a single solution, socio-scientific reasoning in decision-making is important. Sadler, Barab and Scott (2007) explained the dimensions of socio-scientific reasoning in decision-making context as; *complexity, perspectives, inquiry,* and *skepticism*. SSIs are *complex* issues in nature. They are related to many aspects of social, ethical, moral, economical, etc. Making decision on them is not easy because they do not have a single solution. *Perspectives* refer to the different views to be considered for solving socio-scientific problems. Since they are related to various aspects, different perspectives provide to think other possibilities related to socio-scientific problems. While thinking about possibilities of such problems, *inquiry* is needed because multi-aspects of SSIs require using inquiry skills. Lastly, SSIs are required to be the *skeptic* during evaluation and examination processes of complicated aspects. It is seen that socio-scientific reasoning requires using multi-perspectives, inquiry skills, and skeptic manner. By this way, complex socio-scientific reasoning can provide to make the decision on them.

While studying complex SSI issues, which are not exactly known how they started and ended, some cognitive and affective skills were used for informal reasoning. (Topcu, Sadler, & Yilmaz-Tuzun, 2010). Sadler and Zeidler (2005) defined *informal reasoning* as a mental process performed while dealing with such kind of complicated issues. According to them, informal reasoning is used in three situations. When evidences are supporting the ideas, rules, and other calculations, rationalistic informal reasoning is used. For example, in some benefit and cost calculations, rationalistic informal reasoning helps. However, if the emotions are dominant in deciding on the issues, emotive informal reasoning is applied such as empathy-sympathy. Lastly, reactions are seen immediately without any reason; which is considered as intuitive informal reasoning. This type of reasoning is not explained for a reason like emotive informal reasoning. Even if students do not have knowledge about scientific issues, they express their ideas by using informal reasoning. Expressions of informal reasoning provide to obtain different perspectives on socio-scientific reasoning. Topcu, Sadler and Yilmaz-Tuzun (2010) claimed that argumentation was the effective way to represent informal reasoning, by which solutions can be proposed to socio-scientific issues in science lessons.

In science lessons, problems related to complex SSIs can be solved via argumentation**.** In dealing with SSIs in science lessons, teachers' contributions are significant. It is their responsibility to manage the class, present the topic and guide the conversations in class to reach out the goals of scientific literacy. However, while they integrate SSIs into the science lessons their perceptions are also observed in lecture designs which affect the socio-scientific reasoning as a consequence. For this reason, it is important to evaluate teachers' perceptions of SSIs. Since SSIs include science, society, and technology aspects, it is important to learn the perceptions of teachers about in these dimensions. In other words, it is necessary to learn what teachers' perceptions of scientific, societal, and technological aspects of given socio-scientific issues. We believe that similar to teachers, pre-service science teachers' perceptions also an important role. It is the same for pre-service science teachers that knowing their perspectives will allow us

to foresee the future of science education. This is the reason why we learn pre-service science teachers' perceptions of SSIs by means of science, technology, and science-society-technology interaction aspects in this study.

1.1.1. Teachers' and Pre-Service Teachers' Perceptions on SSIs

It is obvious that teachers are one of the fundamental aspects in science education. They try to reach their intended objectives related to scientific issues. In the same way, dealing with SSIs in classrooms, presenting socio-scientific real-world problems to students, obtaining the decision by discussions are also teachers' goals (Abd-El-Khalick, 2006). However, since the SSIs are regarded as controversial to deal with (McGinnis & Simmons, 1998), teachers do not feel comfortable in teaching these issues (Hanegan et al, 2008). In addition, teachers find SSIs difficult to teach because of time resource requirement, make teachers job challenging in preparing and implementing SSIs lessons (Gardner & Jones, 2011). For these reasons, preferring to teach SSIs in science classrooms depends on teachers' own attitudes towards SSI teaching (Gardner & Jones, 2011). Studies on teacher preparations toward SSIs show that teachers' perceptions of SSIs are different (Lee & Abd-El-Khalick, 2006, Sadler et. al., 2006). They can have positive and negative perceptions of SSIs. Because of the negative attitudes and hesitation, teachers may not give enough time and provide good learning environment to students to compensate their lack of knowledge and improve their informal thinking skills to negotiate resolutions of SSIs (Hanegan et al., 2008). This tendency makes teachers' personal beliefs and perceptions on SSIs very crucial in effective of SSIs in science classrooms.

For example, Sadler et. al. (2006) reported that some teachers saw SSIs as important issues to deal with, so they preferred student-centered activities and tried to provide a classroom environment where students could share their ideas. However, some teachers believed that science teachers were responsible for teaching scientific facts and they did not have to deal with ethical or moral concerns which were the part of SSIs. Therefore, they designed their lectures mostly teacher-centered. Therefore, perceptions of teachers' on SSIs have an

6

important effect on socio-scientific lectures because students need to be informed about SSI problems.

In addition to effects on the designing classroom environment, teachers' perceptions also have an effect on teachers' communication skills during their teaching. They prefer to use verbal and non-verbal communication skills while teaching which differ due to the effect of their perceptions of SSIs. For example, in the study of Gardner and Jones (2011), it was seen that instructors who had different perceptions of SSIs prepared different visuals related to the same issue. At the same time, they used different methods to evaluate the issues. This shows that their communicating methods they prefer depend on their perceptions. This is an important effect on socio-scientific lectures because teachers' perceptions are also having an effect on students' perceptions of SSIs. Studies on students' perceptions of SSIs show that students are affected by their teachers' perceptions (Abi-El-Mona & Abd-El-Khalick, 2011; Donelly et al., 2009). For example, in the study of Donelly et al. (2009), most of the high school students thought that their biology teachers believed the evolution as important. Results showed that the majority of students had positive attitudes related to evolution and they enjoyed while learning. For this reason, examining teachers' perceptions of SSIs is important because they are responsible for promoting students' participations to SSI discussions; encourage them for contributing more to the topic discussed with their ideas and evidences.

Teachers' communication skills are represented by language used and behaviors presented. In the same way, words and phrases selected, media tools used also represent perceptions of issues. Teachers use these communication ways which have an influence on students' perceptions of issues. Studies show that individuals' beliefs, attitudes, and perceptions are affected by social impacts. Texts, written information, news etc have an impact on individual perceptions (Steward, Dickerson & Hotchkiss, 2009). In the literature, individuals' interpretation of words, phrases, images etc. were explained as a concept of *framing* (Scheufele, 1999; Stewart, Dickerson & Hotchkiss, 2009; Hallahan, 1999; Vreese; 2005). Individuals' perceptions of scientific issues are influenced by

verbal explanations used, texts, information sheets, and news which are defined as framing effect. In the same way, framing effect can change individuals' perceptions positively or negatively (Chokriensukchai & Tamang, 2010; Zhao, Leiserowitz, Maibach, & Roser-Renouf, 2011). Individuals' perceptions of issues can be stronger if explanations used, texts, or news supports their thoughts. Even if these tools are contrary to their perceptions, individuals' thoughts on issues can be weaker or they can change their thoughts completely. We believe that this perception is also influential on how science teachers teach SSI by using these media sources as teaching tools. In that regarding SSI teachers bring media news to classrooms in providing evidences to the students. Most of the time, these evidences may have the tendency to show parallel thoughts with teachers' perceptions of SSI. Thus, it is necessary to aware of teachers tendency to use these resources in their courses.

Teachers' perceptions and the way that they present their lessons have a significant effect on students' perceptions stronger (Donelly et al., 2009). Students' thoughts about issues can be stronger, weaker or they can even completely change their thoughts if evidences or arguments are strong enough. This direct influence is as a result of the framing effect. Therefore, evaluation of teachers' perception is very important. In the same way, pre-service science teachers' perceptions are also important for SSIs since they will be teaching them to their students in the future. Therefore, examination of pre-service teachers' perceptions shows the future impacts on science education. For this reason, in this study, pre-service teachers' perceptions of SSIs will be evaluated via framing influence by means of science, society, and technology areas of SSIs. This is expected to allow us to how framing effect represents pre-service science teachers' evaluations of science, society, and technology areas of SSIs.

1.1.2. Framing Theory and Its Relation to SSIs

Framing theory is defined as one's making a topic salient to others via communication techniques where he presents the information in a way according to his own understanding and perceptions (Vreese, 2005; Scheufele, 2006;

8

Hallahan, 1999). Individuals compose the messages related to issues and represent them to others. In social life, framing effect has an important role because it provides to affect others' perceptions of issues. Hallahan (1999) sorted models of framings in his study; *framing of situations, attributes, choices, actions, issues, responsibility,* and *news*. Framing of situations enables analysis of everyday living. Framing of attributes provides to assign shapes in mind to people, issues, or products. Framing of risky choice provides to have the decision on risky situations. Framing of actions provides to make the decision on actions related to goals. Framing of issues is used to persuade others on politic argumentations. Framing of responsibility provides to attribute others in responsibility situations. Lastly, framing of news (media framing) provides to explain issues to other via using media tools. News framing is an important tool in public communication. Via news framing, situations can be presented to others in an intended way. Scheufele (2006) claimed that on social changes in the history, news framing had an important role. Intended messages are represented via media tools. These messages make observable changes in behaviors, attitudes, perceptions, thoughts, and other on mind (Scheufele, 2006; Vreese, 2005).

In a classroom environment, science teachers sometimes prefer to use news related to issues discussed. Especially, news related to SSIs helps to better understand some complicated daily life problems. Since SSIs have various aspects like scientific, social, technological aspects, news on these issues can approach problems from different aspects which allow readers to evaluate problems in many perspectives. It is seen that teachers prefer to use educational materials in accordance with their perceptions of issues, which is same for the news materials used in class. Using news samples, teachers can give messages to students which reflect their perceptions on issues. For example, in the study of Corbett and Durfee (2004), it was seen that students' perceptions of global warming were influenced by a news story which their teacher used as a means of news framing. As seen there, news framing effect is an observable way to make an effect on perceptions. Using the news which represents different aspects of issues can change perceptions. Thus news framing stands to be particularly applicable in teaching

SSIs since they have many aspects as discussed in studies on news framing effects on perceptions of SSIs (Gardner & Jones, 2011; Stewart, Dickerson, & Hotchkiss, 2009; Condit & Parrott, 2004; Nisbet & Lewenstein, 2002). In this study, different that the previous studies, news framing was used to show the influence on perceptions of one of the most popular SSIs, global warming issue and the results were evaluated in terms of science, society and technology impacts. To evaluate news effect, different news which had different explanations related to these aspects of SSIs were presented and how perceptions are influenced by news framing was evaluated in this study.

1.1.3. Global Warming as an Issue of SSIs

In this study, global warming, as one of the widely discussed topics (Nuangchalerm & Kwuanthong, 2010) was chosen as one of the many SSIs. Due to the existing controversies about the reasons lying under, global warming became a reasonable candidate for SSI. Here, controversies regarding scientific, social and technological aspects of global warming were considered. The term *global warming* focuses attention on temperature increases, for which seemingly contradictory evidence abounds. According to Feierabend, Jokmin and Eilks (2010), environmental issues are complicated issues and the influences are not understood yet. Although some teachers do not consider environmental issues as controversial (McGinnis & Simmons, 1999), environmental issues are accepted as SSIs (Khishfe & Lederman, 2006; Klosterman & Sadler, 2009). According to Herman (2014), using global warming issues as SSIs provides examining personal beliefs in a reliable and appropriate way. In the same way, evaluation of global warming is also influenced by perceptions. Also, global warming issues can be interpreted in terms of science, society, and technology. For this reason, global warming is selected as SSIs in this study.

Lastly, peoples' attentions have been drawn into global warming issue by various means (i.e. media, social campaigns, government regulations, education sessions etc.) both globally and locally for decades. People are expected to have a common knowledge about global warming such that they can interpret the news

10

about global warming from different aspects. Therefore, global warming is a good candidate for this study where scientific, social and technological aspects of global warming will be considered.

1.2. Statement of the Research Problems

It is intended that these research questions will be guiding this study;

1.   What are the general perceptions of the pre-service science teachers about science, technology, and interaction between science, society, and technology?

2.   How news framing does influence pre-service science teachers' evaluations of global warming in terms of science, society, and technology?

1.3. Significance of This Study

In the literature, it has been widely studied the effect of media on the perceptions of people, in general. But, however, there are very few examples which focus particularly on the effect of media on the perceptions of science teachers or pre-science teachers. In science education, this group (i.e. teachers) has a significant role in conveying the information to the students. Thus, understanding the effect of media on teachers' perceptions is important in terms of education since teachers also affect their students in a similar way. For this reason, this study is expected to contribute to the studies on media effect on teachers' perceptions on SSIs.

To be more specific, aim of this study is an evaluation of pre-service teachers' perceptions of global warming in terms of science, society, and technology. Since SSIs are controversial, the perceptions of these issues have an influence on decision-making on these problems. For this reason, analyzing the perceptions of SSIs has an importance for prediction of reflections to these problems. Moreover, teachers' role in science lessons and also in implementing the

SSIs is important in science education. For this reason, evaluating teachers' perceptions of SSIs show how implementing of SSIs can be achieved. In the same way, pre-service teachers' perceptions also show future teachers' potentials and quality of evaluating SSIs in science lessons.

Global warming is a current issue which is considered as having scientific, social, and technological aspects. Thus, global warming is considered as a SSI. By evaluating perceptions of global warming, pre-service teachers' views on current SSI can be obtained. This will help to evaluate future science teachers' implementations of these topics which will indicate their influence on science lessons and their students.

This study is expected to help the faculty who teach pre-service science teachers to develop methods for building awareness in the prospective teachers about the perceptions by deploying the outcomes of this study.

During this study, the information provided by the pre-service science teachers' is likely to have similarities with those from the in-service teachers. Following the feedbacks from the pre-service science teachers, one can plan for a similar study on in-service teachers. In other words, this study would be a good reference (a starting point) for the future works of science teachers.

One other significant contribution of this study is that the effect of social media instruments will be revealed and teachers can utilize these social media items as an effective tool in order to convey their message in a desired manner.

CHAPTER 2

REVIEW OF LITERATURE

This chapter of the thesis is planned to present previous studies related to socio-scientific issues (SSIs), perceptions of SSIs, teachers' perceptions of SSIs, studies on news frames, and global warming.

2.1. Socioscientific Issues

Socio-scientific issues (SSIs) are defined as social issues related to science (Sadler, 2009; Sadler, Barab, & Scott, 2007; Sadler, Amirshokoohi, Kazempour, & Allpaw, 2006). SSIs are characteristically controversial and ill-structured (Sadler & Donelly, 2006; King & Kitchener, 2004). For this reason, solutions about socio-scientific problems are not single (Abd-El-Khalick, 2006; Topcu, Sadler, & Yilmaz-Tuzun, 2010; Gardner & Jones, 2011). SSIs have many aspects in addition to scientific and social aspects of ethical, moral, technological, politic, personal, etc. (Zeidler, Sadler, Simmon, & Howes, 2005; Abd-El-Khalick, 2006; Gardner & Jones, 2011; Kolstø et al., 2006).

Due to these features of SSIs, socio-scientific reasoning is important to solve related problems. Socio-scientific reasoning provides to make the decision on socio-scientific problems. In the study of Sadler, Barab and Scott (2007), aspects of socio-scientific reasoning were explained. This study summarizes the nature of SSIs under four categories; *complexity, perspectives, inquiry,* and *skepticism.*

SSIs are ill-structured problems and they do not have a single solution. SSIs do not relate to a single factor; in contrast, they have many aspects like moral, ethical, social, political, etc. For this reason, solutions cannot be easily found contrary to simple problems. This is the reason of SSIs are evaluated as *complexity*

13

in nature. In Sadler, Barab and Scott's (2007) study, it was stated that results of many research related to socio-scientific perceptions of SSIs were concluded by showing the complexity aspect of SSIs. While dealing with the socio-scientific problems, many connections to other non-stable factors appear. Therefore, problem-solving is complex. On the other side, in the stages of reflective judgment related to socio-scientific reasoning, knowledge becomes more subjective and not-certain than objective and definite knowledge. This approach makes socio-scientific reasoning more complex.

While problem-solving related to socio-scientific problems, individuals reflect their own self-beliefs, personal values and their own rules. This provides many different *perspectives* while sharing thoughts on issues. During argumentations on SSIs, individuals strongly defend their own thoughts. Sadler, Barab and Scott (2007) explained the perspective feature of SSIs as alternative perspectives provided to examine the problems, to solve them, and to identify individuals' self-thoughts in argumentations on SSIs. This makes available to evaluate complicated socio-scientific problems in various views.

Another aspect of socio-scientific reasoning was defined as *inquiry*, according to the same study. SSIs are related to scientific and societal aspects. It is obvious that science is always developed and changed. For this reason, scientific knowledge is uncertain; new knowledge can be reached in every second. On the other hand, society is characteristically dynamic; its knowledge is also changed in every second and in all conditions. Therefore, SSIs are normal to be uncertain. This characteristic of SSIs makes available to use inquiry which become the main requirement to have the decision about the real world problems because of uncertain aspects of both science and society.

During the procedure of decision-making, inquiry and all other scientific works require *skepticism* which is explained in a manner to think on open-ended SSIs. According to researchers, it is important to dealing with open questions. Understanding the socio-scientific problems provides to be skeptical which the way of socio-scientific reasoning is. At this point, Sadler, Barab and Scott (2007)

14

suggested that preferring open explanations or sources provided to being skeptical. By this way, intended socio-scientific reasoning could be obtained in all aspects.

Aspects of socio-scientific reasoning show us that complex SSIs are needed ongoing inquiry and skeptic approach. Also, different perspectives provide many alternative solutions to uncertain socio-scientific problems. In addition to formal reasoning about SSIs, sometimes individuals can make the decision related to socio-scientific problems even if they do not have enough knowledge about the issue. *Informal reasoning* is defined as people preferred to use their cognitive and affective skills to solve ill-structured and complex socio-scientific problems. In the study of Sadler and Zeidler (2005), informal reasoning was evaluated under two concerns; patterns and quality. As patterns of informal reasoning, *rationalistic, emotive*, and *intuitive* were defined.

Rationalistic informal reasoning is used when faced with rationalistic situations such as calculations, moral and valuable principles, examination of benefit problems, and some evaluations of technological outcomes. *Emotive informal reasoning* is seen when faced some situations relate to the human being. The basic factor of this reasoning is emotions which provide to others' goodness. *Intuitive informal reasoning* is seen when faced with some immediate situations. Reflects in intuitive informal reasoning is immediate, too. The difference between emotive and intuitive informal reasoning is that in emotive reflects, emotions have a role and their purpose is goodness of others. However, in the intuitive reflects, the reason cannot be defined.

Quality of informal reasoning is related to *coherence, internal consistency*, and *the variety of perspectives*. These factors provide to make better informal reasoning. This means that in addition to multi-perspectives, clarity, and coherent explanations also makes available high quality of informal reasoning. Argumentation is the way of representing the informal reasoning. Sadler and Zeidler (2005) claimed that providing the best argumentation about SSIs returned the best informal reasoning. In that study, it was purposed to show the relations between content knowledge and quality of informal reasoning and content

15

knowledge and patterns of informal reasoning. Findings showed that content knowledge was related to the quality of informal reasoning. Conversely, results did not show any correlation between different content knowledge and different informal reasoning patterns.

Topcu, Sadler and Yilmaz-Tuzun (2010) also studied the relation between content knowledge and quality of informal reasoning related to SSIs. In that study, it was stated that informal reasoning provided to the examination of individuals' thoughts and their decision-making procedures in the context. Similar to Sadler and Zeidler's (2005) study, it was indicated that to provide informal reasoning on SSIs, argumentation was one of the ways. Different socio-scientific scenarios (gene therapy, human cloning, and global warming) were chosen as context and interview were done as qualitative research method. As a result of the study, it is obviously seen that different contexts of SSIs do not have the significant effect on informal reasoning because responds of similar contexts are different and distinct contexts are seen similar. This means the influence of context on informal reasoning is not regarded as the main determination factor.

It is obviously seen that studies represent different results of content knowledge and informal reasoning related to SSIs. The reasons for difference are the characteristics of SSIs. SSIs are ill-structured, controversial, open-ended issues. Problems related to SSIs are not single. In addition, there are many aspects which are connected to SSIs such as science, society, politics, economy, technology, etc. All of these aspects are dynamic so solutions related to these problems are varied. Furthermore, SSIs are complex issues in nature, required inquiry and multi-perspectives, and skepticism. All these features of SSIs show how important SSIs are in adapting science lessons. At this point, the importance of science teachers' role is seen. In many study, it is seen that science teachers sometimes have difficulties about SSIs (Sadler et. al., 2006; Gardner & Jones, 2011; Lee & Witz, 2009; Lee & Abd-El-Khalick, 2006). They can feel unprepared related to SSIs or they can feel some deficiencies in their pedagogical knowledge or content knowledge. These reasons have an influence on their socio-scientific lesson designs. In addition to them, sometimes teachers' beliefs, attitudes, perceptions

have an influence on their lessons related to SSIs. Due to teachers are the main coordinators of socio-scientific arguments or the main factor or socio-scientific lecture design, examining their perceptions of SSIs are important. In addition to science teachers' perceptions, pre-service science teachers' perceptions are also important to future science lessons design about SSIs. This is the reason for this study why pre-service science teacher' perceptions of SSIs are examined. In the next section, studies done in the literature related to teacher and pre-service teachers' perceptions of SSIs were explained.

2.2. Teachers' and Pre-Service Teachers' Perceptions of SSIs

In science education, teachers have an important role in socio-scientific lecture design. However, it is seen that teachers' perceptions of SSIs are varied which have an influence on their SSI teachings. In this part, studies related to pre-service and in-service science teachers' perceptions of socio-scientific issues will be presented.

In literature, it is seen that there are many studies in Western and non-Western cultures related to teacher perceptions. Sadler, Amirshokoohi, Kazempour and Allspaw's (2006) study is an example of Western culture science teachers' perceptions. In this study, researchers explained that SSIs were value-laden issues which issues included ethics in it. Science depended on humans so cultural impacts had a part on scientific studies. In science lessons, teachers had a role in lecturing about value-laden SSIs which meant self-influences of teachers had a part of science lecture designs. The purpose of this study was that how values influenced on scientific research and classroom settings. In this study, semi-structured interviews were completed by 22 science teachers. Results of this study were collected on these topics; science and ethics, patterns across profiles, and teachers' own values. Answers related to science and ethics, except one participant, all teachers agreed on values and ethics had an importance in science. By evaluating the given answers, five profile teachers (profile A, B, C, D, E) were designed. Profile A teachers agreed on the importance of SSIs in education, necessity of ethics and willing to use SSIs for their classrooms. Profile B teachers also agreed

17

on the importance of SSIs and the necessity of ethics. However, they felt under restriction during implementing because of fearing about their job security, lack of materials or feeling unprepared for these issues. Profile C teachers thought that SSIs provided a connection between science and ethics but they did not see these issues were important topics to deal with. They thought that SSIs should focus on just science aspects and science teachers did not have responsibility on making connection with ethics. Profile D teacher (only one participant) thought that science teachers should have only responsibility to teach scientific facts. In science classrooms, ethical discussions should not take place. Profile E teachers thought that not only science teachers, all teachers (math, literature etc.) were responsible for teaching these values. In patterns across profiles topic, school levels' and gender differences were compared. In order to comparison of school level, most of the middle school teachers were seen profile A and B, but high school teachers were seen mostly profile B and C teachers. In addition, most of the female teachers were seen profile A and B and most of the male teachers were seen profile C. As a result of this study, it was seen that middle school teachers and female teachers thought SSIs were important topics with including ethical aspects. Also, most of the high school teachers and male teachers did not think important to deal with by ethical aspects. Lastly, in expressing teachers' own values part, it was seen that teachers avoided expressing their own values because they thought that if they implied their own values, it was not necessary to citizenship. They also thought that both sides of SSIs should be included in lessons because they accepted the responsibility to behaviors and decision-making. This study shows that beliefs of teachers on SSIs are varied on SSIs and they design their lectures in the light of this influence. Including into the lectures, time spending, lecture designs are closely related to teachers' perceptions.

Another example study in Western culture about influence of teachers' perceptions of SSIs on lecture design is Gardner and Jones's (2011) study. In that study, how lecturers design their lesson plans under their perceptions was studied. They examined the influences of biology graduate students' perceptions of SSIs. Gardner and Jones claimed that SSIs were controversial issues which topics were

designed by instructors' perceptions toward issues. Instructors used verbal and non-verbal communication skills which influence on others' perceptions. In order to examine that, six graduate teaching assistants (GTAs) contributed to this study. Presented SSIs topics (genetically modified crops) were designed in a presentation by GTAs and they were observed their non-verbal and verbal communication skills via influences on their perceptions of issues. Then, semi-structured interviews were done to obtain their perceptions toward SSIs. Results of this study were divided into two parts; classroom observations and interview themes. It was seen that in classroom observations, three instructional frames were observed; science as the authority, community as the authority, and individual as the authority. Two participants thought science as authority. They prepared lesson plans lecture-based, teacher-centered and little time for discussion. They spent their time only positive effects on genetically modified crops without dealing with social and ethical aspects. They thought that science was enough to overcome public problems. In second category, two participants thought community as the authority. They prepared their lessons by spending time for discussion. They mentioned economic and moral aspects during lesson. They thought that not only science was enough to make decision, but also public values were important. For this reason, discussion was required to make the decision related to SSIs. Lastly, two participants thought individual as authority. They saw that SSIs could be solved by individuals own opinions. For this reason, they prepared student-centered activities to gain students' opinions. Moreover, interview was done to obtain GTAs thoughts about SSIs. By this way, their thoughts and lesson practices were compared to evaluate perceptions influence on lesson design. Firstly, aspects of science which were critical for student understanding by means of social and ethical influences were asked. Participants explained this question similarly as their lesson plans. Participants who thought science as the authority mentioned about benefits of biotechnology, and participants who thought individual as the authority mentioned the importance of discussion to make the decision about biotechnology. However, all the participants agreed on the personal evaluations were required to make the decision on such issues. Answers to thoughts on science and society interaction were similar to all participants. They agreed on the importance of social

19

embeddedness of science. Also, they thought that students should be informed about the link between scientists and social groups. It is clearly seen that instructors design their lectures how they perceive the issues. Some of them believe that science is the authority; they plan their lectures lecture-based and they do not spend much time for discussion. Some of instructors believe community as authority; they spend time for discussion and they deal with the other aspects of the issue. Lastly, some the instructors believe as individuals as the authority; they prefer student-centered activities and they try to obtain participation. These results show that teachers' perceptions have an influence on lecture designs. Another important result of that study is that teachers use the way of communication about SSIs with students by the influence of their perceptions. This way of communication has direct influence on the students' perceptions of SSIs.

In addition to studies belongs to Western cultures about the importance of teacher perceptions toward SSIs, there are many studies in non-Western cultures. One of them is Lee and Abd-El-Khalick's (2006) study. Researchers examined Korean science teachers' perceptions toward SSIs. In this study, 86 in-service teachers took place. 20 five-point Likert-type questionnaires were applied to all participants and semi-structured interviews were applied to randomly select 12 participants. Questionnaire included questions related to the necessity of SSIs, factors during application of SSIs, and personal efficiency beliefs with SSIs. Semi-structured interview questions included questions related to gain deep analysis on perceptions toward SSIs. Results of this study were collected on three topics; perceptions of SSIs, perceptions of necessity to include SSIs in classrooms, and factors influence on the application of SSIs. Firstly, it was seen that participants' perceptions toward SSIs were negative. Almost all participants thought that SSIs included dangerous and destructive topics. They agreed on humans destroy natural life such as cloning, scientific products etc. They thought that SSIs were related to moral-ethical values. They agreed on humans used science and technology in order to obtain desired imaginations without thinking moral and ethical aspects. Also, they saw SSIs as relationships between NOS. They gave examples of science was subjective, socially embedded, tentative etc. Secondly, in contrast to negative

20

perceptions toward SSIs, almost all participants (81%) agreed on SSIs should be included in science classrooms. They thought that SSIs provided thoughts on the necessity of application science to daily life problems, improvement of decision-making ability, development their judgment ability, improvement of understanding of science. Thirdly, factors influence on addressing SSIs in science classrooms were divided into three topics; low personal science-teaching efficacy (PSTE) beliefs, students' and teachers' own values, and other situational factors. PSTE beliefs were presented as most important factors which had an influence on addressing SSIs. Lack of content knowledge or pedagogical expertise, their understanding, and low confidence to develop materials were presented questionnaire results of PSTE beliefs. In addition, 50% of participants indicated their lack of understanding and knowledge, 30% of them said low confidence in their pedagogical skills in interview results. Another factor was presented as teachers' own values toward SSIs. Teachers said that they did not think critically on SSIs. Also, they saw SSIs as presentable topics by traditional epistemology and pedagogy. In addition, teachers thought that students only absorb teachers' values during lessons. Lastly, other situational factors were presented as lack of time, lack of available materials, lack of classroom management ability, difficulties evaluating student performance. All of these results show that teachers' perceptions of SSIs are negative. However, they think that these issues are important to deal with. At this point, reasons to explain this contradiction are explained as personal deficiency on SSIs. Teachers think that they do not have enough knowledge and pedagogical skills on SSIs and they feel low confidence to touch. In addition, lack of educational materials, assessment protocols, lecture timing are other reasons of teachers about why they have negative perceptions of SSIs.

It is the important point in Lee and Abd-El-Khalick's (2006) study that they think that students only absorb what teachers explain. It is important because it shows that students are not regarded as the authority like Gardner and Jones's (2011) study. For this reason, teachers do not spend time to think on SSIs and they do not effort to teach these issues. However, Gardner and Jones categorized the

teachers who believe science as the authority, community as the authority, and individuals as the authority. In contrary to results of Lee and Abd-El-Khalick's (2006) study, it is seen that teachers, who see science as the authority, also spend time for discussion. And, all teachers deal with the issues and they include them into their lesson plans. In addition to this study, Sadler, Amirshokoohi, Kazempour and Allspaw (2006) categorized teachers based on their perceptions of SSIs and their lecture plans. In both Western cultures, studies show that teachers use SSIs in their lectures. In addition, they spend time for discussion which is changed by their perceptions of SSIs. On the other hand, it is obvious that both in Western and non-Western cultures, teachers agree on the importance of SSIs. Contrary to some of them opposite thoughts, their lecture designs are varied based on their perceptions. By this way, students' learning is directly affected by the influence of teachers.

Results of them show that teachers are the main factor of socio-scientific lectures. Students can learn socio-scientific objectives under the influence of teacher perceptions. For this reason, evaluation of teacher perceptions on SSIs is important in science education. It is seen that results of Western and non-Western cultures are different. Since SSIs have many aspects such as social, political, moral, etc. cultural influence can be seen in the teacher perceptions of SSIs. Turkey is geographically in the middle of these cultures. For this reason, similar results can be seen in Turkish teacher perceptions. This is the reason of this study to show Turkish pre-service science teachers perceptions of SSIs.

Studies show that teachers design their lessons by the influence of perceptions of issues. They use instructional techniques or methods, materials, time during lessons which differ to all teachers depending on their perceptions. Moreover, during lectures, their communication skills also show their perceptions which have an effect on students' perceptions of issues. They use verbal explanations or images during lecturing. These verbal or non-verbal messages, named as *framing effect*, have an effect on students' perceptions. Gardner and Jones (2011) claimed that students' perceptions could be stronger, weakened, or completely changed by the influence of framing effect. This shows that teachers use some communication skills, verbal or non-verbal, and they influence on

22

students' perceptions in this way. Students can change their thoughts, or their thoughts can be stronger or weak. All of these influences can be made by the influence of teacher perceptions. In the study of Stewart, Dickerson, and Hotchkiss (2009), teachers used news, based on *the news framing effect*, during lessons and changing of students' beliefs were analyzed. It was seen that some students changed their thoughts via the influence of news. In addition, some of students' beliefs were seen stronger. These results of studies show that teachers' perceptions are changed or effected via the influence of news. It is important to study because teachers have some perceptions of SSIs and their perceptions directly influence on students' perceptions about SSIs. For this reason, how teachers' perceptions are influenced via news framing is important to examine. Moreover, it is also important to examine the influence of news framing on pre-service science teachers' perceptions because pre-service science teachers are also responsible for socio-scientific lecture design in the future. This is the reason of the aim of this study which was the evaluation of pre-service teacher perceptions by influence of news framing.

2.3. Frame Theory

In Hallahan (1999) study, framing theory was explained in all aspects. According to Hallahan (1999), framing was to select a situation related to life and to make it more obviously understood via communication techniques. For that reason, in public communication, framing had an important role because it caused to change others' perspectives and perceptions via hidden-or not- messages. Framing theory dealt with the results of indented to given messages under psychological and mental processes. Framers made message which were composed for a purpose. For example, some aspects related to an issue could be represented in positive or negative aspects (valence framing), or used terms could be changed in alternatives (semantic framing), or events could be explained like a story (story framing). Intended messages were designed under patterns; syntactic structure (constant word or phrases used in written), script structure (written situations in an order), thematic structure (written events in a relationship). Two mechanisms were

defined in framing works; *contextual cues* and *priming*. According to the Hallahan's explanations, framing caused *contextual cues* via shaping decision-making and drawing conclusions about issues by messages. As an example of contextual cues, negative-or-positive framing was preferred more in empirical designs but it could have some unpredictable results because it was seen that negative framing caused individuals more thoughtful and individuals preferred to protect themselves in negative situations. Another mechanism of framing was *priming* which was explained as schematic knowledge in the human mind where framing effect was observed with the disturbing the memory vertex or existing schemas via messages. Memory nodes or memory schemas were examples of framing mechanism of priming.

According to the researcher, framing was used in many areas like psychology, sociology, politics, etc. Hallahan (1999) examined these areas, where framing was used, and sorted the models of framing under seven titles; *framing of situations, attributes, choices, actions, issues, responsibility,* and *news* (Table 2.1).

Table 2.1 *Typology of seven models of framing applicable to public relations*
          (Hallahan, 1999, p. 210)

What is Framed	Description	Key Sources
Situations	Relationships between individuals in situations found in everyday living and literature. Framing of situations provides structure for examining communication. Applies to discourse analysis, negotiation, and other interactions.	Bateson (1972), Goffman (1974), Putnam & Holmer (1992), Tannen (1993)
Attributes	Characteristics of objects and people are accentuated, whereas others are ignored, thus biasing processing of information in terms of focal attributes.	Ghanem (1997), Levin, Schneider, & Gaeth (1998), McCombs & Ghanem (1998), Ries & Trout (1981), Wright & Lutz (1993)
Choices	Posing alternative decisions in either negative (loss) or positive (gain) terms can bias choices in situations involving uncertainty. Prospect theory suggests people will take greater risks to avoid losses than to obtain gains.	Bell, Raiffa, & Tversky (1988), Kahneman & Tverksy (1979, 1984), Levin, Schneider, & Gaeth (1998)
Actions	In persuasive contexts, the probability that a person will act to attain a desired goal is influenced by whether alternatives are stated in positive or negative terms.	Maheswaran & Meyers-Levy (1990), Smith & Petty (1996)
Issues	Social problems and disputes can be explained in alternative terms by different parties who vie for their preferred definition a problem or situation to prevail.	Best (1995), Gamson & Modigliani (1989), Snow & Benford (1988, 1992)
Responsibility	Individuals tend to attribute cause of events to either internal or external factors, based on levels of stability and control. People portray their role in events consistent with their self-image in ways that maximize benefits and minimize culpability. People attribute causes to personal actions rather than systemic problems in society.	Iyengar (1991), Iyengar & Kinder (1987), Kelley (1967, 1972a), Protess et al.(1991), Wallack, Dorfman, Jernigan, & Themba (1993)
News	Media reports use familiar, culturally resonating themes to relay information about events. Sources vie for their preferred framing to be featured through frame enterprise and frame sponsorship.	Gamson (1984), Gamson et al. (1992), Ryan (1991)

Framing of situations, included behavior and negotiation, made others show the real problems which were in intended way. *Framing of attributes* made shapes related to issues, people or products in others minds with picture framing, problem framing, advertising framing, and experience-frames-advertising framing. *Framing of risky choices* made others choose one way which included the risk of loss or gain. *Framing of actions* was seen the actions towards to intended aims. *Framing of issues* was used in discussions to influence others' views like political

25

discussions. *Framing of responsibility* was seen when the people faced to the events which caused to have responsibility towards reactions. The last model of framing theory, *news framing* was explained as the way of represent the issues to make meaningful via media. For that reason, news framing had an important role in public relations to represented issues. Media packages, defined as symbols or framing devices, were developed through media workers to make mental images to the audiences. In literature, it was seen that in many areas, news framing was used to examine the perspectives related to social problems (i.e. abortion, drug problems, women's issues, welfare, etc). In addition, there were studies related to scientific areas (i.e. climate change, ozone depletion, memory recovery etc).

As it is seen, news framing has an important role in public communication related to some important social problems. Individuals' perceptions of these problems are influenced and shaped by the influence of news. Due to socio-scientific problems are also within in daily lives, socio-scientific problems are also presented others via news. For example, news about climate change, global warming, etc. are presented others by news. This presentation way of such socio-scientific problems has also influences on others' perceptions related to these issues. For this reason, it is important to examine the influence of news framing on individuals' perceptions. For this reason, in this study, influence of news framing was examined. Therefore, in this part, studies on news framing will be presented.

Scheufele (2006) examined media (news) effect on frame theory in his study. In this study, framing theory was shown to the significant effect of the social changes. In history, it was realized that mass media was seen as a strong influence on people so media was adapted and applied to the public to construct social changes. Media provided to compose frames on people minds so people inferred the events under the light of media perspective. Inferring was the result of the news processing. News processing started with the active process that means individuals tried to understand what the media said via other sources. Then, with other mass media, individuals completely understood the meaning of information. Lastly, individuals passed over what they not understood or found irrelevant, and made a conclusion via their backgrounds about information, effects of sharing with

others, or results of media search. Scheufele classified the typology of framing under two aspects; *media vs audience frame* and *independent frames vs dependent variables*. Firstly, media (news) frame was defined as the give salient meaning the events to the audience. How media frame occurred was also explained in here. According to researcher, 'selection' and 'salience' were two main factors which mean choosing some points in the text made those parts more attractive. Individual (audience) frame was defined as individuals' self-thoughts had effects on their understanding of issues. Individuals' 'global and long-term political views' composed their characteristics which had influences on their perceptions or explanation of issues. Their 'short-term, issue related frames' had effects on their seeing, understanding and inferring of issues. As it is seen here, news framing directly influences the perceptions of individuals. Some messages are intended to send others so they are designed for this aim. Individuals understand or interpret these messages under the effect of their own thoughts. By this way, these messages can be effective in their perceptions about issues or their understanding of issues.

There are many studies related to news framing and its effects on perceptions. In some studies, news frames are used as a dependent variable and others show the news frames as independent variable. Scheufele (2006) summarized the studies under four typology of media framing in literature. *Media frames as dependent variable* part examined studies did not have any verification to collect data in systematic to show the effective factors on media frame as a dependent variable. *Media frames as an independent variable* part were categorized under two groups. In the first group of studies showed the influences on individuals' attitudes, thought, or individual frames. In the second group of studies showed the influences on individual framing appearing the different priorities. *Individual frames as dependent variable* part included the results of studies done only experimentally on individual frames when different media frames were applied. The results showed that issue frames of news had a significant impact on mental reacts. Lastly, *individual frames as independent variables* part included the studies on the relationships between understanding issues and reacting as a social movement. These summarization of studies show

27

that news framing is used in many study as both independent and dependent. By this way, it is seen that news framing can be applicable in studies in many different ways. It is also an important point that how news framing works on individuals' perceptions.

To explain the process of news framing, Scheufele (2006) developed a process model of framing. According to Scheufele, there were four paths and relations between them; frame building, frame setting, individual-level effects of framing, and the relation between individual frames and media frames. It was explained that in earlier studies, effective factors on news were defined, but Scheufele did not agree on these factors. This was the reason for the categorization of frame building via model of agenda-setting in literature which included the effective factors by means of structural impacts resulted on newsmakers. Frame setting was showed as accessibility of frames which was explained via agenda-setting idea used in literature. Individual-level effects of framing were observable changes of media frames by means of behaviors, attitudes, thoughts, and other effects on the mind. That part was divided into two parts; inputs and outputs. According to Scheufele, many studies showed the direct relation with media framing and behavioral, attitudinal, or thinking changes as output effect. Journalists as audience part was defined as a relation of input of individual-level effects of framing and media frame. In that part, journalists were evaluated as other audiences and the frames which had an effect on them were evaluated such as other elites, ideologies etc. This process model of framing explains how news framing works on perceptions. Intended messages are designed as an input by journalists and they affect the audiences' perceptions as output.

Another study related to the theory and typology of news framing was done by Vreese (2005). In that study, there were some similarities and differences between Scheufele's (2006) study. In that study, news framing was defined as process of understanding and reflecting on different points related to issues. Similar to Scheufele's process model framing, Vreese made a model of framing process and used same terms 'frame-building' and 'frame-setting'. (Figure 2.1).

28

Frame-building		Frame-setting	
Framing in the newsroom	**Frames in the news**		**Framing effects**
– internal factors (editorial policies, news values) – external factors	– issue-specific frames – generic frames		– information processing effects – attitudinal effects – behavioral effects
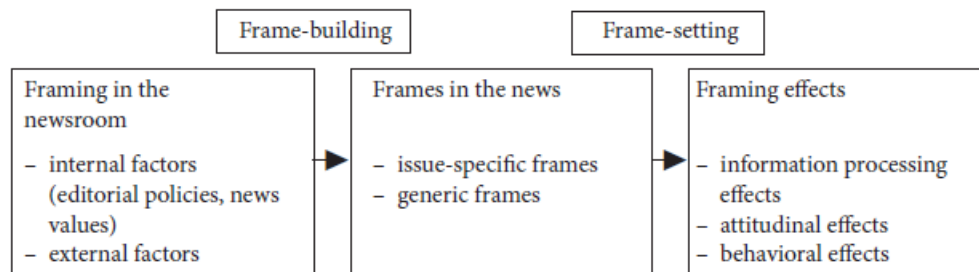
Figure 2.1 *Process model of framing (Vreese, 2005, p. 52)*

Frame-building part included the effective factors on news frames. Effective factors of editing journals were defined as internal factors, and other factors like social movements were defined as external factors. Frame-setting part reflected the relation with news and individuals via affecting existing knowledge of them. According to Vreese, researchers agreed on that all verbal and visual images (media packages) were frames such as headlines, subheads, photos, photo, statistics, paragraphs etc.

Vreese composed a typology of news framing contrary to Scheufele who made a typology by classifying used news frames in literature as dependent or independent variables. Vreese evaluated the studies in a more general perspective and classified the literature by considering the nature and content of frames. According to Vreese, there were two types of news frames; issue-specific news frames and generic news frames. Issue-specific news frames included the studies which dealt with the specific content such as women's movement, labor disputes etc. Generic news frames were examined in two groups. In the first group of generic news frames focused on studies which included the issues on winning-losing, language used in war, or other competition areas, issues on performers-critics-preformed, different styles and perceptions, promotions of election. In the second group of studies were related to journalism means of council, pattern, or worth of news.

In both studies of Scheufele's and Vreese, news framing was explained under different categories. Both researchers examined the related literature and

29

they made their own models of framing process and typologies of news framing. It is obviously seen in both studies news framing has an impact on behaviors, attitudes, perceptions of the audience via used visual or textual messages. In the study of Gardner and Jones (2011), biology graduate students' framing of SSIs was explained. As a result of that study, it was seen that graduate students designed their lectures under the effect of their perceptions of the issues and they preferred to use verbal and non-verbal explanations for the effects of their perceptions. In the study of Stewart, Dickerson, and Hotchkiss (2009), the impacts of news frames on undergraduate and master's students' beliefs were studied. As a result of that study, it was seen that beliefs about ethics-related to the issue were getting stronger via news frames and beliefs on credibility and usefulness were not affected. In the study of Corbett and Durfee (2004), students' perceptions related to global warming issue was influenced by the influence of news. These studies are examples of the influences of news framing on individuals' perceptions. As it is seen, in all academic levels (students, undergraduate students, master students), news framing has effects in different aspects. We believe that news framing has also an effect on pre-service science teachers' perceptions, too. Especially, pre-service science teachers are important in future science lessons so how their perceptions are influenced via news is important to study. On the other side, studies show that teachers design their lessons according to their perceptions of issues which are important to students' perceptions about issues. This is another important reason to examine pre-service science teachers' perceptions by the influence of the news framing. Therefore, in this study, the influence of the news framing on pre-service science teachers' perceptions was examined.

2.4. Global Warming as an Issue of SSIs

Global warming is one of the well-known current topics of SSI. As it was explained before, SSIs are controversial and ill-structured issues and they do not have a single solution. Global warming has these characteristics which make global warming as a socio-scientific issue. In addition, global warming issue is argued globally in many areas because it is related to science, society, technology,

30

economy, politics, etc. For this reason, there are so many studies related to global warming in literature.

In education area, global warming is commonly used. In many studies, teachers' attitudes toward environmental education and relation to global warming were evaluated (Teksoz, Boone, Yilmaz-Tuzun, & Oztekin, 2014; Campbell, Medina-Jerez, Erdogan, & Zhang, 2010; Braten, Gil, Stromso, & Vidal-Abarca, 2009; Kogce, Unal, & Sahin, 2009; Tekkaya, Sungur, Cakiroglu, Ertepinar, & Kaplowitz, 2009; Culley, Carton, Weaver, Oliver, & Street, 2011). For example, in the study of Campbell, Medina-Jerez, Erdogan, and Zhang (2010), science teachers' attitudes and knowledge about environmental education was examined. In that study, science teachers in three different countries (54 U. S, 63 Bolivian, and 54 Turkish) was participated. Results showed that there were differences in environmental knowledge and practices in these countries. However, almost all the science teachers in that study agreed on the importance of environmental education in science classrooms.

Teksoz, Boone, Yilmaz-Tuzun, and Oztekin's (2014) study about pre-service teachers' attitudes toward environmental issues is another example. In that study, 2311 pre-service teachers' knowledge, attitudes, responsibility and concerns of environment literacy were examined. The results of that study showed that pre-service teachers did not have enough knowledge about environmental problems and its relation with nature and social life. Results also showed that pre-service teachers' attitudes toward the environment were positive, but they did not feel enough responsible related to environmental problems.

In both national and international studies, similar results were seen that teachers had positive attitudes toward environmental education. Some of these studies were summarized as teachers' misconceptions about environmental problems and some studies were concluded as lack of knowledge about environmental issues. As it was explained before, sometimes have difficulties in teaching SSIs because of their lack of pedagogical knowledge or content knowledge. These studies exemplify teachers' deficiencies about environmental

31

issues and also global warming issue. In addition, it was also explained that teachers' attitudes, perceptions, beliefs related to SSIs have an influence on socio-scientific lecture design. These studies also illustrate the differences of teachers' perceptions of global warming.

Especially, in science education, global warming has a special part in the curriculum. Science teachers are responsible for achieving the objectives related to global warming. However, it is seen that science teachers' perceptions of global warming are different which directly has an influence of their communicating with students related to global warming. Teachers deal with global warming issue by the influence of their perceptions of global warming. For this reason, it is important to examine science teachers' perceptions of global warming. For the same reasons, pre-service science teachers' perceptions of global warming are also important. This explains why pre-service science teachers' perceptions of global warming were examined in this study.

It was explained before that individual' perceptions of SSIs are influenced by news framing. Especially, global warming is one of the commonly known current controversial issues so there are so many news related to global warming. These news have an important role in public perceptions of global warming issue. People' perceptions can be stronger if news is parallel to their thoughts or their perceptions can be weaker or they can change their thoughts if news about global warming is stronger enough. In literature, there are so many studies related to global warming and news framing. For example, in the study of Smith (2005), author explained the role of news about environmental issues on people understanding of issues. According to the author, news media had an important role in shaping individuals' understanding of environmental issues. Results of that study showed that there was a disagreement between science part of climate change and presented news about the issue. This made the risks on the perceptions of the audience of news.

This study shows that news about global warming has an influence on perceptions of people. It is an interesting point that there is a limited study to

examine the teachers' perceptions of global warming. However, global warming is a specific issue in science curriculum. In the study of Corbett and Durfee (2004), pre-service science teachers' perceptions of global warming were examined according to controversy and context of news. In this study, it was seen that pre-service science teachers' perceptions of global warming were influenced by news of both controversy and context of news. This study is an example of the influence of news framing on pre-service science teachers' perceptions of global warming. In another study about pre-service teacher perceptions and news framing, Steward, Dickerson and Hotchkiss (2009) founded the news had an influence of pre-service teachers' perceptions in terms of ethics, credibility, and usefulness. These studies are examples of news framing influences on pre-service teachers' perceptions. These studies show the importance of examining the influence of news framing because science teachers have an important role to teach global warming to students. This is the reason of this study which is the examining the influence of news framing on pre-service science teachers' perceptions.

CHAPTER 3

METHOD

In this chapter, information about participants, the data collection, and data analysis procedures of the study conducted are presented.

3.1. Methodology

The research design can be defined as basic or generic qualitative research approach (Merriam, 1998). The aim of the researcher can be stated simply as to reveal the participants perception of science, technology, and society aspects of global warming news rather than focusing on intensive case and building a grounded theory. In this study data were collected through interviews based on basic or generic qualitative study and the explanations of the PSTs were analyzed under recurring patterns for science, society, and technology aspects of the given news. According Merriam (1998) the important philosophical assumption of a qualitative study is to reach realities constructed by individuals. Therefore, in this study the perceptions about participants tried to be understood in more detail. The PSTs were engaged with global warming news that they can easily reach in their real life settings. According to Merriam (1998), qualitative research usually involves understanding of participants ideas formed as a result of participants' experiences in their daily lives. Thus, through including news in data collection procedure, the researcher had an opportunity to get pre-service science teachers' real perceptions as they use in their daily lives.

3.2. Participants

The participants of this study composed of eighteen (16 female and 2 male) PTSs, enrolled in a large research-oriented public university's elementary science education department. They were within their academic semester of

graduation from Department of Elementary Science Education. The participants were selected by using purposeful and convenient sampling. In terms of purposeful sampling, engagement was seen as important criterion. Since global warming issue was used as a socio-scientific issue, it was required to have participants who had prior knowledge about environmental issues for reasonable results. Due to the must course, named *Environmental Science*, offered to PTSs in their senior year, senior PTSs were asked to involve this study purposefully. Therefore, it was assumed that all participants had taken at least one environmental course and they were engaged with environmental issues. Convenience sampling was also used due to time and availability of internet access. All senior PTSs were asked to involve in this study through online environment. Eighteen of the senior PTSs were agreed to participate this study volunteerly.

3.3. Data Collection Procedure

Internet was used as a tool to communicate all participants. All participants joined in an online communication platform and talked to the researcher based on their convenience. Each interview lasted approximately 60-90 minutes. All of the interviews were audio taped and transcribed to capture the participants' explanations and for further evaluation.

3.4. Instruments

In this study, two research questions were tried to be answered where for each research question, two separate semi-structured interview questions were composed.

The first research question was asking the participants' perceptions of science, technology, and interaction between science-society-technology separately. For this reason, first semi-structured interview questions were asked (Appendix A). These questions were adapted from the study of Kahyaoglu (2004). Interview questions were related to three concepts; perceptions of science (4

items), perceptions of technology (2 items), and perceptions of interaction of science-society-technology (2 items).

In the second part of the study, the second research question was addressed which aimed to evaluate news framing patterns of participants' perceptions of science, society, and technology aspects separately regarding global warming issue. To do this, second semi-structured interview questions were designed. These questions were used in the study of Stewart, Dickerson, and Hotchkiss (2009). Nine questions were used from this study and adapted to this study regarding science, society, and technology aspects (Appendix B, C, D).

In order to be able to evaluate their perception changes on each aspect separately, the interviews were designed to be three sessions dedicated to science, society, and technology aspects of global warming. Each session started with sharing two news articles specific to the aspect of that session. These news were adapted from a web page (www.ntv.com.tr/arsiv/ id/24930653 /). The reason to select these news (Appendix E, F, G) from this web address was that they had a special page dedicated to 'Green News' which included special global warming news. Furthermore, this web page was also awarded by ÇEVKO in 2008 because of its news about environmental awareness. For each aspect, first news included positive expressions and the second one included negative expressions. This was designed in order to evaluate the influence of the news framing on perceptions of PTSs. Influence of news framing is explained as verbal explanations in news, texts, and information sheets have effects on individuals whose perceptions are stronger if the explanations are similar to their thoughts. If not, individuals' perceptions can be weaker or they can change their thoughts (Chokriensukchai & Tamang, 2010; Zhao, Leiserowitz, Maibach, & Roser-Renouf, 2011). For this reason, it was aimed at sharing positive and negative news that evaluating the news framing influences on participants' perceptions of each aspect.

After PTSs read the news about each aspect, related semi-structured questions were asked. To evaluate the news framing effect on PTSs' perceptions of science, these nine questions were adapted to perceptions on science aspect of

global warming issue portrayed in the news (4 items), changes in science perceptions (4 items), and perceptions about science and environment relationship (1 item). To evaluate the news framing effect on PTSs' perceptions of society, same questions were adapted to perceptions of society aspect of global warming issue portrayed in the news (4 items), changes in society perceptions (4 items), and perceptions about society and environment relationship (1 item). Lastly, to evaluate the news framing effect on PTSs' perceptions of technology, these questions were adapted as perceptions of technology aspect of global warming issue portrayed in the news (4 items), changes in technology perceptions (4 items), and perceptions about technology and environment relationship (1 item).

3.5. Data Analysis

Data analysis was done by using Miles and Huberman (1994) approach which included the data reduction, data display, and conclusion drawing-verification process.

Miles and Huberman (1994) approach explains the data reduction process by summarization of data, explanation of notes, determination of the common words used etc. In this study, data reduction was done by summarization of data after interviews, by coding the common keywords which were used to express similar meanings. First the codes on the science aspect were evaluated, then the results were categorized and the themes were determined accordingly. Similar procedure was applied to the technology and society aspects as well. To display data, Miles and Huberman (1994) recommend two ways: networks and matrices. Networks are used to show direct relationships and matrices are used to show complex relationships. In this study, matrices were preferred to show complex relationships of the pre-service teachers' general perceptions and the news farming effects on their perceptions of science, society, and technology aspects of global warming. Lastly, the data summaries obtained were evaluated via interpretation of the codes according to the criteria mentioned in the literature. This was done to verify the

37

analysis. By this verification process, validity and reliability of the study were demonstrated.

3.6. Trustworthiness of the Study

The trustworthiness of qualitative studies was an important issue to make valid and reliable inferences. Lincoln and Guba (1985) argued that trustworthiness is related to what extent the researcher persuades the readers of the study about the findings of the study are reliable and valid. In this section, how trustworthiness was ensured to gather and analyze the data was presented.

3.6.1. Triangulation

This strategy refers to the utilization of multiple investigators or multiple sources of data (Denzin, 1970). Both data collection triangulation and data analysis triangulation were used in this study. Triangulation of this study was provided by using different news and asking science, technology and society perceptions of the PSTs. The data obtained from different news were used to triangulate their consistencies' across news.

3.6.2. Reliability

Reliability refers to whether same results can be obtained if the study is replicated (Merriam, 1998). Cresswell (2007) explains the strategies used in qualitative research to check the validity where inter-coder agreement was used to supply the validity of the research. Cresswell suggests codes determined by the researcher which should be also evaluated by another field expert. In this study, expert opinions were provided to check the codes and the data analysis to verify the validity of this study. Two investigators analyzed the data and at least 0.80 inter-rater consistency was determined.

3.6.3. Applicability (External Validity)

In qualitative approach, external validity refers to transferability of inferences of the study beyond study itself (Lincoln & Guba, 1985). For this

purpose rich and thick descriptions of participants were provided in purposeful sampling procedure. In sampling, the maximum variation was provided to external validity. Also, the using internet environment ensured the consistency of data collection environment for all participants. This approach enabled researcher to use similar rapport in her conversation with the participations. Thus, same procedure can be used by other researchers to increase the consistency of data collection procedure.

CHAPTER 4

RESULTS

In this chapter, results of the study are presented in two sections; where pre-service science teachers' general perceptions of science, technology, and interaction of science-society-technology are presented first, and then news framing influences on pre-service science teachers' perceptions of science, society, and technology were analyzed.

In each subsection, it is started with the detailed explanation of the answers and presented the tables which include all answers with their percentages, and sample phrases representing that type of answer. At the end of each section a summary of the answers are provided. More will be said in the Discussion chapter.

4.1. Pre-Service Science Teachers' General Perceptions of Science, Technology and Science-Society-Technology Interaction

In order to evaluate the pre-service science teachers' perceptions of science, technology, and science- society- technology interaction, eight questions were asked. Responds were presented below in three sections as; perceptions of science, technology, and science-society-technology interaction.

4.1.1. Pre-Service Science Teachers' Perceptions of Science

In order to learn participants' perceptions of science four questions were asked. First, definition of science was asked (Appendix A, item 1).Participants explained science in different ways. 38 % of the responders defined science as way of explaining natural phenomena. 22 % of them explained science via exemplification the science interests. 13 % of them defined science as nature of science aspects. 11 % of them claimed that science was the nature of human beings and environment, 11 % of them defined science as activities used by science

process skills (SPS). Lastly, two of them (4 %) approached science as being harmful.

The 38 % of the responders mentioned above, who said that science was a way of explaining natural phenomena mentioned the purpose of science while they were explaining their ideas. Most of them (41 %) said that science provided to learn new things. 29 % of them said that science made lives easier. 12 % of them mentioned that purpose of science was to share what scientists discovered with other people. Rest of them said that science helped solving daily life problems, gaining analytical thinking abilities, and provided development on health, education, and other areas (6 % for each answer).

13 % of the participants mentioned science as the nature of human and environment. According to them, science explains the reasons behind natural events like striking of a thunder or falling of an apple down the tree.

11 % the participants said that science was the activities that use science process skills (SPS). According to 60 % of this group, doing research on their certain topic was science while others (40 %) added curiosity as an additional requirement to doing research to make science.

While they were defining science, 22 % of them also mentioned interests of science. According to them, health (30 %), space (30 %), social life (20%), education (10 %), and technology (10%) were the areas where science was applicable.

13 % of the participants mentioned nature of science aspects in definition of science. 33 % of this group thinks that science depends on observations. Other participants mentioned different properties for the nature of science aspects given as certainty of scientific knowledge, being universal and objective and being empirical (17 % each) (See Table 4.1).

As it is seen in Table 4.1, it is an important point that only one participant (4 %) mentioned its harms when science was asked. According to this participant science causes environmental pollution and diseases.

41

Table 4.1 *Pre-service science teachers' definitions on science*

Definition	Overall %			# of usage	% in each	Example
Way of explaining natural phenomena	38	Purpose of science	Provide learning new things	7	41	P13: I think exploring new things is science.
			Make life easier	5	29	P3: It makes our life easier.
			Share learning with others	2	12	P14: Science tries to inform others…
			Gain analytic thinking ability	1	6	P4: Science provides to think analytically…
			Help solving daily life problems	1	6	P3: It helps to solve problems related with…
			Development	1	6	P17: …to develop some areas such as health, education etc.
Nature of human and environment	13	Environmental events		5	100	P3: I think science as nature of human and environment.
Activities used SPS	11	Search		3	60	P4: They [scientists] observe and search on them because…
		Curiosity		2	40	P5: Science is processes or activities which include curiosity, observing…
Science interests	22	Health		3	30	P8: …scientists tried to develop a prosthesis which has feeling emotion.
		Space		3	30	P12: For instance, scientists studied space…
		Social life		2	20	P11: Science is also in social world…
		Education		1	10	P17: …to develop some areas such as health, education …
		Technology		1	10	P16: It is exploration of new systems in technological area or other scientific areas for a better life.
Nature of science	13	Observation		2	33	P4: They observe and…
		Universal		1	17	P9: It is universal …
		Objective		1	17	P9: If we focus on the main source of science, objectivity is achieved
		Certainty		1	17	P3: It is based on research and has certain truths.
		Empirical		1	17	P18: Observations, research, and experiments are common in science
Harms of science	4	Environmental pollution		1	50	P17 It causes environmental pollution…
		Threaten Health		1	50	P17: Causes environmental pollution and related diseases.

As a second question, personality of scientists was asked (Appendix A, item 6). Participants responded this question by attributing combinations of different personality aspects to scientists (See Table 4.2).

Table 4.2 *Pre-service science teachers' views on personality of scientists*

	Overall %		# of usage	%	Example
Characteristics of scientists	100	Curious	11	30	P17: They are curious people.
		Ordinary people	8	22	P10: They are normal people.
		Patient	6	16	P15: They are so patient people that they do not give up even if they fail.
		Creative	2	5	P11: Everyone cannot be a scientist because they have creativity.
		Determined	2	5	P14: The only difference is they are determined people.
		Imaginative	1	2	P5: Imagination, they should have.
		Extraordinary people	1	2	P4: They are extraordinary people.
		Open-minded	1	2	P11: They are open-minded.
		Social	1	2	P12: I think they are in the society; they are a part of it.
		Asocial	1	2	P13: They cannot find time to their dresses, cannot meet and spend time with others.
		Hard-working	1	2	P13: I think scientists are mostly hard working…
		Objective	1	2	P1: Scientists should be objective as much as possible.

According to them, scientists are curious (30 %) who want to learn always more, they are ordinary people like others (22 %), and they are patient (16 %) since scientific studies require being patient like in some experiments which are repeated too many times. 5 % mentioned that scientists had to have creativity. They had to be determined (5 %), objective (2 %), imaginative (2 %), open-minded (2 %), social (2 %), and hard-working (2 %) people. Opposing these positive definitions, one of the responders (2 %) claimed that scientists are extraordinary, and one of the participants (2 %) believed that they are asocial people.

As a third question, pre-service science teachers' views on effects of science courses on their daily life which were taken in university and primary school were asked (Appendix A, item 5). Responds to this question were quite different. It is an interesting result that all of the pre-service science teachers thought that science courses taken in university only had positive effects on their daily lives. However, responders to the effects of science courses taken in primary school part of the question varying answers (See Table 4.3).

Most of the responders (33 %) of participants, who had positive effect on their daily lives via science courses taken in university, thought that these courses helped to understand the reasons behind the physical events. 26 % of them thought that science courses in university provided awareness, 14 % of them thought they improved reasoning abilities. Moreover, 11 % of them had broader view of life events after those courses, 11 % of them could use learning in their daily lives. 3 % of them learned protection ways of environment. However, responds related with primary school are seen as varied. Similar to responds toward university science courses, most of the pre-service science teachers (50 %) believed that science courses taken in primary school had positive effects on their lives. 30 % of them considered these courses applicable in their daily lives and 20 % of them understood the reasons of events with the effects of these courses. However, one of the participants (10 %) claimed that these courses had negative effect on daily life because they caused misconceptions which could not be corrected easily. Interestingly, 40 % of them responded this question as they did not see any effect of science courses taken in primary school.

Table 4.3 *Pre-service science teachers' views on effects of science courses taken in primary school and university on daily life*

Categories		Overall %		# of usage	% in each category	Example
Influences of science courses in university	Positive effects	100	Become more aware	7	26	P10: All of them make me more aware of the scientific studies.
			Understand the reasons of events	9	33	P3: These courses helped to easily understand physical world.
			Gain reasoning ability	4	14	P4: We have the reasoning ability in our daily lives
			Being applicable in daily life	3	11	P9: I applied what I had learned in these courses in my daily life
			Provide broader view	3	11	P2: I can look at things in at different points
			Learn protection ways of environment	1	3	P17: We learned the real world problems and the protection ways to save the environment.
Influences of science courses in primary school	Positive effects	50	Being applicable in daily life	3	30	P15: I could easily apply my learning into my life
			Understand the reasons of events	2	20	P16: I learned that in rainy days, thunder falls to the trees so I was keeping away from trees in those days.
	Negative Effects	10	Misconceptions	1	10	P3: I had misconceptions about science courses; it was not easy to correct them
	No Effect	40	Science courses did not have effect on me.	4	40	P5: In primary school, I do not remember anything I learned as science. We took science courses but none of them had an effect on my daily life.
Reasons of ineffectiveness of science courses	Poor teaching techniques	92	Lack of relation with daily life	14	61	P18: I did not like the science courses in primary school because I cannot relate them with daily life.
			Memorization	5	22	P10: Before university, science courses did not have any mean for me. We memorized what teacher said.
			Exam oriented	4	17	P14: I took many science courses before university. There, we learned science for only to be successful in our exams.
	Poor teaching materials	8	Designs of science course books	1	50	P2: Chapters related with environment were mostly being in the end of the books so they were not covered
			Educational equipment	1	50	P13: We did not have educational equipment and we had to imagine our teachers' explanations.

When answers are examined in Table 4.3, it is seen that there are significant differences between the effects of science courses in university and in primary school. While participants were explaining their thoughts, they also explained the factors which made science courses ineffective. It is a significant result that 92 % of them thought that the reason of infective science courses was poor teaching techniques. 61 % of them said that that science courses become ineffective due to the fact that the relationship between daily lives was not well composed. 22 % of them think that memorizing technique makes science courses ineffective and 17 % of them thought that science courses aimed preparing students for the exams only and being test oriented made them ineffective. Lack of some educational equipment and using poor teaching materials were other factors causing science courses to become ineffective (8 %). Having the environmental issues at the very end chapters of textbooks made is less likely to cover these issues during the semester.

As a forth question in this section, differences between environmental science and other scientific disciplines were asked (Appendix A, item 8). More than half of the pre-service science teachers (53 %) thought that there are differences between environmental science and other scientific disciplines. According to these responders environmental sciences can be solved by everyone (33 %). They include all other scientific disciplines (25 %). They can be understood easily (17 %), they are always changing (17 %), and %). The main purpose of environmental science is to save environment but other scientific disciplines may have different purposes (8 %). As given above, participants who claim that environmental sciences are different than others express different explanations (See Table 4.4).

Table 4.4 *Pre-service science teachers' views on differences between environmental science and other scientific disciplines*

	Overall %	Categories	# of usage	% in each category	Example
There is a difference	53	Everyone can contribute the solution of environmental problems.	4	33	P10: I feel myself in the problem. And, I can find solutions myself to environmental studies.
		Environmental science includes all other scientific disciplines.	3	25	P15: Environmental science study on effects of global warming which includes all other science fields
		Environmental science is always changing.	2	17	P6: Environmental science is changeable.
		Environmental science can be understood easier.	2	17	P3: People can understand issues related with environment easier.
		Environmental science tries to save environment.	1	8	P8: Environmental science, scientists try to save the Earth.
There is no difference	47	Every scientific discipline interrelated	6	54	P18: All of them are related with each other.
		All scientific disciplines explain the same issues from their perspectives	4	36	P14: They both try to learn about the environment and seek to find solutions to the problems. I cannot see any difference between them.
		Scientific methods are the same.	1	9	P11: Methods used and processes are all the same

Other 47 % of the participants think the other way and claim that science and other scientific disciplines are not different. In this part, 54 % of the responders thought that every scientific discipline is interrelated. 36 % of them thought that all scientific disciplines explain the same issues from the point of their specific areas. One participant (9 %) pointed out that the methods used in scientific studies were all same.

Summarizing what pre-service teachers think in general about science, we can say that there is no definite respond to definition of science. Mostly, they defined science as a way of understanding the natural phenomena. They think that science provides learning new things about the natural events, making life easier, sharing information with others, solving daily life problems, and gaining thinking abilities. Some of the participants also think that science is the nature of human and environment, activities or processes done with SPS. In addition, they explain

the nature of science aspects as being certain, universal, objective, empirical based, and observation dependent. As science interest areas, they mentioned health, space, social life, education, and technology. Apart from all above, one participant mentioned harms of science applications causing pollution and diseases.

Their perceptions about the scientists are also similar. Most of them think that scientists are patient, curious, ordinary people. Other definitions attributed to them, which are not common as that much are being objective, extraordinary, open-minded, social, hardworking, determined, and creative people.

Pre-service science teachers' perceptions of science courses in university and primary school are different. It is a significant result that the entire participants think that science courses in university has a positive influence on their daily life. They agree that they understand the natural events via these courses. Also, they became more aware about certain issues, gained reasoning abilities, had a broader view, and were able to apply their knowledge in their daily lives. There was also an agreement on the idea that science courses in primary school were ineffective. As a reason behind the effectiveness of science courses, almost all of them agree on poor teaching techniques.

Lastly, pre-service science teachers' perceptions of environmental science and other scientific disciplines are also interesting because most of them think that environmental science and other scientific disciplines are different due to various reasons. Others believe that there is no difference between environmental science and other scientific disciplines and they presented similar reasons.

4.1.2. Pre-Service Science Teachers' Perceptions of Technology

To learn the perceptions of pre-service science teachers related to technology, two questions were asked. As a first question, definition of technology was asked (Appendix A, item 2). Nine participants (50 %) directly defined technology. Other half of the participants explained technology by its aspects. There was an agreement on the responds of the nine participants who defined "technology", where most of them (88 %) evaluated technology as applications of

science. Only one of them (11 %) considered technology as development of human intelligence (See Table 4.5).

Table 4.5 *Pre-service science teachers' definitions on technology*

			# of usage	% in each	Example
Definition of technology	Applications of science		8	88	P11: Technology is developed by science.
	Development of human intelligence		1	11	P7: Technology is the developments which are the outcome of human intelligence…
Purpose of technology usage	Good intention (84 % in overall)	Makes life easier	14	67	P16: Technology is specifically aimed to make our life easier.
		Makes science develop	3	14	P11: …technology helps science to develop
		Used for education	3	14	P17: Technology is a tool providing ease in educational area…
		Used in medical field	1	5	P17: Technology provide advanced tools used in medical industry etc.
	Bad intention (16 % in overall)	Weapons used against people	2	50	P7: …a bomb is also a technology product
		Easy income is not fair	1	25	P8: … not ethic to earn that much so easily while others still work hard
		Makes people lazy	1	25	P15: We use technology but lose some important skills
Technological concerns	Pollution		4	31	P10: … disadvantages of technology such as environmental pollution.
	Health		3	23	P17: It has disadvantages like illnesses.
	Being uncertain about future		3	23	P8: I wonder about my the future with this technology
	Ethics		1	8	P8: I think technology is not ethic…
	Conservation of heritage		1	8	P8: I think something should be preserved as natural and pure.
	Nonrenewable energy sources		1	8	P9: But, machines need to nonrenewable energy sources

As it is seen in Table 4.5, participants mentioned purpose of technology while they were defining it. Evaluation of their responds shows that most of the participants' (85 %) explanations were about good sides of technology. Responds of participants, who believe technology is used for good intentions, show that most

of them (67 %) consider technology as a means, which make life easier. Additionally, 14 % of them said technology makes science develop, 14 % of them saw technology as an educational tool, and 5 % of them thought it was used for health areas. Furthermore, according to the responds 14 % of the participants, who mentioned purpose of technology within their definitions of technology, believed that technology is used for bad intentions. According to their answers, it is seen that 50 % of responders believe that technology is used as a weapon in wars. 25 % of the responders thought that technology is used to earn more money and the rest (25 %) thought it causes laziness in people.

While participants were explaining technology, thirteen of them (72 %) mentioned technological concerns. According to their responds, most of the participants (31 %) thought that technology causes environmental pollution while 23% of them were worried about how technology will affect their lives in the future, and they were thus uncertain about the future.23% of them thought technology caused health problems. The other concerns are consumption of nonrenewable energy resources, not being ethic and being harmful to heritage (8% each).

As a second question, who decides on the technological developments was asked (Appendix A, item 7). For this question, most of the pre-service teachers (47 %) pointed governments as the main decision makers on technological developments. 71 % of these responders who think the decider as governments, presented economic concerns as the driving factor for governments. Among these 47%, other factors mentioned for governments were political reasons (14 %), opportunities provided (7 %) and international economic relations (7 %) (See Table 4.6).

Table 4.6 *Pre-service science teachers' views about deciders on technological*

developments

Categories	Overall %		# of usage	% in each category	Example
Government	47	Economic reasons	10	71	P4: Main factor is the government because of the economic reasons. s
		Political impacts	2	14	P1: We see that governments have a role on technological development
		Providing opportunities	1	7	P8: Government provides funding for research (hire people, equip laboratories)
		Relation with other economic powers	1	7	P9: Turkey has boron but due to some restrictions from other big countries we cannot benefit from boron mine.
Public	30	Needs of public	4	45	P16: Needs of society affect technological developments
		Demands of public	2	22	P13: Some technological developments are done based on publics' needs or their requests.
		Religious constraints	1	11	P11: Religion may approve or disapprove the studies on the technological developments.
		They elect the governments	1	11	P8: Public elect governments so I believe the main decision-maker is public
		Financial status of people	1	11	P12: The most important factor is financial level of society.
Big companies	17	Economic powers	5	100	P15: I think decider is the one who earns most of the money from technology
Scientists	6	Curiosity of scientists	1	50	P14: Curiosity and needs are the reasons of technological developments
		Needs of development	1	50	P17: I think scientists are deciders to technological developments because they try to address peoples' demands.

Table 4.6 shows that 30 % of the participants responded as public being the decider on technological developments. According to most of these responders (45 %), who thought decider as public, public needs are the reasons of technological developments where demands of public (22 %) and financial status of public (11 %) are other reasons stated. Interestingly, 11 % of them brought up religion factor to have a role on technological developments. The remaining 11 % expressed themselves as deciders since they were part of the community voting for the government.

A fair amount of the responders (17 %) thought that the main decision makers on technological developments are big companies and they all agreed on the fact that they are the economic powers leading the countries. Lastly, only two of the participants (6 %) believed that scientists have right on technological developments. Curiosity of scientists (50 %) and demands for development (50 %) are the reasons mentioned making scientists as decision makers.

As a summary to this section, results are telling us that almost all of the pre-service science teachers' perceptions of technology are centered on applications of science. In addition to this, most of them (85 %) think on the good purposes of technology. Most of them agree that technology makes lives easier by fulfilling needs, developing science, providing better communication, and helping education and medical areas. Only 15 % of them mentioned the bad sides of technology such as its utilization in wars, in generating huge incomes easily, and causing laziness. In addition, they had concerns due to technology such us consumption of limited nonrenewable energy sources, environmental pollution, being uncertain about future, ethical violations, medical problems and conservation of natural and historical heritage.

In addition, it is a significant result that most of the pre-service science teachers (47 %) believe that governments are decider on technological developments due to economic reasons. Also, some of them (30 %) believe that needs of public trigger technological developments. 17 % of them think that big companies have right on technological developments as economic powers. Only two participants believe that scientists are decision makers on technology issues because of their curiosity and own demands as a member of the society.

4.1.3. Pre-Service Science Teachers' Perceptions of Science-Society-Technology Interaction

To learn the pre-service science teachers' perceptions about science-society-technology triple interactions, two questions were asked. First question was on the effects of society on science and technology was asked (Appendix A, item 3).

In the first part of this question, effects of society on science were asked. It is an important result that almost all of the pre-service science teachers (95 %) agreed that society had effects on science. Only one participant (5 %) thought that there was no effect of society on science. According to this participant, science explains the natural facts so science is not related with society.

According to the 35 % of responders, who believed society had effects on science, that effect was positive. Most of them (42 %) thought that needs of society affects science in a positive way. In addition, other positive effects which responders thought were social demands (25 %), curiosity of society (17 %), supporting effect on technological developments (8 %), and political powers of countries (8 %).

Results show that most of the responders (62 %) believed that society had negative effects on science. According to their responds, it is seen that most of them (57%) thought strict traditions and rules in the society effects science negatively. 28 % of them thought that scientists' beliefs had a negative effect on science. Other negative effects were listed as misconceptions about studies (10 %) and political views (5 %) (See Table 4.7).

Table 4.7 *Pre-service science teachers' views on society influences on science-*

technology

Categories		Overall %		# of usage	% in each category	Example
Influences of society on science	Positive effects	35	Needs of society	5	42	P12: I think that science is shaped by the needs of the society..
			Demands of society	3	25	P5: …some subjects are studied because of social demands.
			Curiosity of society	2	17	P9: Society wonders or wants to see something so they study on science.
			Supporting effect on technologic developments	1	8	P2: Science supports technology and technology supports science, also
			Political powers of countries	1	8	P13: Countries want to prove own powers.
	Negative effects	62	Strict traditions and rules in the society	12	57	P3: …scientists make science as obeying society rules.
			Beliefs of scientists	6	28	P10: …beliefs etc has effects on scientists
			Misconceptions about studies	2	10	P5: because people have misconceptions about studies…
			Political views	1	5	P5: Government cannot be support some scientific studies…
	No effect	3	Science explains the natural facts.	1	100	P1: It explains general rules so I don't think it's changing via society.
Influences of society on technology	Positive effects	83	Needs of society	16	84	P2: Our needs are the reasons which yield technological developments.
			Supports technological developments	2	11	P11: Society supports technology and uses technological products
			Powers in military	1	5	P13: Countries want to prove their power.
	Negative effects	13	Ethics of society	1	33	P16: Harming via technology That is a negative thing based on ethics.
			Economic conditions	1	33	P7: Technology is not developed in poor societies because of their economic conditions.
			Sensitivity of society	1	33	P11: If society is sensitive for animal rights….technological studies may not develop
	No effect	4	Technology affects the society.	1	100	P4: Technology is not affected by the society; in contrast technology affects the society.

In the second part of this question, effects of society on technology were asked. Answers to this part are similar to the pre-service teachers' views on effects of society on science. Similarly, almost all of the participants (95 %) believed that society has effects on technology. Only one participant (5 %) thought that there was no effect of society on technology (See Table 4.7). According to this participant, society does not have an effect on technology; on the contrary technology had effects on society.

Results show that most of the pre-service science teachers (83 %) believe that society has positive effects on technology. According to their responds, needs of society have significant positive effects on technology (84 %). Other positive effects are listed as positive support of the society on technological developments (11 %), and the necessity of being strong in military (5%).

On the other side, 16 % of participants believed that society had negative effects on technological developments. Responds show that ethical rules in the society, economic conditions of society, and sensitivity of society on developments are the reasons of the negative effects of society on technology which are similar to the reasons of the negative effects of the society on science as discussed above.

As a second question, science and technology effects on society was asked (Appendix A, item 4). All of the participants agreed that science had effects on society. Majority of the pre-service science teachers (79 %) said that science had positive effects on society while rest of them (21 %) believed the opposite way (See Table 4.8).

55

Table 4.8 *Pre-service science teachers' views science-technology influences on society*

		Overall %			# of usage	% in each	Example
Influences of science on society	Positive effects	79	Find solutions of problems of society		4	21	P18: …we argue on it and we allow or not based on our researches. Science leads to society in that way.
			Develop the society		3	16	P16: Science affects society because by new explanations…
			Explain the natural events		3	16	P12: Science proved them to planets movements and society learned them.
			Treat illnesses		3	16	P3: The most effective area of science to society is medical science…
			Change acceptability of society		2	11	P8: Science changes the acceptability of the society.
			Gain thinking abilities		2	11	P6: Science affects the society on their thinking abilities.
			Provide comfortable life		1	5	P1: .…provide an easier and livable life to us.
			Correct the mistakes of society		1	5	P17: Science finds a mistake which is done by the society. Then, society changes their behaviors.
	Negative Effects	21	Conflict with beliefs		2	40	P15: Sometimes, scientific studies are done in an existentialist philosophy which is contrary to religion.
			Used in wars		1	20	P2: …war has a negative effect on society in that science and technology has a role.
			Conflict with norms of society		1	20	P4: … traditional norms of the society, they may affect as negatively.
			Causing pollution		1	20	P9: Science develops a technology because of needs of the society. While using that technology, society pollutes the environment.
Influences of technology on society	Positive effects	59	Provide comfortable life	Communication	7	44	P12: We are using internet now and we are trying to communicate
				Travel	1	6	P9: Technology affects the society, e.g. every city is connected to each other via train.
			Develop the society		4	25	P1: Technology and science help the development in society
			Makes science applicable		2	13	P4: Via technology, many scientific studies are done so society is affected positively.
			Treat illnesses		1	6	P2: Science and technology has a role. And also, there are some positive effects in daily life to explain for instance cancer treatment.
			Make society powerful		1	6	P15: Technology has effects on the society by means of their developments, their power etc.

Table 4.8 *(continued)*

	Negative Effects	41	Used in war	3	27	P11: Technology may be harmful, like in the case of nuclear weapons.
			Pollution	2	18	P9: While using that technology, society pollutes the environment
			Getting lazier	2	18	P13: Internet makes people lazier
			Consumption	2	18	P8: Technology makes us consume more.
			Break social activities	1	9	P3: Negative effect is observed in social relations…
			Addiction to technology	1	9	P7: We are getting lazier. As a result, we become addicted to technology.
Reasons of influences	Purpose of usage			4	31	P2: Two ways interactions can be seen, positive and negative. It depends on purpose of usage.
	Age of society			3	23	P14: By the time, people accepted some facts and these facts are known as normal today.
	Needs of society			2	15	P13: People need science, and their efforts yield scientific studies. If they do not need, there will be no efforts, no science
	Understanding the scientific claims			2	15	P3: If they do not understand their claims, they do not show any reaction.
	Restrictions of religion			1	8	P3: … his claims were against to church. Maybe, his thoughts were found different. These could be reasons to draw attention.
	Relationship between daily life			1	8	P3: If society finds relationships between their claims and their daily life, they will show a reaction to them, positively or not.

As it is seen in Table 4.8, answers provided to these questions show that pre-service science teachers' perceptions of science-society and society-technology interactions are similar. When their perceptions of the effects of society on science and technology are regarded, it is obvious that that society has negative effects on science (62 %) and society has positive effects on technology (83 %). They think that needs of society (42 %) are the most important reasons behind society effects on science. Demands and curiosity of society, their supports to technologic developments, and positive approach of political powers in the countries are other reasons which yield positive effects of the society. On the other hand, they think that strict traditions and rules in the society and beliefs of scientists are the biggest discouraging reasons which cause the negative effects of society on science. Society rules and misconceptions of studies can be also considered as additional reasons in this realm. We also had one participant who believed that there was no effect of society on science.

Effects of society on technology were questioned in the same manner as above. Results show that most of the pre-service science teachers believe society has positive effects on technology (83 %). It is a significant result that needs of society (84 %) is the most important cause which yields positive effect on technology. Supports on scientific developments and powers in military are other effects of society. Again, only one of the participants (the same person) believes that there is no effect of society on technology.

On the other hand, pre-service science teachers' perceptions of science effects on society are significantly positive (79 %). They believe that science develops the society, finds solutions of problems of society, provides comfortable life, explains the natural events, treats illnesses, gains thinking abilities, changes acceptability of society and corrects the mistakes of society. Applications on dangerous weapons, conflicting with beliefs and society norms and causing pollution are the social reasons which result in negative effects on science.

When it comes to the effects of technology on science, they believe to have positive effects (59 %). Technology in public communication has the most

58

significant positive effect on society (44 %). Other than that, respondents mentioned other positive effects such as, technology develops the society, treats illnesses, makes science applicable, makes society powerful, and provides comfort in travel.

Due to causing pollution, being utilized in wars, breaking social bonds, causing waste of resources by excessive consumption, making people lazier, and causing addiction to technology it is considered as having negative effects on society. Most of them believe that purpose of usage determines the effect of science-technology on society. In addition, age of society, restrictions of religion, needs of society, their understanding of the scientific claims, and their relations to science-technology in daily life are other factors which determine the effects.

4.2. News Framing Influences on Pre-Service Science Teachers' Perceptions of Global Warming

In order to evaluate the news framing influences on pre-service science teachers' perceptions of global warming issues in terms of science, society, and technology, we shared with the pre-teachers two news related to science, society, and technology aspects of global warming. After they read the news, three set of interview questions were asked. By this way, news framing influence on pre-service science teachers' perceptions of global warming issue in science, society, and technology was evaluated.

4.2.1. News Framing Influences on Pre-Service Science Teachers' Perceptions of Global Warming in Terms of Science Aspect

In this part of the study, two news related to science aspect of global warming were shared which included explanations related to positive and negative sides of global warming (Appendix E). After participants read the news, they were asked nine questions.

First question asked was about what participants learned from news (Appendix B, item 1). First new was new for most of them in some way where 42 % of them said that the first new was completely new, 42 % said that they had not known anything about the new bacteria specie and 11 % said they had not known about the global effect on microorganisms. Only one participant (5 %) said that he had known the first news before.

Different than the first news, most of the responders said that they had known the second news before. 41 % of them said that nothing in the second news were new for them. 27 % of them said that they had not known before the carbon amounts of oceans. 13 % of them learned pH amounts of oceans in the second news. One participant (5 %) had not known before that fossil fuels caused carbon emission. Lastly, again only one participant (5 %) said that the second news was completely new (See Table 4.8).

Table 4.8 *Pre-service science teachers' new learning from scientific news*

	Responds	# of usage	% in each news	Example
In first news	The first news is completely new.	8	42	P4: The first news was completely new.
	The bacteria specie is new.	8	42	P3: Magnetotactic bacteria. I did not know before…
	Global warming has an effect on microorganisms.	2	11	P1: Global warming has an effect on people but also has an important effect on microorganisms.
	Nothing new	1	5	P2: I know all things in news.
In second news	Nothing new.	9	41	P14: I knew the second news before.
	Carbon amount of oceans is a new information	6	27	P16: I did not know exactly the amount of the carbons.
	pH amount of oceans is a new information	3	13	P11: The pH amounts of oceans and…
	Carbon amounts alter water acidity.	2	9	P1: I haven't thought before that by increasing carbon amount, oceans' acidity also increases.
	Fossil fuels cause carbon emission.	1	5	P13: I did not know before fossil fuels cause to the carbon emission.
	The second news is completely new.	1	5	P12: All of them are new for me.

Second question was about what participants consider as important points about news (Appendix B, item 2). Responds to the second question show that most of the participants (68 %) consider global warming as the most important point in these news. They thought that global warming harmed the natural balance (on living organisms (32 %), carbon emission through oceans (26 %), and global temperature increase (10 %)).

13 % of the participants said that people behaviors were important in these news because people and their behaviors caused these harms. 5 % of them found the most important part as the scientific studies done since they help to see and control the changes in the environment. Lastly, for the 5 % (one participant) everything in this news were new and interesting thus he considered the entire news as important (See Table 4.9).

Table 4.9 *Results of responds on most important points in positive and negative*

scientific news

Responds			# of usage	Overall %	Example
Global warming is important. (68 %)	Harms on the natural balance	Direct harm on living organisms	10	32	P14: Little temperature changing has an effect on living organisms. Some organisms are disappeared and some new organisms are discovered.
		Carbon emission through oceans	8	26	P15: Carbon emissions cause to losing natural balance.
		Global temperature increase	3	10	P11: In the first news, the temperature increasing part was important.
People behaviors are important.			6	18	P1: People and people's actions are reasons for these diseases.
News is new/interesting so it is considered important.			2	7	P9: It was new for me. For that reason, that part was important.
Scientific studies are important.			2	7	P18: Scientific studies were important because it shows the changing.

As a third question, participants' feelings about future were asked (Appendix B, item 3). Surprisingly, most of the participants were pessimistic for their future due to global warming (89 %). This 89% of the pessimistic group is split into sub-groups according to the factors they mentioned. 50% pronounced the human factor as the reason behind global warming and all consequences. (People's behaviors harmed the natural balance (38 %), water resources are polluted which is essential for living (8 %), preventing the expected results of global warming was too hard (3 %), people were not aware of the global warming (3 %)).

25 % of them felt pessimistic because there was an obscurity about future. 10 % of them felt pessimistic because of the effects of global warming (global warming causes the extinction of livings (5 %), harms the bacteria species (3 %), and global warming still continues (3 %).) Remaining felt pessimistic because of negative expressions in news and prior knowledge about the issue (3 % each).

Lastly, only one participant felt optimistic after reading these news because such kind of news on environmental issues provided more awareness about the problems, reasons behind them and possible solutions (3 %).

On the other side, 8% of the participants were not affected from news. They said that the results of global warming were not seen yet (3 %), there was an obscurity about future (3 %), and responder got used to read similar news about global warming so it did not affect (3 %) (See Table 4.10).

Table 4.10 *Pre-service science teachers' feelings on scientific news*

Responds			# of usage	Overall %	Example
Optimistic **(3%)**	Such news provides awareness thought to society.		1	3	P2: When we read such news, we can see the possible dangers and try to eliminate it. Thus we should be optimistic about the future.
Pessimistic **(89 %)**	People factor (50 %)	Harms of behaviors on the natural balance	15	38	P2: Damages on natural balances which are result from our actions.
		Difficulty to prevent the global warming	1	3	P9: Many reasons causes to carbon emissions and to prevent it is too hard.
		Effects on water resources	3	8	P17: We cannot find the water to use or drink. Water is an essential for all of us so I felt pessimistic.
		Consciousness of people on the environmental changing.	1	3	P16: We mostly do not understand anything. For that reason I felt pessimistic.
	There is obscurity about future. (25%)		10	25	P17: There is an obscurity about the future so I felt pessimistic.
	Effects of global warming (11 %)	Harms to the bacteria specie.	1	3	P1: 5 C warming has an effect on bacteria life.
		Causes the extinction of livings.	2	5	P3: One organism is living by adapting but another one is dying.
		Continuity of global warming.	1	3	P16: I felt pessimistic about my future because warming still continues.
	Negative impressions made pessimistic.		1	3	P3: I do not feel positive because all mentions are made me anxious.
	Due to prior knowledge, feeling about future is pessimistic.		1	3	P5: I also remember my prior knowledge about acid rains etc. Thus, I feel worry again.
No effect **(8%)**	The results are not observed yet.		1	3	P12: I felt neutral about my future. There is an obscurity about the future.
	There is an uncertainty.		1	3	P14: I am not sure. I cannot feel anything about our future.
	I knew before, the news did not affect me.		1	3	P10: I got used to read so it did not affect me.

Forth question was about the changes in pre-service science teachers' views after news were shared. (Appendix B, item 4). As it is seen in Table 4.11, most of the participants (70 %) said that they thought similar to the presented news. Other participants (30 %) read new information from news.

Table 4.11 *Changes in pre-service science teachers' views after scientific news*

	Overall %	Responds	# of usage	%	Example
I thought same as in the news.	70	Supports my thoughts. My thoughts get stronger.	16	59	P3: The first reading shows me the truth of my knowledge. It exemplifies to me.
		I knew before, did not affect my opinions at all	3	11	P10: I knew before the mentions in that news so it did not effect on me.
I saw new information	30	No change in my thoughts.	4	15	P14: News did not change any difference in my thoughts. I still think the same things.
		Provide new aspects	2	7	P11: I saw that there were many effects which we had not realized yet.
		There is an obscurity about future, present situation is scaring me	1	4	P7: Because there is an uncertainty, I am still feeling fear.
		New aspects change my thoughts about global warming.	1	4	P12: When I read the first news, my feelings were changed. I had felt too pessimistic about my future but now I felt neutral.

As seen in the table above majority of the participants had similar views with the news (70%).Among them, 59 % (in overall) said that they had thought the same with the news so they claimed that these news were just supporting their ideas and contrary to them, 11 % (in overall) of them claimed that readings did not have any positive or negative effect on their views.

News contained some new information for the remaining 30 % of the participants. Most of them (15 % in overall) said that the new explanations did not change their thoughts. 7 % of them said that new explanations provided to see events from a different point of view. 4 % of them were worried, even scared for the uncertainty of the future when they read the news. Lastly, 4 % of them said that new explanations changed their thoughts on global warming.

In order to learn whether participants will use these news and their purpose of use if they do, we asked the fifth question (Appendix B, item 5). Responds show that most of the participants (75 %) thought same with the news. This is a significant result that 48 % of them answered this question as they would use these news to support their thoughts. 33 % of them would use to change others' thoughts. 10 % of them would use to have a reaction toward global warming.

Lastly, 10 % of them said that they would only share with others without aiming to change others' opinions (See Table 4.12).

Table 4.12 *Effects of the scientific news on pre-service science teachers'*

discussions with others

Responds	Overall %		# of usage	% in each category	Example
These news were parallel to my having thoughts.	75	To support having thoughts.	10	48	P8: I believe that global warming is not good and these news were supported my thoughts.
		To change others' thoughts to my thoughts	7	33	P11: If one of my friends sees these issues as harmless, I will try to change his view.
		To explain having thoughts.	2	10	P10: I can use it to explain my thoughts about global warming to others.
		To share with others.	1	5	P9: I will share my reading. But it does not meaning to change him thoughts. Only sharing…
		To have reaction toward global warming	1	5	P14: I will use the second news to defend my thoughts. We have to show reaction such kind of events.
These news were new for me.	25	To change others opinions	4	57	P2: I can use this news to persuade people that global warming harm living organisms.
		Used to inform others.	2	28	P4: I will share that news objectively and try to show one of the effects of global warming.
		Would not used because it does not represent my view	1	14	P14: I will not use the first news because it does not show my thoughts.

As seen in the table above, remaining 25 % of the participants said that these news were new for them. Most of them (57 %) thought in the same way with participants who had known these news before. They said that they would use this news to change others to their thoughts. 28 % of them would use to inform others related to news. 14 % of them would not use them because these news were not parallel to their thought.

To learn the participants' views on science portrayed in news, sixth question was asked (Appendix B, item 6). Results of responders showed that 41 % of participants mentioned about science as activities used SPS. 31 % mentioned about science as nature of science aspects. 25 % of them portrayed science as it needed inquiry. Rest of them (3 % each) said that science was subjective and uncertain.

In addition, 22 % of them said that purpose of science was to take precautions to against dangers. Lastly, 6 % of them mentioned that scientific studies harmed on environment so these effects had to be controlled (See Table 4.13).

Table 4.13 *Pre-service science teachers' views on science portrayed in the news*

Responds		# of usage	%	Example
Activities used SPS		13	41	P9: Measurements, explanations… All of them are science, I think.
Nature of science (31 %)	Science is uncertain	1	3	P6: Science is always changing. New organisms were seen, some organisms were extinct. Scientists study on them,
	Science is subjective	1	3	P16: I saw that science is subjective. There are two news about global warming and you can interpret them based on your thoughts or emotions toward to the issue.
	Science needs inquiry	8	25	P12: Science tried to show others what the situation was by using numeric data.
Purpose to take precautions		7	22	P3: Science provides to take precaution against dangers.
Harms on environment		2	6	P17: Scientific studies have to be under control to decrease harms on environment.

Seventh question aimed to learn what participants wanted to see in news about science (Appendix B, item 7). Most of them (47 %) wanted to read detailed information about magnetotactic bacteria specie and ocean acidity. Others things the rest of the participants wanted to see were specific examples from daily life if possible (19 %), advices for the future (14 %), detailed references about study (9 %), and more emphasis on the importance of the global warming (2 %). 9 % of them said nothing required to include in news about science (See Table 4.14).

Table 4.14 *Pre-service science teachers' demands related to news about science*

Responds	# of usage	%	Example
Detail explanations on bacteria and ocean acidity	20	47	P2: More detailed information or explanations can be given to reach all people.
Specific examples seen around	8	19	P14: More specific examples can be given. For example, increase in acidity causes harms on the corals.
Advices for the future	6	14	P16: There should be some precautions or advices.
Detailed references about study	4	9	P6: I want more details for example scientists' names or location names etc.
Nothing required to include	4	9	P5: I think all of them are enough to them.
More emphasis on importance of the global warming	1	2	P1: More emphasis was put on global warming, more awareness could be raised.

In the eighth question, we asked what they need to change their views (Appendix B, item 8) and most of them (58 %) said some additions could change their views about science. The additions that would change their views can be summarized from their responses as more positive expressions about global warming (20 %), detailed explanations about natural balance consistency (13 %) and explanations about the benefits of magnenotactic bacteria specie in natural balance (13 %), strong references (8 %), and more news supporting the claims in news (4 %) (See Table 4.15).

The rest of them, 42 %, as seen below, said that nothing changes their views about global warming.

Table 4.15 *Pre-service science teachers' demands to change views about science*

aspect

Responds	Overall %		# of usage	%	Example
Nothing changes my thoughts.	42	Nothing	10	42	P8: Anything included in that news change my thoughts.
I need some additions to change my view.	58	Positive expressions about the global warming	5	20	P10: If the author used more positive words or explanations, I would be affected and I would change my thoughts.
		Detail explanations about natural balance consistency	3	13	P3: If author said that carbon dioxide amount is increased but scientifically nature can balance the changing, my thoughts could be change.
		Detail explanations about the benefits of bacteria	3	13	P14: If author showed us benefits of those bacteria or if author proved increasing acidity does not affect the livings, I would see the global warming harmless.
		Strong reference	2	8	P6: References should be given in a more detail but it helps me to search on the news more.
		More news related to claims in news	1	4	P10: I did not change my thoughts to read only one news. I need more. If I feel comfortable to our new findings, I can change my mind.

For the last question, relationships between science and environment were asked (Appendix B, item 9). Results of this question show that most of the participants (62 %) thought that there were both positive and negative relationships between science and environment. 28 % of participants said that scientific studies harmed the environment but other science fields developed while looking for the solutions of these harms. 23 % of responders said that relationship between science and environment depended on the purpose of the scientific study (i.e. how science was used for what purposes). 10 % of them mentioned that scientific studies was related to the environmental conditions. According to them, if environmental conditions were convenient for the scientific studies, positive relationship was observed.

On the other hand, 24 % of the participants thought that there was only a positive relationship between science and environment .14 % of them said science

explained the natural facts so this was a positive relationship and 10 % claimed that it was positive since science reveals environmental problems.

Lastly, 14 % of the responders thought that the relationship between them was negative. 10 % of them said that science harmed the nature via technology. One participant (5 %) mentioned that some scientific products (such as chemicals used in agriculture) harmed the nature. This was the reason why the relationship between them was negative (See Table 4.16).

Table 4.16 *Pre-service science teachers' views on relationship between science*

and environment

Responds	Overall %		# of usage	%	Example
Positive relationship	24	Science shows the environmental problems	3	14	P1: Science solves the environmental problems.
		Science explains the natural facts.	2	10	P18: Science studies on the problems and with its finding science makes us more aware about environmental problems.
Negative relationship	14	Science harms the environment via technology	2	10	P15: If science is connected with the developed technology, their relation will be negative because developed technology is harmful for the environment.
		Science harms the nature via chemicals	1	5	P3: Chemicals using in farms to production more are dangerous.
Both positive and negative relationship	62	Scientific developments harm the nature but science tries to find solutions at the same time.	6	28	P4: Science causes some environmental problems, and science tries to save the environment, again.
		It depends on the purpose of scientists.	5	23	P16: Relationship depends on how we use the science and what we aim to do.
		It depends on environmental conditions.	2	10	P12: If environment is suitable, scientific studies can be done. If not, we do not find any area to study because the environment is the main area of the science.

Summarizing the general approach of the responds to the questions could be as given as follows. First of all, the pre-service science teachers had not known about positive sides of global warming in the first news (42 %) and some were not aware of magnetotactic bacteria species (42 %). Related to second news, they had

69

known negative sides of global warming before (41 %). The carbon amounts of oceans were seen as new knowledge (27 %). Most of the participants thought that global warming was the important point in both news (77 %) because of harms on the natural balance (42 %) and causing unpreventable changes in nature (35 %). Others also stated the important points as people behaviors (14 %), being new or interesting for them (5 %), and scientific studies in news (5 %).

Most of the pre-service teachers' feelings about global warming effects on society were pessimistic (89 %). People effects in environment (50 %), being an obscurity about future (25 %), and harms of global warming (11 %) were the reasons behind their being so pessimistic. It is an important result that pre-service science teachers want to use these news while discussing with others to support their thoughts (48 %), and to change others' views to theirs (32 %). These results show that pre-service science teachers want to affect others' perceptions and make others think like themselves.

The result concluded about changes of pre-service science teachers' views was that most of them who thought the same with the news (70 %) said that news supported their thoughts (59 %). Small percentage of participants read the information about global warming related to science in the news for the first time (30 %) and only one participant changed his views according to the news (4 %). This result shows that pre-service science teachers' perceptions about global warming related to science aspect are strong. News framing effect was observed here only in terms of support to the existing thoughts.

However, although having very strong perceptions, participants said they could have changed their opinions about global warming relation to science, if some strong additions were provided (58 %). Those additions they meant to change were addition of positive expressions about global warming (20 %), detailed explanations about natural consistency (13 %), detailed explanations about the benefits of magnetotactic bacteria specie (13 %), and strong references (8 %). 42 % of them did not change their thoughts and they claimed that nothing could change their thoughts about global warming related to science. This shows that

most of the pre-service science teachers seek some additional explanations to believe the claims of the news about scientific aspect. By this way, they could change their opinion. Others' perceptions are strong and their ideas would not change by any means.

Pre-service science teachers evaluations of science portray after reading news are similar the responds of first interview. 41 % of them explained science as activities used SPS, 31 % of them mentioned NOS aspects, and 22 % of them mentioned on the purposes of science. Before news, most of them said that science is a way of explaining the natural phenomena (38 %) and nature of human and environment (13 %), and activities used SPS (11 %). They also mentioned science interests (22 %), NOS aspects (13 %). It is seen that pre-service science teachers' views on science are similar to after news. The only difference is the percentage of the definitions. News had an effect on shaping their thoughts about science portray.

Lastly, it is a significant result that most of the pre-service science teachers think both positive and negative relationships between science and environment (62 %). Most of them believed that scientific developments harm the environment but science is needed to eliminate these harms (28 %) and relationship is related to purpose of science usage (23 %). In addition to whom, 24 % said that there is a positive relation and 14 % said that there is a negative relationship between them.

4.2.2. News Framing Influences on Pre-Service Science Teachers' Perceptions of Global Warming in Terms of Society Aspect

In this section, two news related to society aspect of global warming were shared. First one includes mostly positive expressions about global warming and second one has mostly negative expressions about global warming (Appendix F).

First question was about what participants learned from news (Appendix C, item 1). According to the responds, all of the participants had known the second news before. But for the first news, 50 % of the participants heard it for the first time. 28 % of them said that the claims about global warming effects on rain and

71

green area were new. 11 % of them learned that some scientists believed global warming as harmless. Lastly, 11 % of them said that nothing was new in the first news (See Table 4.17).

Table 4.17 *Pre-service science teachers' new learning from social news*

	Responds	# of usage	% in each news	Example
In first news	The first news is completely new.	9	50	P4: The first news was new.
	Global warming may provide more rain & green area	5	28	P3: 'By global warming, raining will be seen more' is said. I did not know before.
	Some scientists believe global warming as harmless	2	11	P1: I didn't know before that some scientists think like that. This is new to me.
	Nothing new.	2	11	P7: I heard nearly same thing before for both news.
In second news	Nothing new.	18	100	P6: In second part, I knew them all before.

In order to evaluate which parts participants considered as important about news, second question was asked (Appendix C, item 2). Responds show that the majority (53 %) said that global warming was the most important point in both news. According to them global warming would affect agriculture (19 %), cause drought (14 %), change ecologic balance (13 %), and provide more rain and green areas (4 %).

18 % of them thought that harms of people were important. 10 % of them said that people destroyed the nature and they suffer its consequences. 8 % claimed harms of people were more severe than positive results of global warming.

In addition to them, 8 % of them found the claims of scientists as important who believed that global warming had positive effects. 6 % of them mentioned that scientific studies done in both news were important. 6 % of them said that readings were new so they were important. On the other side, 8 % of them

did not believe these news so they did not find any important points in there (See Table 4.18).

Table 4.18 *Results of responds on most important points in positive and negative*

social news

Responds		# of usage	%	Example
Global warming is important. **(53 % in overall)**	Agriculture will be affected negatively.	9	19	P4: It was important that global warming will negatively affect the agriculture
	Drought will be seen as a result of global warming.	7	14	P9: In the second news, drought is the important part.
	Global warming will provide a new eco-balance.	6	13	P2: New plants will be seen. New eco-balance will be obtained. These are important for me.
	Global warming provides more rain and more green areas.	4	8	P6: More rainy days will be seen so more green areas we will have.
Harms of people are important. **(18 % in overall)**	Humans destroy the environment and they see the results of it.	5	10	P1: This article is related to our actions and their results on humans.
	Harms of people are more than positive effects of global warming.	4	8	P15: Even if the nature provides greener areas, we still destroy it.
Positive beliefs of some scientists are important.		4	8	P11: Scientists claim that global warming will cause good things.
I do not believe so there is no important part.		4	8	P18: I did not believe the first news so much. I did not find it as important.
Reading is new so it is important.		3	6	P16: That part was important because it was new for me.
Scientific studies are important.		3	6	P18: Scientific studies were important because it shows the changing.

As a third question, participants' feelings about future were asked (Appendix C, item 3). It is a significant result that most of the participants were pessimistic (74 %). 23 % of them said that the reason for their being pessimistic was the negative effects of global warming. Those negative effects were drought and starving (10 %), less productivity in agriculture (13%). In addition to these reasons, their prior knowledge about global warming (20 %), negative expressions in news (13 %), people's misuse (10 %), and obscurity about global warming effects in the future were other reasons of pessimistic feelings (See Table 4.19).

73

Table 4.19 *Pre-service science teachers on feelings after social news*

Responds			# of usage	Overall %	Example
Optimistic (13 %)	New ecosystem will be seen as a result of global warming.		2	5	P4: The first news made me hopeful because some scientists thought that global warming had positive effects.
	Probability of green world made me optimistic.		2	5	P16: Rain forest part affected my thoughts. I did not think that probability before.
	Too much time required to the expected bad results.		1	2	P14: It was claimed that global warming was started to see too many years ago. It started years ago, it is warming now, and it will be warming in the future.
Pessimistic (74 %)	Effects of global warming (23 % in overall)	Global warming causes drought and starving.	4	10	P3: Pessimistic because drought and starving were mentioned.
		Agriculture will be harmed this will cause to poverty.	3	13	P11: Agricultural will be harmed because of the global warming.
	Based on prior knowledge about issue.		8	20	P9: My background about global warming was negative so I am pessimistic.
	Negative impressions made me pessimistic.		5	13	P13: The news was totally negative.
	New balance will be destroyed by human being.		4	10	P13: I think if there are human beings somewhere, I cannot say good things for the environment there.
	There is an obscurity about the future.		4	10	P7: I am not certain for the future.
No effect (13 %)	I knew the same things before so news did not affect me.		4	10	P10: I knew that news before. For that reason, I was not affected.
	I did not believe so it did not affect me.		1	2	P18: I did not believe the first news.

On the other side as given in Table 4.19, 13 % of them felt optimistic after reading news. The reasons were the claims about new ecosystem (5 %) and the claims about green world (5 %). Only one participant (2 %) estimated bad consequences will emerge after very long time, so he was optimistic for his future.

Contrary to them, 13 % were not affected from news. 11 % of the said that they had known news before and one of them (2 %) did not believe both news. These are the reasons why they were not affected both news.

To evaluate changes in pre-service science teachers' views after news, forth question was asked (Appendix C, item 4). Responds show that 52 % of them

read new information while for the rest (48 %) of the participants news were not a big surprise since they knew them before. People of this second group said news supported their opinions, so their opinions became stronger (See Table 4.20).

Table 4.20 *Changes in pre-service science teachers' views after social news*

Responds	Overall %		# of usage	% in each	Example
I think same as in news	48	Supports my thoughts. My thoughts get stronger.	14	48	P7: I thought the same thing and believed in that ways. There was a news which supported my thoughts by scientists.
Information was new for me	52	Did not change my thoughts.	5	34	P18: Any positive news about the global warming does not affect on me. I still think and believe the same things.
		There is new knowledge; I have to search on it to think different.	5	34	P6: I did not read before like the first news. I have to research more to change my mind because reference is not enough for me.
		Due to prior knowledge, explanations support my having thoughts.	3	20	P15: The second news was also parallel to my thoughts so that one also supported me.
		New aspects confused my strong belief about global warming.	2	13	P17: The first news made me confused because the idea about greener world was different. But, totally, I did not change my thoughts.

As it is seen in Table 4.20, on the other side among the people of the first group; 34 % said that new explanations did not change their thoughts. Another 34 % mentioned that they read new aspects so they needed to make search on them to change their thoughts. 20 % of them said that new explanations supported their ideas. Lastly, 13 % of them mentioned that they were confused because of new explanations about global warming.

To learn whether participants will use these news and for what purpose if they do, fifth question was asked (Appendix C, item 5). Responds of this question show that 58 % of the participants thought the same with the news. It is significant since 67 % of this group answered this question as they would use these news to support their views. 17 % of them would use to change others' thoughts. 11 % of them would use to have a reaction against global warming. 6 % of them said that

they would just share with others without pursuing any purpose to change their ideas (See Table 4.21).

Table 4.21 *Effects of the social of news on pre-service science teachers'*

discussions with others

Responds	Overall %		# of usage	% in each category	Example
These news were parallel to my thoughts.	58	Used to support having thoughts.	12	67	P7: I will use them to prove my negative thoughts about the global warming.
		Used to change others' thoughts to my thoughts	3	16	P7: If someone thinks like global warming is good, I will try to change him thoughts by using these news.
		Used to have reaction toward global warming	2	11	P14: I will try to make sense of global warming by showing the bad picture
		Used to share with others.	1	6	P10: While talking, I will mention as casual.
These news were new for me.	42	Used to inform others.	5	39	P9: I will use both news to show both aspects.
		Used to change others' thoughts to my thoughts.	3	23	P2: I can use this news to persuade my thoughts which global warming harms living organisms
		Not used because I did not believe the reading.	3	23	P12: I will not use the first news because I did not believe so much.
		Not used because reading does not have strong evidence to talk on it.	2	15	P3: Second reading is not enough to explain them. So, I do not think to use so much both readings while discussing with others

As it is seen above that 42 % of the participants said that these news were new for them. 39 % of them said that they would use these news to inform others. 23 % of them thought to use these news to change others to their thoughts. 23 % of them would not use them because they did not believe these news. Lastly, 15 % of them said that they would not use because they did not find strong evidence to talk on them.

To learn the participants' views on society portrayed in news, sixth question was asked (Appendix C, item 6). Results of responders showed that 42 % of participants think society caused global warming and they were also affected by

global warming. 37 % of them thought that global warming was directly related with society. Two participants (11 %) said that these news were not related with society and also two participants (11 %) claimed that society is sensitive to news about global warming (See Table 4.22).

Table 4.22 *Pre-service science teachers' views on social portray in the news*

Responds	# of usage	%	Example
Society causes the global warming, and affected the result of their behaviors.	8	42	P12: Society both affects and be affected part of global warming.
Global warming is directly related with the society.	7	37	P7: These news tell us that human factor and environment are closely connected
Society is sensitive to the news about the global warming issues.	2	11	P5: I think that global warming and climate change issues are accepted by society. If global warming related news is given in newspapers, it shows us this type of acceptance.
News are not related with society.	2	11	P13: I cannot see any relation with society part in those readings.

For the seventh question, what participants wanted to see in news about society was asked (Appendix C, item 7). 22 % of them said nothing extra is required in the news about society. On the contrary, participants wanted to see some scientific quantitative data (43 %), detailed references about study (14 %), specific examples from daily life (11 %), advices for the future (8 %), and visuals (3 %) in the news (See Table 4.23).

Table 4.23 *Pre-service science teachers' demands related to news about society*

Responds	# of usage	%	Example
Detailed explanations and scientific quantitative data	16	43	P18: In the first news, the author should include some scientific data
Nothing required	8	22	P18: The second news was good and enough.
Detailed references about study	5	14	P6: Background of these studies, scientists, universities… Detailed reference should be given.
Specific examples	4	11	P5: I need to read news which are related to my daily life
Advices for the future	3	8	P13: In both news, what we should do to prevent the nature is missing. I think there should be some advise.
Visuals	1	3	P17: Some visuals make that news more attractive.

For the eighth question, what they needed in news to change their views was asked (Appendix C, item 8). It is an important result that most of the participants (56 %) needed some additions to change their views about society. According to their responds, some scientific quantitative data (29 %), some advices to eliminate global warming for the future (23 %), strong evidences supporting claims (23 %), strong references (15 %), and more news related to claims in news (8 %) would help to change participants' views (See Table 4.24).

Table 4.24 *Pre-service science teachers' demands to change views about society*

Responds	Overall %		# of usage	% in each	Example
Nothing changes my thoughts.	44	Readings support my thoughts.	10	100	P2: Whatever author includes in reading is not change my view.
I need some additions to change my view.	56	Scientific data/measurements	4	31	P10: If there were more scientific information, I would believe and I would change my view.
		Persuasive advices	3	23	P15: If some advices were added to prevent to the predicted difficulties resulted from global warming, I would think global warming as less important.
		Strong argumentations	3	23	P12: I need to read a very strong argument supported with clear and exact proofs or explanations so that I will change my mind.
		Strong reference	2	15	P10: Author should add the names of scientists and universities. By that way, I would believe and I would think in that way.
		More news related to claims in news	1	8	P9: To change my views, there should be more news than I learned before.

As a last question, relationship between society and environment was asked (Appendix C, item 9). Most of the participants (60 %) believed there were both positive and negative relationships between society and environment. 40 % of participants said that the relationship between them was negative. Responds show that none of the participants found any positive relationship between society and environment.

45 % of the participants said that there was both positive and negative relationship between them which depended on behaviors of society. If society is careful on environment, relationship is positive. 15 % of them said that relationship depended on education level of society. They thought that if society had knowledge about environment, relationship was positive. In societies of different education levels environmental awareness is not the same which shows the effect of education.

On the other hand, 40 % of them founded this relation as negative. According to them, society always harms the environment (20 %) and society and environment always affect each other negatively (20 %) (See Table 4.25).

79

Table 4.25 *Pre-service science teachers' views on relationship between society*

and environment

Responds	Overall %		# of usage	%	Example
Negative relationship	40	Society and environment affect each other in negative way.	4	20	P15: There is a negative relationship. Society harms to the environment and these harms affect on the society again.
		Society always harms the environment.	4	20	P16: People always harm the environment so I think there is a negative relationship.
Both positive and negative relationship	60	It depends on the behaviors of society on environment.	9	45	P2: Society decides on this relationship. If society behave negative to environment, relationships will be negative.
		It depends on educational levels on environment	3	15	P17: I think the relationships between science and environment is different in societies and it depends on their education about the environment.

Having asked these nine questions and analyzing them specifically above, it can be now summarized in a more general manner.

50 % of the pre-service science teachers had not read any news which was about positive sides of global warming on society. However, all of them said that they had read similar news before which was about negative sides of global warming on society. For the important points in news, most of them pointed out global warming in news because of the effects on agriculture and drought (53 %). In addition to them, claims about new ecosystem and greener world concerns were other important points. Society effects (18 %), scientists' positive thoughts (8 %), scientific studies in news (6 %), being new for them (6 %) were other responds of important points in news. In contrary, 8 % of them did not believe news so they did not find any important point in news.

It is a significant result that after reading second set of news, the pre-service science teachers' feelings about future become pessimistic (74 %). The effects of global warming on society (23 %), their prior knowledge about global warming (20 %), negative expressions in news (13 %), effects of people on natural balance (10 %), and being an obscurity about future made them pessimistic. On the

80

other side, 13 % of them felt optimistic about their future because of the positive probabilities given in news. Also, another interesting result that 13 % of them were not affected from news because of their background. This responds show that negative expressions in news had an effect on pre-service science teachers' feelings about issue. It is seen that very few participants were affected from the positive expressions given in news.

Another result was that none of the participants changed their thoughts about global warming related to society aspect. Results show that participants, who thought similar with news, still thought the same. They said that their thoughts were supported with news (48 %). Participants, who read new information in news, also did not change their thoughts. Only two participants (13 %) were confused about relation of global warming to society. This shows that pre-service science teachers' perceptions of global warming related to society was strong and they are not affected from the news about positive aspects of global warming.

It was also interesting that contrary to their strong perceptions of global warming relation on society; most of the participants (56 %) need some additional explanations to change their thoughts. 31 % of them said that scientific explanations could change their thoughts. Persuasive advices against to global warming (23 %), strong arguments (23 %), and strong reference (15 %) were other additions that participants wanted to see .This shows that pre-service science teachers' perceptions related to global warming on society are strong but they needed some additional explanations to change their opinions.

Participants who read the news for the first time and who had known about them before both wanted to use these news about global warming to change others' thoughts .Responds show that participants, who founded these news as parallel to their thoughts want to use these news to support their own ideas (67 %) or to have a reaction toward global warming (11 %). Others, who read the news for the first time, wanted to use them only for sharing without any further purpose. Some of them did not want to use since they did not believe in the news (23 %) or think that

they were not worth to share (15 %). It is clearly seen that participants want to share the news if their perceptions are parallel to the news.

Lastly, the pre-service science teachers' views on society portrayed in news are similar to their perceptions of the society and environment relationship. Most of them think that there are both positive and negative relationships between society and environment (60 %). Most of them believe that the relationship is related to the behaviors of society (45 %). It should be also noted that pre-service science teachers do not think any positive relationship between society and environment.

4.2.3. News Framing Influences on Pre-Service Science Teachers' Perceptions of Global Warming in Terms of Technology Aspect

In this part of study, two news related to technology aspect of global warming were shared. First one includes mostly positive expressions about global warming and second one has mostly negative expressions of global warming (Appendix G). Nine questions were asked again.

As a first question, what participants learned from news was asked (Appendix D, item 1). Results of their responds show that most of the participants (83 %) had not read the first news before. Two of them (11 %) had not known about the carbonless certification for the phones in the first news before. One of them (6 %) said that design of the eco-phone, which absorbed the carbon in air, was new. For the second news, most of them (72 %) also had not known before. Three of them (17 %) had not known before that internet caused carbon emission. Two of them (11 %) said that this news was new but they had expected such results of internet usage (See Table 4.26).

82

Table 4.26 *Pre-service science teachers' new learning from technological news*

	Responds	# of usage	% in each news	Example
In first news	The first news is completely new.	15	83	P7: The first news is new for me
	Carbonless certificate is new.	2	11	P8: In the first one, there is a carbonless certificate.
	Design of eco-phone provides the carbon absorption.	1	6	P1: I didn't know before that a phone was manufactured which decreases amount of carbon footprint.
In second news	The second news is completely new.	13	72	P3: All readings are new for me.
	Internet usage causes to the carbon emission.	3	17	P1: I didn't know before that usage of internet caused carbon emission.
	News is not news, I expected such harms of internet usage.	2	11	P7: Second news, I guessed such kind of effects of technology. It did not surprise.

In order to evaluate what participants thought as important points about news, second question was asked (Appendix D, item 2). Results show that they are differing on the important points in third set of news. They evaluated the importance in news as people behaviors (33 %), production of eco-phone (29 %), and harms of internet usage (29 %). For some of them everything in the news was considered important (9 %).

33 % of them thought that the most important point in news was people behaviors. According to them, some unconscious behaviors harmed the environment (50 %). People could do some good things for environment, if they really wanted (36 %). Some people were aware of the possible dangers (17 %).

On the other hand, 29 % of the participants found the production of eco-phone as important. Most of them (75 %) agreed on the recycling materials usage during production as important. In news, it was said that during production, some harms of environment could be prevented via foresting. Two participants (17 %) founded this explanation as important. One participant (8 %) said that the important point was the carbon absorbing feature of manufactured phone .In addition to them, 29 % of them founded the important points as harms of internet usage. Equal amount of responds (50 % each) show that internet usage causing the

carbon emission and the amount of carbon emitted via internet usage were

important (See Table 4.27).

Table 4.27 *Results of responds on most important points in positive and negative*

technological news

Responds	Overall %		# of usage	% in each news	Example
People behaviors are important.	33	Some unconscious behaviors also harm the nature.	7	50	P6: I saw that we are harming environment unconsciously in daily life.
		If people want to save the environment, they can do something for it.	5	36	P6: In the first part, I saw that if we wanted to decrease carbon emission, we can do something.
		Some of people aware of the dangers on the nature	2	14	P8: Producers are aware of their harm to the environment and they try to eliminate it.
Production of eco-phone is important.	29	Re-cycling materials are used in phone production.	9	75	P10: The most important part was the recycling, in the first part because there is too much pollution while producing such kind of things
		During production of phone, caused harms can be handled with foresting.	2	17	P2: During re-cycling, given some diseases to environment are tried to handle by foresting.
		Manufactured phone provides to absorb emitted carbons.	1	8	P18: The important part was that phone reduces to carbon amounts in the environment.
Harms of internet usage are important.	29	Internet usage cause to the carbon emission.	6	50	P17: I was surprised because I did not know anything about harms of information technology. Using internet makes carbon emission… That news was totally important.
		Emitted carbons amounts are important.	6	50	P15: I was surprised because the amount of carbon emission was too much.
All news are important.	9	All of them are important.	4	100	P13: Those news were totally important.

As a third question, participants' feelings about future was asked

(Appendix D, item 3). It is seen that equal amount of participants responded this

question as optimistic and pessimistic (46 %) (See Table 4.28).

Table 4.28 *Pre-service science teachers on feelings after technological news*

Responds		# of usage	Overall %	Example
Optimistic (46 % in overall)	People can do something good for the environment if they want.	8	23	P6: When I read, I feel that if we want to do good things, we can do. And, I feel more optimistic in my beliefs.
	Using re-cycle materials in production is good for the environment.	6	17	P3: Plastic water-bottles usage makes my feeling positive
	Technologic developments have positive aspects on the nature.	1	3	P1: First part makes me more optimistic because technological developments have positive sides.
	I will inform my friends the harms of the technology via the news.	1	3	P18: I read that news and I decided to change my behaviors. And, one person decided to reduce the carbon emission.
Pessimistic (46 % in overall)	Technology harms to the environment.	10	29	P7: We always use Google but each using, we cause to carbon emission
	People always harm the environment.	4	12	P5: I felt pessimistic because we destroy environment in all the way.
	I do not believe people prefer that phone to use.	2	5	P13: People will not think the recycling way of that phone. I felt pessimistic again.
No effect (8 % in overall)	People will continue to use the technology.	2	5	P14: I did not think that we should never give up to using Google because Google is necessary for everyone.
	I did not trust the news.	1	3	P18: I am not sure so I have to search on

As it is shown in Table 4.28, 46 % of participants felt optimistic about their future after reading. 23 % of them said that people could do something good for environment if they wanted. 17 % of them said that using re-cycling materials during production of eco-phone was beneficial for the environment. 3 % of them (one participant) mentioned that technology had positive effects on environment. Another participant (3 %) said that such news provided awareness of others.

On the other hand, 46 % of them felt pessimistic about their future. According to their responds, harms of technology on environment (29 %) and harms of people on environment (12 %) were the reasons of pessimistic feelings. In addition to them, two of participant (6 %) thought that people would not prefer to use that phone so they felt pessimistic about their future.

Lastly, 9 % of the participants were not affected from news. Two of them (6 %) believed that people would continue to use technology. One of them (3 %) did not believe the reliability of news.

Forth question was asked to evaluate changes in pre-service science teachers' views after news (Appendix D, item 4). It is seen that most of the participants (67 %) read the news for the first time .The overall distributions of these first time readers' views are as follows: their views changed 33%, they felt hopeful about their future17 %, they had new aspects about global warming related to technology aspect (13 %). Only one participant (4 %) said that new explanations confused him. Remaining 33% had known about the news before and they found the news as supportive to their previous opinions (See Table 4.29).

Table 4.29 *Changes in pre-service science teachers' views after technological*

   news

Responds	Overall %		# of usage	%	Example
I think same thoughts with readings.	33	Supports my thoughts. My thoughts get stronger.	8	33	P11: Both news supported my thoughts which harms or benefits of technology depends on how we use it
I met new explanations.	67	Readings change my thoughts completely.	8	33	P4: I had not thought that producers evaluate the recycles to produce something. But, they did. I was surprised and changed my view.
		The news made me more hopeful about the future.	4	17	P8: Some people wanted to do something and they gained their aim. I felt more hopeful.
		Provide new aspects of having thoughts.	3	13	P5: These news did not change my views but they provided to have new aspects.
		New aspects confused my strong thoughts about global warming.	1	4	P7: What we can do after that reading, I do not know because we will continue to use. Maybe, we try to use it less but I am not sure. I am confused.

To learn whether participants will use these news and for what purpose if they do, fifth question was asked (Appendix D, item 5). It is seen that most of the participants, who founded news as new, wanted to use these news to inform others (62 %). It is an important result that participants, who changed their thoughts via news, wanted to change others thoughts in the same way (31 %). Only one

participant of this group did not believe these news so responder would not use them.

In addition to them, 28 % of the participants said that these news were parallel to their own thoughts. Most of them (80 %) said that they would use these news to support their own thoughts about issue. Only one participant (20 %) would use them to initiate a reaction toward global warming issue (See Table 4.30).

Table 4.30 *Effects of technological news on pre-service science teachers'*

discussions with others

Responds	Overall %		# of usage	% in each category	Example
These news were parallel to my own ideas.	28	Used to support their ideas.	4	80	P5: When I will talk about these news, I will explain my ideas in this way.
		Used to have reaction toward global warming	1	20	P1: I can use the news about Google where it says 'one can affect give harm to the environment unconsciously' to my friends.
These news were new for me.	72	Used to inform others.	8	62	P4: I will use the second news to inform others how internet usage causes to the carbon emission.
		Used to change others' thoughts.	4	31	P10: I changed my view. For that reason, I try to change others' views if they thought same as my old view.
		Not used because I did not believe the news	1	7	P18: I will not use the first news because I did not believe it.

To learn the participants' views on technology portrayed in news, sixth question was asked (Appendix D, item 6). It is an important result that most of the participants (77 %) said technology had positive and negative effects on us/environment. According to them, the effects of technology depended on the purpose of usage (62 %) and the effects of technology depended on who used it (15 %).

87

On the other hand, 23 % of them said that technology always harmed the environment. They believed that people had to use the technology despite its harms. (See Table 4.31).

Table 4.31 *Pre-service science teachers' views on technology portray in the news*

Responds		# of usage	%	Example
Technology has positive and negative effects on us/environment. (77 % in overall)	Effects of technology depend on the purpose of usage.	8	62	P13: Technology can be good or not which depends on us. If we want to use for good purposes, technology can be good. All of them are related with human. they have knowledge about it.
	Effects of technology depend on who uses the technology.	2	15	P8: Technology can be a danger or benefit for environment which depends on who use it and how much
Technology always harms to the environment but we have to use it. (23% in overall)		3	23	P18: Technology had more negative effects than positive effects. All technological devices are harmful for the environment and health such as cell phones, TVs, refrigerators…

For the seventh question, what participants wanted to see in news about science was asked (Appendix D, item 7). Participants wanted to see detailed explanations to understand the news better (36 %), advices for the future (18 %), detailed references about study (9 %), visuals (6 %), and specific examples from daily life (3 %) in the news. Contrary to them, 27 % of them said nothing extra is required in news about technology (See Table 4.32).

Table 4.32 *Pre-service science teachers' demands related to news about*

technology

Responds	# of usage	%	Example
Detailed explanations to understand better	12	36	P11: Some details can be added such as how many bottles are used for a phone, how much carbon emission is provided, how much carbon emission differences are expected when we compare with normal phone usage etc.
Nothing required to include	9	27	P8: Everything is understandable
Advices for the future	6	18	P12: It can advise to us to use less such kind of technology.
Detailed references about study	3	9	P18: Scientists' name and university names… by this way those news will be more reliable.
Visuals	2	6	P10: Pictures of phone and availability in Turkey can be added.
Specific examples seen around	1	3	P17: There should be more examples to show reacts to the environmental pollution. People will see some examples and they will want to do against it.

Eighth question was about what they needed in news to change their views (Appendix D, item 8). It is seen that responds of this question was different. Only 33 % of them said that nothing would change their thought.28% changed their thoughts had while 39% needed additions to change their thoughts (39 %) (See Table 4.33).

Table 4.33 *Pre-service science teachers' demands to change views about*

technology

Responds	Overall %		# of usage	%	Example
Nothing changes my thoughts.	33	Nothing changes my thoughts.	6	33	P11: I did not change my view wheatear author had added anything else because I can see the positive and negative ways of technology on the environment in my daily life.
I need some additions to change my view.	39	Persuasive explanations change my view.	4	22	P15: If the author included some examples to show positive aspects of the technology, and some predicted examples to show benefits of the technology in the future, I would change my view.
		Results of usage the new manufactured phone	2	11	P4: If completely those phones finish such kind of pollution, I would change my view. But, to change, 100 percent that phone should finish that problem.
		More reliable research related to news	1	6	P18: I am not sure to change my thoughts completely. Changing view is hard so I have to search on it.
My thoughts have already changed.	28	Readings are enough to change view.	5	28	P3: In first one, my thoughts of plastic re-cycling has changed so there is no more thing to change my idea. In second one, my thoughts on internet usage has changed. These are enough for me.

As it is seen in Table 4.33, 39 % of the participants need additions to change their thoughts. According to their responds, persuasive explanations about positive aspects of technology (22 %), results of eco-phone usage (11 %), and more reliable research related to news (6 %) would help to change participants' thoughts about global warming related to technology aspect.

Last question was asked to find out the relationships between technology and environment (Appendix D, item 9). It is an important result that most of the participants (73 %) agreed on that there were both positive and negative relationships between technology and environment. 27 % of them thought that there was a negative relationship between them because they believed that technology always harmed the environment. It is another important result that no one said there was a positive relationship between them (See Table 4.34).

As it is seen in Table 4.34, 73 % of them thought that there were both positive and negative relationships. Most of whom (53 %) said that relationship

depended on the purpose of usage. 13 % of them believed that technology had some positive effects but harms of it more than positive effects. Lastly, one participant (7 %) said that technology harmed the environment while it was trying to save it.

Table 4.34 *Pre-service science teachers' views on relationship between technology and environment*

Responds	Overall %		# of usage	%	Example
Negative relationship	27	Technology always harms to the nature.	4	27	P15: There is a negative relationship. Society harms to the environment and these harms affect on the society again.
Both positive and negative relationship	73	It depends on purpose of usage the technology	8	53	P5: There is a cycle between them. They are related with each other closely. It is depend on their usage.
		Technology mostly harms to the nature but there is also positive effect on it.	2	13	P8: I believe that mostly effects of technology on environment are negative. Positive examples are exceptions, I think.
		Technology harms to the environment, and tries to save at the same time.	1	7	P1: There are both positive and negative relationships between technology and environment. Using Google causes carbon emission but same technology tries to reduce carbon emission.

As a result of these questions, it is seen that most of the pre-service science teachers founded both news as new. They are differing in important points. They thought that thought that people behaviors (33 %), production of eco-phone (29 %), harms of internet usage (29 %) were important.

It is an important result that 46 % of the participants were optimistic and 46 % were pessimistic about future related to technology and environment aspects .While 29 % of them thought that technology always harmed the environment, 23 % of them thought that people could do some good things for environment if they really wanted. This result shows that pre-service science teachers are hopeful for the future by means of technological aspects of global warming.

91

Another important result is related to changes in their thoughts. It is seen that most of the participants read new explanations in news (67 %). 33 % of whom said that readings changed their thoughts about global warming related to technology aspect. 17 % of them felt hopeful about their future. This is another result that 62 % of them want to use these news to inform others, and 31 % of them want to change others' thoughts, too. This result shows that the news about technology aspect of global warming has effects on pre-service science teachers' perceptions. Their thoughts and feelings are affected by the news. Furthermore, they also want to affect others' thought in the same way with them. Results also show that other participants (33 %) think the same with the news and they said that news were supporting their ideas. They claimed that their thoughts were stronger. They wanted to use these news to support their own thoughts while discussing with others. This result shows that news has influence on participants' thoughts. Participants' thoughts are shaped by the influence of the news. They want to affect others in the same way with their thoughts by using such news.

Responds of pre-service science teachers to additions in news related to technology show that most of them want to see detailed explanations to understand better (36 %). 27% of them do not want any addition to these news.

Responds show that 28 % of them had already changed their thoughts. 39 % of them are ready to change their thoughts about global warming related to technology aspect by additions in news. Only 33 % of them said that nothing changed their thoughts. These results show that pre-service science teachers' perceptions of global warming related to technology are changed via news effect or they are ready to change their perceptions about this issue with some additions to the news.

Lastly, responds to technology portray in news are similar to their responds on relationships between technology and environment. It is a significant result that most of the pre-service science teachers agree on that there are both positive and negative relationships between technology and environment (73 %) which depend to the purpose of usage (53 %). Also, they think that technology

92

mostly harms the environment but there are also some positive effects on it. However, these positive effects are less than negative effects (13 %). In addition to them, 27 % of them think that technology always harms the environment which implies a negative relationship between them.

CHAPTER 5

DISCUSSION

In this chapter, the results given in the previous section will be discussed in two sections. First section will cover the general perceptions of pre-service science teachers on science, technology and their interactions with society. Following chapter will present the influences of news framing on perceptions of the same pre-service science teachers group science, society and technology aspects of global warming issue.

5.1. Perceptions of Preservice Science Teachers on Science, Technology, and Their Interactions with Society

Results derived from the answers given to the questions relevant to this section are similar to the results reported in the study of Kahyaoglu (2004). In this study, responders did not present a certain definition for science. Most of them defined science as different ways of explaining the natural phenomena while others explained science as nature of the human and environment and as activities which used Science Process Skills (SPS). In the study of Aikenhead and Ryan (1992), Kahyaoglu (2004) and Yalvac, Tekkaya, Cakiroglu, and Kahyaoglu (2007), pre-service science teachers' definitions of science were also uncertain. For example, in study of Yalvac, Tekkaya, Cakiroglu, and Kahyaoglu (2007), exploration of unknown things, the way to improve the world, and basic physics, chemistry, or biology knowledge were stated as the definitions for science by pre-service science teachers.

In this study, it was interesting that only one of the participants also mentioned the negative effects of science besides positive ones (i.e. environmental pollution and diseases). This shows that there is mostly a positive perception of science. Their responds on science also show that pre-service science teachers have

94

detailed knowledge of science. For example, when asked the definition of science, some of the participants shared their knowledge about nature of science (NOS). According to them, science is universal, objective, certain, empirical based and it depends on observation. Their explanations show that most of them explained the NOS aspects in parallel to Lederman (2006). In his study, NOS aspects are stated as observation-inference, being empirical based and requiring science process skills which are similar to those given in this study. Lederman (2006) also mentions about being subjective and tentative for NOS which are not included in this study.

Another important result was that their opinions on the effects of science courses taken at different levels. Most of the pre-service science teachers agree that university level science courses had positive effects on their lives. For the science courses taken before college, half of them thought that they had positive effects, but the other said they either had negative or no effect on them. The reasons for the ineffectiveness of the early science courses were seen as poor teaching methods and materials. These answers comply with Osborne's (2003) study where it was said that the quality of teaching in schools had a significant effect on science courses. In the study of Kahyaoglu (2004), responders agreed on the positive effects of science courses on daily life but she also reported that participants agreed on the influence of teachers or instructors teaching science course.

Opinions on environmental science among other scientific disciplines were asked in order to specify the participant's perspectives on the environment and science relationship. Half of the participants said science areas were all the same and interrelated. Other half said environmental science is unique in terms of people's contributions. Everyone is somehow related to the environmental issues and they can express their ideas or offer solutions to the environmental science problems which are not possible for the other science areas. These responds show that there is no uncertainty on their thoughts about environmental literacy like in the study of Amirshokoohi (2010). In that study, pre-service science teachers portrayed low level of environmental literacy but they agreed on the importance of environmental courses.

Perceptions of the participants towards technology were positive, in general. Most of them mentioned the good purposes of technology. Participants had a consistent definition of technology, where they defined it as the applications of science. Similar responds were seen in the study of Yalvac et. al. (2007). In this study, participants also implied the concerns about technology regarding its negative effects on health, environment (e.g. Pollution, renewable resource consumption, etc.), social ethics and inpredictability of its future benefits or inverse effects. However, their responds show that pre-service science teachers defined technology in a more general manner which shows that they did not have detailed knowledge about technology. Similar results were seen in the literature that pre-service science teachers did not know exactly what technology was and they confused technology with science (Yalvac et. al, 2007; Haidar, 2002; Tairab, 2001).

Up to this point, participants' perceptions of science and technology were discussed in a separate manner. Here, to understand their perceptions of the society, the relations between science-society and society-technology were asked. Participants said that society had mostly negative effect on the science due to the strict traditional rules and cultural dogma, which contradicts Buaraphan's (2013) results where it was reported that needs of society promoted science. Looking at the other way around, responders said that science had positive effects on the society since problems can be solved via science in the society. These results confirm Mansour's (2010) results where his responders said science supported and made society stronger. The other relationship is that society needs promote technological developments and in return technology provides a better, comfortable life to the society. Both for science and technology effects on the society, it is the purpose of usage and intentions which determines whether they are good or harmful, as participants said. In study of Yalvac et. al. (2007), same results with this study were represented as a positive relationship where science and technology tried to make people lives better and they were affected by religion and ethics of society in a positive way.

5.2. Influences of News Framing on Perceptions of Preservice Science Teachers on Science, Society and Technology Aspects of Global Warming Issue in Terms

Results of this part show that influences of news framing on pre-service science teachers' perceptions in terms of science, society, and technology aspects of SSIs are different. To evaluate the influence of the news framing, global warming issue was chosen. After reading positive and negative news about global warming, participants had similar impressions related to scientific and social news. Most of them had a negative background about effects of global warming issue related to science and society aspects and they were surprised to see positive news about it. But however, their thoughts were not changed, but supported. According to news framing theory, individuals' perceptions can be stronger if the news is parallel to their thoughts. In science and society aspects of global warming, influence of news framing was seen in the supportive way. But news affected participants in a different way for technology aspect of global warming. They claimed that their thoughts were changed by the influence of the news. After news, they changed their thoughts as people could do something good for the environment if they really wanted. According to news framing theory, individuals' perceptions can be weaker or they can change their thoughts if the news is strong and well stated enough to change the opinions. In technology aspect of global warming, influence of news framing provided change in thoughts. These influences of news on perceptions of participants verifies the claims about news framing and related studies (Steward, Dickerson & Hotchkiss, 2009; Chokriensukchai & Tamang, 2010; Zhao, Leiserowitz, Maibach, & Roser-Renouf, 2011). In these studies, authors explained the influences of news framing on individuals' perceptions of many different SSIs. In this study, influence of news framing on pre-service science teachers' perceptions related to one of the socio-scientific issues was shown. In this way, it was seen that news framing has an influence of pre-service science teachers' perceptions of science, society, and technology aspect, but it is seen in a supportive way in scientific and social aspects and it changed the perceptions in technological aspects.

The reason why the influence of news framing is different in science and society aspects than the technology aspect may be that pre-service science teachers' prior knowledge about the issue. For example, in the first part of the study, participants' perceptions of science, technology, and their interactions with society were examined. In that part, it was seen that participants explained the science in detail when the definition was asked about nature of science aspects, science process skills, science interest areas, etc. These explanations show that participants had a strong background related to the science aspect. However, when definition of technology was asked, their responds about purpose and concerns of technology were limited. These responds show that participants did not have detailed knowledge about technology. In the study of Tsai (2006), science education courses were designed to examine the view changes of pre-service and in-service science teachers about nature of science. Results showed that pre-service science teachers' views on empirically based views of nature of science changed to the constructivist view. However, in-service science teachers' shaped strong beliefs which did not change. Authors concluded that due to in-service science teachers' strong backgrounds in the science, they were not affected easily. For this reason, we believed that in this study, pre-service science teachers' strong backgrounds about the science is the reason for the supportive way of influence of news framing.

Moreover, pre-service science teachers' prior knowledge may also affect their interpretation of news. For example, most of the pre-service science teachers said that they had known the news about the negative aspects of global warming about science and society aspects. After reading, most of them did not consider the positive aspect of the news and they did not change their thoughts. In contrast, their thoughts were supported with the negative news. However, in the technology news, many of them said both news were new to them and they evaluated the news in positive and negative aspects. In the study of Corbett and Durfee (2004), authors tried to examine the influence of the news about global warming on undergraduate students' perceptions of certainty by means of controversy and context. Results showed that news had an effect on perceptions; especially, context had an

98

important influence on controversial (e.g. scientific, social and politic) issues. It was a crucial finding that this effect on the interpretation of those news was not purely due to the news, but also due to the effect of prior knowledge. For this reason, the difference in news framing about science and society aspect of global warming may be the prior knowledge of participants which may affect their interpretations of news.

It is an important finding that pre-service science teachers wanted to use these news related to science and society aspects which supported their negative perceptions, in order to support their thoughts about the issue in the same way while teaching and talking to other people. Same for the technology related news which changed their ideas, they said they would use them to inform others or to change others thoughts, too. These results show that pre-service science teachers prefer to use news materials in the same way with their thoughts. Similarly, their communication with socio-scientific issues was influenced by their perceptions of the issues. This result is similar to what Gardner and Jones (2011) and Sullivan, Ledley, Lynds, and Gold (2014) concluded in their studies. These groups both designed the science courses and communication skills according to their perceptions and reflected accordingly. This is an important result that pre-service science teachers are responsible for socio-scientific lecture design and communicating with students about these issues. However, these results show that pre-service science teachers' perceptions about socio-scientific issues influence their communication ways.

5.3. Implications of This Study and Further Work

In this study, the influence of communication skills, material selections and lecture design of teachers were seen to be crucially important while conveying science topics. It was an important finding that pre-service science teachers' perceptions of controversial SSIs had an important role in their lecture designs and their communication ways.

Pre-service science teachers are important for future science lesson designs. In order to achieve their teaching goals, pre-service science teachers should know how to manage student perceptions (i.e. change them to the correct ones or support existing perceptions) for an effective science education. In the same way, in-service science teachers' perceptions are also important because they have a role in socio-scientific lecture designs, at present. For this reason, as a future work, in-service science teachers' perceptions of SSIs should be examined and the awareness of the influence of their perceptions of their lecture design should be provided. By this way, negative unintentional influence of teacher perceptions about SSIs can be eliminated.

In the same way, the instructors who are responsible for training science teachers should include a section which is related to methods providing awareness about the influence of individual perceptions to developing effective communication ways about socio-scientific issues. This will allow teachers to be aware of and manage their perceptions on their lecture designs and help them to make a correct material selection without reflecting their own perceptions.

As a further work, the same procedure can be applied on a different SSI topic other than global warming issue which would initially sound more neutral to the participants. This would allow seeing the effects of the news objectively. Including both in-service teachers and responses of their students in this study would give a broader perspective on the factors affecting perceptions and thus efficiency in science education can be improved.

REFERENCES

Abd-El-Khalick, F. (2006). Socioscientific issues in pre-college science classrooms: The primacy of learners' epistemological orientations and views of nature of science. *Contemporary Trends and Issues in Science Education, 19*, 41-61.

Abi-El-Mona, I., & Abd-El-Khalick, F. (2011). Perceptions of the nature and 'Goodness' of argument among college students, science teachers, and scientists. *International Journal of Science Education, 33*, 573-605.

Aikenhead, G. S., & Ryan, A.G. (1992). The development of a new instrument: "Views on science-technology-society" (VOSTS). *Science Education*, 76(*5*): 477-491.

Albe, V. (2008). When scientific knowledge, daily life experience, epistemological and social considerations intersect: Students' argumentation in group decision on a socio-scientific issue. *Research in Science Education, 38*, 67-90.

American Association for the Advancement of Science. (1989). *Science for all Americans*. Washington, DC: American Association for the Advancement of Science.

American Association for the Advancement of Science. (1993). *Benchmarks for science literacy*. New York: Oxford University Press.

Amirshokoohi, A. (2010). Elementary pre-service teachers' environmental literacy and views toward science, technology, and society (STS) issues. *Science Educator, 19*, 56-63.

Baber, M. (2001). *A comparison of NEAB and salters a-level chemistry: Students view and achievement.* York, UK: University of York.

Barab, S. A., Sadler, T. D., Heiselt, C., Hickey, D. T., & Zuiker, S. (2007). Relating narrative, inquiry and inscriptions: Supporting consequential play. *Journal of Science Education and Technology, 16,* 59-82.

Barker, V., & Millar, R. (1996). *Differences between salters' and traditional a-level chemistry students' understanding of basic chemical ideas*. York, UK: University of York.

Bennett, J., Grasel, C., Parchmann, I., & Waddington, D. (2005). Context-based and conventional approaches to teaching chemistry: Comparing teachers' views. *International Journals of Science Education, 27*, 1521-1547.

Boyes, E., & Stanisstreet, M. (1992). Students' perceptions of global warming. *International Journal of Environmental Studies, 42*(4), 287-300.

Bozdogan, A. (2009). An investigation on Turkish prospective primary school teachers' perceptions about global warming. *World Applied Sciences Journals, 7*, 43-48.

Braten, I., Gil, L., Stromso, H. I., & Vidal-Abarca, E. (2009). Personal epistemology across cultures: exploring Norwegian and Spanish university students' epistemic beliefs about climate change. *Social Psychology Education, 12,* 529-560.

Buaraphan, K. (2013). In-service science teachers' common understanding of nature of science. *OIDA International Journal of Sustainable Development, 6,* 17-38.

Bulte, A. M. W., Westbroek, H. B., de Jong, O., & Pilot, A. (2006). A research approach to designing chemistry education using authentic practices as contexts. *International Journal of Science Education, 28*, 1063-1086.

Campbell, T., Medina-Jerez, W., Erdogan, I., & Zhang, D. (2009). Exploring science teachers' attitudes and knowledge about environmental education in three international teaching communities. *International Journal of Environmental & Science Education, 5,* 3-29.

Chokriensukchai, K., & Tamang, R. (2010). Thai youths and global warming: Media information, awareness, and lifestyle activities. *Applied Environmental Education & Communication, 9*, 198- 208.

Condit, C., & Parrott, R. (2004). Perceived levels of health risk associated with linguistic descriptors and type of disease. *Science Communication, 26*, 152-161.

Corbett, J., & Durfee, J. (2004). Testing public (un)certainty of science media representations of global warming. *Science Communication, 26*, 129-151.

Creswell, J.W. (2007). *Qualitative inquiry and research design: Choosing among five approaches.* Thousand Oaks, CA: Sage.

Culley, M. R. et al. (2011). Sun, wind, rock and metal: Attitudes toward renewable and non-renewable energy sources in the context of climate change and current energy debates. *Current Psychology, 30,* 215-233.

Denzin, N. K. (1970). *The Research Act in Sociology*. Chicago: Aldine.

Donelly, L. A., Kazempour, M., & Amirshokoohi, A. (2009). High school students' perceptions of evolution instruction: Acceptance and evolution learning experience. *Researches in Science Education, 39*, 643-660.

Dori, Y. J., Tal, R., & Tsaushu, M. (2003). Teaching biotechnology through case studies: Can we improve higher-order thinking skills of non-science majors? *Science Education, 87*, 767-793.

Duan, H., & Fortner, R., W. (2005). Chinese college students' perceptions about global versus local environmental issues. *The Journal of Environmental Education*, *36* (4), 23-32.

Durant, J. R. (1993). *What is scientific literacy*? In J. R. Durant & J. Gregory (Eds.), Science and culture in Europe (pp. 129–137). London: Science Museum.

Esa, N. (2010). Environmental knowledge, attitude and practices of student teachers. *International Research in Geographical and Environmental Education, 19,* 39-50.

Feierabend, T., Jokmin, S., & Eilks, I. (2010). Controversial environmental issues: A case study for the professional development of science teachers. *Chemistry Education Research and Practice, 12,* 85-91.

Gardner, G. & Jones, G. (2011). Perceptions and practices: Biology graduate teaching assistants' framing of a controversial socioscientific issue. *International Journal of Science Education, 33,* 1031-1054.

Haidar, A. H. (2002). Professors' views on the influence of Arab society on science and technology. *Journal of Science Education and Technology, 9*, 257–273.

Hallahan, K. (1999). Seven models of framing: Implications for public relations. *Journal of Public Relations Research, 11*, 205-242.

Hanegan, N., Price, L., & Peterson, J. (2008). Disconnections between teacher expectations and student confidence in bioethics. *Science & Education, 17*, 921-940.

Harris, R., & Ratcliffe, M. (2005). Socio-scientific issues and the quality of exploratory talk-what can be learned from schools involved in a 'collapsed day' project? *Curriculum Journal, 16*, 439-453.

103

Herman, B. C. (2014). The influence of global warming science views and sociocultural factors on willingness to mitigate global warming. *Science Education, 99*, 1-38.

Hodson, D. (2003). Time for action: Science education for an alternative future. *International Journal of Science Education, 25*, 645-670.

Hogan, K. (2002). A socio-cultural analysis of school and community settings as sites for developing environmental practitioners. *Environmental Education Research, 8*, 413-437.

Kahyaoglu, E. (2004). *Investigation of the pre-service science teachers' views on science technology and society issues.* Unpublished master thesis, Middle East Technical University, Ankara, Turkey.

Khishfe, R., & Lederman, N. (2006). Relationship between instructional context and views of nature of science. *International Journal of Science Education, 29,* 939-961.

Kilinç, A. (2009). Can project-based learning close the gap? Turkish student teachers and proenvironmental behaviours. *International Journal of Environmental & Science Education, 5,* 495-509.

King, P. M., & Kitchener, K. S. (2004). Reflective judgment: Theory and research on the development of epistemic assumptions through adulthood. *Educational Psychology, 39*, 5–18.

Klishfe, R., & Lederman, N.G. (2006). Teaching nature of science within a controversial topic: Integrated versus non-integrated. *Journal of Research in Science Teaching, 43*, 395-318.

Klosterman, M., & Sadler, T. D. (2009). Multi-level assessment of content knowledge gains in the context of socio-scientific issue-based instruction. *International Journal of Science Education, 32*, 1017-1043.

Kogce, D., Unal, S., & Sahin, B. (2009). The effect of pre-service mathematic teachers' socio- economic status on their ideas and behaviors about environment. *Turkish Science Education, 6*, 19-37.

Kolsto et al. (2006). Science students' critical examination of scientific information related to socio-scientific issues. *Science Education, 90*, 632-655.

Kolsto, S. D. (2001). Scientific literacy for citizenship: Tools for dealing with the science dimension of controversial socioscientific issues. *Science Education, 85*, 291-310.

Kortland, K. (1996). An STS case study about students' decision making on waste issue. *Science Education, 80*, 673-689.

Lederman, N. G. (2006). Students' and teachers' conceptions of the nature of science: A review of the research. *Journal of Research in Science Teaching, 29*, 331-359.

Lee, H., & Abd-El-Khalick, F. (2006). Korean science teachers' perceptions of the introduction of socio-scientific issues into the science curriculum. *Canadian Journal of Science, Mathematics and Technology Education, 6,* 97-117.

Lee, H., & Witz, K. G. (2009). Science teachers' inspiration for teaching socio-scientific issues: Disconnection with reform efforts. *International Journal of Science Education, 7*, 931-960.

Lee, M. K., & Erdogan, I. (2007). The effect of science-technology-society teaching on students' attitudes toward science and certain aspects of creativity. *International Journal of Science Education, 11*, 1315-1327.

Lincoln, Y. S. & Guba, E. G. (1985). *Naturalistic Inquiry*. Newbury Park, CA: Sage Publications.

McGinnis, J. R., & Simmons, P. (1998). Teachers' perspectives of teaching science–technology–society in local cultures: A sociocultural analysis. *Science Education, 83*, 179-211.

Merriam, S. B. (1998). *Qualitative research and case study applications in education. revised and expanded from "case study research in education."* San Francisco, CA: Jossey-Bass Publishers.

Miles, M. B., & Huberman, A. M. (1994). Qualitative Data Analysis: An Expanded Sourcebook. Thousand Oaks, CA: Sage Publications.

Monsour, N. (2010). Science Teachers' Perspectives on Science-Technology-Society (STS) in Science Education. *Eurasian Journal of Physics and Chemistry Education, 2*, 123-157.

Nisbet, M. C., & Lewenstein, B. V. (2002). The future of public engagement. *The Scientist, 21*, 39-44.

Nuangchalerm, P., & Kwuanthong, B. (2010). Teaching "Global Warming" through socioscientific issues-based instruction. *Asian Social Science, 6,* 42-47.

Osborne, J., Simon, S., & Collins, S. (2003). Attitudes towards science: a review of the literature and its implications. *International Journal of Science Education, 25,* 1049-1079.

Parchmann, I., Gracel, C., Baer, A., Nentwig, P., Demuth, R., Ralle, B., et al. (2006). 'Chemie im Kontext': A symbiotic implementation of content-based teaching and learning approach. *International Journal of Science Education, 28*, 1041-1062.

Pedretti, E. (1999). Decision making and STS education: Exploring scientific knowledge and social responsibility in schools and science centers through an issue-based approach. *School Science and Mathematics, 99*, 174-181.

Roth, W. M., & Lee, S. (2004). Science education as/for participation in the community. *Science Education, 88*, 263-291.

Sadler, T. D. (2009). Situated learning in science education: socio-scientific issues as contexts for practice. *Studies in Science Education, 45*, 1-42.

Sadler, T. D. et al. (2006). Socioscience and ethics in science classrooms: Teacher perspectives and strategies. *Journal of Research in Science Teaching, 43*, 353-376.

Sadler, T. D., & Donelly, L.A. (2006). Socioscientific argumentation: The effects of content knowledge and morality. *International Journal of Science Education, 28,* 1463-1488.

Sadler, T. D., & Zeidler, D. L. (2005). The significance of content knowledge for informal reasoning regarding socioscientific issues: Applying genetics knowledge to genetic engineering issues. *Science Education, 89*, 71-93.

Sadler, T. D., Barab, S. A., & Scott, B. (2007). What Do Students Gain by Engaging in Socio-scientific Inquiry? *Research in Science Education, 37*, 371-391.

Scheufele, D. (1999). Framing as a theory of media effects. *Journal of Education, 49*, 103-122.

Scheufele, D. A. (2006). Framing as a theory of media effects. *Journal of Communications, 49*, 103-122.

Simmons, M. L., & Zeidler, D. L. (2003). *Beliefs in the Nature of Science and Responses to Socioscientific Issues.* Netherlands: Springer.

Smith, J. (2005). Dangerous news: Media decision making about climate change risks. *Risks Analysis, 25*, 1471-1482.

Stewart, C., Dickerson, D. L., & Hotchkiss, R. (2009). Beliefs about science and news frames in audience evaluations of embryonic and adult stem cell research. *Science Communication, 30*, 427-452.

106

Sullivan, S. M., Ledley, T. S., Lynds, S. E., & Gold, A. U. (2014). Navigating climate science in the classroom: Teacher preparation, perceptions and practices. *Journal of Geoscience Education, 62*, 550-559.

Tairab, H. H. (2001). How do pre-service and in-service science teachers' view the nature of science and technology? *Research in Science and Technological Education, 19*, 235–250.

Tal, R., & Hochberg, N. (2003). Assessing higher order thinking of students participating in the 'WISE' project in Israel. *Studies in Education Evaluation, 29*, 69-89.

Tal, T., & Kedmi, Y. (2006). Teaching socio-scientific issues: Classroom culture and students' performances. *Cultural Studies in Science, 1*, 615-644.

Tekkaya, C., Sungur, S., Cakiroglu, J., Ertepinar, H., & Kaplowitz, M. (2009). Assessing pre-service teachers' environmental literacy in Turkey as a mean to develop teacher education programs. *International Journal of Educational Development, 29*, 426-436.

Topcu, M. S., Sadler, T. D., & Yilmaz-Tuzun, O. (2010). Preservice science teachers' informal reasoning about socioscientific issues: The influence of issue context. *International Journal of Science Education, 32,* 2475-2495.

Tuncer, G., Sungur, S., Tekkaya, C., & Ertepinar, H. (2007). A comparative study on pre-service teachers' and elementary students' attitudes towards the environment. *International Research in Geographical and Environmental Education, 16,* 188-198.

Tuncer-Teksoz, G., Boone, J. W., Yilmaz-Tuzun, O., & Oztekin, C. (2014). An evaluation of the environmental literacy of preservice teachers in Turkey through Rasch analysis. *Environmental Education Research, 20,* 202-227.

Vreese, C. H. (2005). News framing: Theory and typology. *Information Design Journal+ Document Design, 13*, 51-62.

Walker, K. A., & Zeidler, D. L. (2007). Promoting discourse about socio-scientific issues through scaffolded inquiry. *International Journal of Science Education, 29*, 1387-1410.

Yager, S. O., Lim, G., & Yager, R. (2006). The advantages of an STS approach over a typical textbook dominated approach in middle school science. *School Science and Mathematics, 106*, 248-260.

Yalvac, B., Tekkaya, C., Cakiroglu, J., & Kahyaoglu, E. (2007). Turkish pre-service science teachers' views on science–technology–society issues. *International Journal of Science Education, 29,* 331-348.

Yilmaz-Tuzun, O., Tuncer, G., & Aydemir, M. (2008). An investigation on the elementary teachers' knowledge about air pollution issues. *Hacettepe University Journal of Education, 35*, 374-385.

Zeidler, D. L. et al. (2005). Beyond STS: A research-based framework for socioscientific issues education. *Science Education, 89*, 357-377.

Zeidler, D. L., & Keefer, M. (2006). *The role of moral reasoning and the status of socioscientific issues in science education*. Netherlands: Springer.

Zeidler, D. L., Sadler, T. D., Applebaum, S., & Callahan, B. E. (2009). Advancing reflective judgment through socio-scientific issues. *Journal of Research in Science Teaching, 46*, 74-101.

Zhao, X., Leiserowitz, A., Maibach, E., & Roser-Renouf, C. (2011). Attention to science/environment news positively predicts and attention to political news negatively predicts global warming risk perceptions and policy support. *Journal of Communication, 61*, 713-73.

Zohar, A., & Nemet, F. (2002). Fostering students' knowledge and argumentation skills through dilemmas in human genetics. *Journal of Research in Science Teaching, 39*, 35-62.

APPENDICES

APPENDIX A

Semi-structured Interview Questions-1

1. What is science?
2. What is technology?
3. Are science and /or technology affected by the society in which it constructs and its culture?
4. How can science/technology affect the society?
5. You have taken science courses since primary school. Do you think it has an effect on your daily life, whether positive or negative?
6. What can you say about the personality of scientists?
7. Who decides on the technological developments; governments, public, scientists, or other?
8. Are there any difference between environmental science and other scientific disciplines?

APPENDIX B

Semi-structured Interview Questions-2

1. What did you learn from the readings that you did not already know?
2. What were the most important parts of the readings?
3. How did the readings make you feel for your future; optimistic or pessimistic?
4. In what ways did the readings change your views?
5. In what ways do you think these readings will impact the ways that when you discuss these topics with others?
6. How was science portrayed in the readings?
7. What else should the author(s) of the article have included?
8. What else could the author of the article have included that would have made you change your views?
9. Is there a positive or negative relationship between science and environment? If yes, can you define this relationship?

APPENDIX C

Semi-structured Interview Questions-3

1. What did you learn from the readings that you did not already know?
2. What were the most important parts of the readings?
3. How did the readings make you feel for your future; optimistic or pessimistic?
4. In what ways did the readings change your views?
5. In what ways do you think these readings will impact the ways that when you discuss these topics with others?
6. How was society portrayed in the readings?
7. What else should the author(s) of the article have included?
8. What else could the author of the article have included that would have made you change your views?
9. Is there a positive or negative relationship between society and environment? If yes, can you define this relationship?

APPENDIX D

Semi-structured Interview Questions-4

1. What did you learn from the readings that you did not already know?
2. What were the most important parts of the readings?
3. How did the readings make you feel for your future; optimistic or pessimistic?
4. In what ways did the readings change your views?
5. In what ways do you think these readings will impact the ways that when you discuss these topics with others?
6. How was technology portrayed in the readings?
7. What else should the author(s) of the article have included?
8. What else could the author of the article have included that would have made you change your views?
9. What else would you like to see in such articles?
10. Is there a positive or negative relationship between technology and environment? If yes, can you define this relationship?

APPENDIX E

Çevre-Bilim İlişkisi

Küresel Isınma Yeni Yaşam Türleri Yarattı

Yapilan calismalar gosteriyor ki, Dünya'nın isinmasi ile ortaya yeni bir bakteri turu olan manyetotatik bakteriler ortaya cikiyor. Bu bakteriler, Dunya'nin manyetik alan hatları boyunca yasiyor ve manyetofosiller adiyla bilinen manyetik parçacıkların kalıntılar olusturabiliyor. Profesör Hojatullah Vali, bunun şimdiye dek bilinmeyen tamamen yeni bir organizma sınıfı olduğunu belirterek, bu türlerin küresel ısınmanın aniden 5 derece arttığı dönem boyunca yaşadıklarını söyledi. Kanadalı bilim adamları, bu bakterilerin urettigi fosillerin sadece 4 mikron uzunluğunda olduğunu belirtirken, bunların önceden bulunan manyetofosillerden 8 kat daha uzun olduklarına işaret ettiler.

"İlginç olan, bu organizmaların var olduğu spesifik zaman çerçevesini bilmemiz. Eğer bu dönemden öncesine gitseniz bu türleri bulamayız, sonrasına gitseniz yine bulamayız. 5 derece daha fazla sıcaklık çok fazla görünmeyebilir, ama yeni yasam turleri olusturmaya yetiyor" diyen Kanadalı bilim adamı, kuresel isinma ile daha nice yasam turlerinin ortaya cikabilecegini belirtti.

Okyanus Canlıları Tehlikede

Lawrence Livermore National Laboratory'den Ken Caldeira ve Michael Wickett'in Nature dergisinde yayımladıkları makaleye göre, fosil yakıtların kullanılması daha çok karbon dioksitin havaya karışmasına neden oluyor ve açığa çıkan bu karbon dioksitin çoğu yine okyanuslar tarafından emiliyor. Suya karışan karbon dioksit ise, girdiği reaksiyon sonucu karbonik asite dönüşüyor. Bilim insanları okyanusların geçtiğimiz yüzyılda daha asidik yani asit yoğunluğu yüksek hale geldiklerine inanıyorlar.

Bilgisayar modelleme ile mevsim simulasyonları yapan bilim adamları, asik miktarının bu oranlarla artması durumunda gelecekte tehlikenin varacağı boyutları öngörüyorlar. Hesaplamalara göre okyanusların yakın gelecekte varacağı asit oranı bu gidişle son birkaç yüzyılda görülmemiş düzeylere varacak. Araştırma insanoğlunun atmosfere bu yoğunlukta karbon dioksit bırakması durumunda okyanuslardaki pH oranları 7.9 dan 7.7'ye kadar inebileceğini ortaya koyuyor. Uluslararası İklim Değişikliği Paneli'nin (IPCC) açıklamasına göre pH değerinin 0.1 azalması, denizlerdeki H^+ yoğunluğunun %30 artması anlamına geliyor.

APPENDIX F

Çevre-Toplum İlişkisi

Dünya Isındıkça Yeşerecek

Bugune kadar ortaya konan kuresel isinma haberleri yerini guzel haberlere birakiyor. Küresel ısınmanın bilinen ve farkedilen etkilerinin yanı sıra, dünyada yeni bir eko-denge kuracağını, küresel iklim karışıklığının çevreye endirekt de olsa olumlu etkileri olacağını savunan uzmanlar da var. Bilim adamları küresel ısınmanın gezegeni ısıtarak yağmurları artıracağını ve bunun sonucu olarak da yeryüzünde yeniden bitkilerin yeşereceğini, yeni bir eko-dengenin kurulucağını savunuyorlar. Bu sekilde yeniden ormanlasma ile yeni yasam alanlari olusabilecek, insanlar da bundan her sekilde faydalanma imkanina sahip olabilecek.

Küresel Isinma Açlikla Tehdit Ediyor

Stanford Üniversitesi'nden Robamond Naylor, "Science" dergisinin son sayısında yayınlanan makalede, küresel ısınma ve iklim değişikliği ile ilgili en kötü ihtimali göz önünde bulundurduklarını söyledi.

Küresel ısınmayı göz önüne alarak tarım sisteminin bütünüyle gözden geçirilmesi gerektiğini vurgulayan Naylor, ortaya çıkacak sıcak ve kuraklık şartlarına uyum sağlama yönünde adımlar atılmazsa, geleceğin hiç de parlak olmadığına işaret etti ve özellikle yoksul ülkelerde bugün tarımdan geçinen nüfusun büyük kısmının bu faaliyetin dışına düşeceğini vurguladı

Washington Üniversitesi'nden David Battisti de Naylor ile birlikte kaleme aldığı aynı makalede, sadece sıcaklık artışının bile dünya tarımına olumsuz etkisinin devasa boyutlarda olacağını bildirdi ve öngörülerinde su miktarının azalacak olmasını hesaba bile katmadıklarını kaydetti.

APPENDIX G

Çevre-Teknoloji İlişkisi

Su Şişelerinden Geri Dönüştürülen Telefon

Piyasaya gelecek günlerde çıkması planlanan telefon, karbon ayak izlerini azaltmayı hedefliyor. Plastik kasası geri dönüştürülmüş su şişelerinden elde edilen malzemeyle üretilen Renew'in kendisi de yüzde yüz geri dönüştürülebilir bir ürün, ayrıca Renew dünyanın karbon dengesi nötrleştirilmiş ilk telefonu olma özelliğine de sahip. Motorola, Carbonfund.org ile yaptığı bir anlaşma çerçevesinde, bu telefonun üretim, dağıtım ve kullanılma aşamalarında ortaya çıkacak karbon dioksit miktarını yenilenebilir enerji kaynaklarına ve ağaçlandırma faaliyetlerine yaptığı yatırımlarla dengeleyecek. Telefon, kullanım ömrü üzerinde yapılan kapsamlı değerlendirmelerin ardından Carbonfund.org tarafından verilen Karbonsuz (CarbonFree) Ürün Sertifikasını almaya hak kazandı.

Küresel Isınmada Google'ın Etkisi Az Değil

Harvard Üniversitesi fizikçilerinden olan Alex Wissner-Gross'un hesaplamaları, Google'a iki arama sorgusu gönderildiğinde, Google sunucularının tükettiği enerjinin 14 gram karbondioksit salınımına neden olduğunu ortaya koydu. Elektrikli ısıtıcıda bir fincan çay (yaklaşık 200 ml) ısıtmak için kullanılan enerjinin yarattığı karbondioksit salınımı ise yaklaşık 15 gram. Gartner firmasının bir raporuna göre, küresel bilişim endüstrisi, atmosfere dünyanın tüm havayolları kadar zarar veriyor. Havayolları, toplam karbondioksit emisyonunun yüzde 2'si kadar sera gazına neden oluyor. Wissner-Gross'un hesabına göre basit bir internet sayfasını bile görüntülemek atmosfere saniyede 0.02 gram karbondioksit salıyor.

TEZ FOTOKOPİSİ İZİN FORMU

ENSTİTÜ

Fen Bilimleri Enstitüsü ☐

Sosyal Bilimler Enstitüsü ☒ X

Uygulamalı Matematik Enstitüsü ☐

Enformatik Enstitüsü ☐

Deniz Bilimleri Enstitüsü ☐

YAZARIN

Soyadı : AL
Adı   : SALİHA
Bölümü : İlköğretim Fen ve Matematik Alanları Eğitimi Bölümü

TEZİN ADI (İngilizce) : PRE-SERVICE SCIENCE TEACHERS' PERCEPTIONS OF SOCIOSCIENTIFIC ISSUES: GLOBAL WARMING AS A CASE

TEZİN TÜRÜ : Yüksek Lisans ☒ X   Doktora ☐

1. Tezimin tamamından kaynak gösterilmek şartıyla fotokopi alınabilir. ☐

2. Tezimin içindekiler sayfası, özet, indeks sayfalarından ve/veya bir bölümünden kaynak gösterilmek şartıyla fotokopi alınabilir. ☒ X

3. Tezimden bir bir (1) yıl süreyle fotokopi alınamaz. ☐

TEZİN KÜTÜPHANEYE TESLİM TARİHİ:

116

ÖZET

Bu çalışmada, fen bilgisi öğretmen adaylarının sosyo-bilimsel konulara yönelik görüş ve yaklaşımları incelenmiştir. Sosyo-bilimsel konuların çeşitli açılarından bilim, toplum ve teknoloji yönleri bu çalışmada incelenmek üzere belirlenmiştir. Bu çalışma iki kısımdan oluşmaktadır. İlk kısımda, katılımcıların genel anlamda bilim, teknoloji ve bunların toplumla olan ilişkisine bakılmıştır. İkinci kısımda ise sosyo-bilimsel konular hakkında görüşlerinin, bu konuları yansıtan haberlerin etkisiyle nasıl değiştiğine bakılmıştır.

Bu çalışmaya 18 fen bilgisi öğretmen adayı katılmıştır. Katılımcılar bu çalışmaya gönüllü olarak internet ortamında katılmışlardır. Bu çalışmada öğretmen adaylarının görüş ve yaklaşımlarını öğrenebilmek için yarı-yapılandırılmış mülakat soruları sorulmuş, cevaplar daha sonra analiz edilerek sonuçlara ulaşılmıştır. Çalışmanın ilk kısmında, katılımcıların genel anlamda bilim, teknoloji ve bunların toplumla ilişkisini incelemek için sekiz soru sorulmuştur. Bu sorular Kahyaoğlu (2004)'ten bu çalışmaya uyarlanmıştır. İkinci kısımda ise katılımcıların sosyo-bilimsel konuları yansıtan bilim, toplum ve teknoloji açılarından görüşlerinin bu yönleri yansıtan haberler ile nasıl değiştiğine bakılmıştır. Bu kapsamda, sosyo-bilimsel konulara örnek vaka olarak küresel ısınma konusu belirlenmiştir. Küresel ısınma konusunda yapılan haberlerin katılımcıların görüşlerine etkisini inceleyebilmek için küresel ısınmanın bilim, toplum ve teknoloji yönlerini yansıtan haberler katılımcılar ile paylaşılmıştır. Haberlerin, katılımcıların görüşlerine nasıl bir etkide bulunacağını incelemek için haberler olumlu ve olumsuz ifadeleri içermektedir. Bu şekilde katılımcıların

küresel ısınma konusunun bilim, toplum ve teknoloji yönleri hakkında var olan görüşlerinin olumlu ve olumsuz ifadeler ile etkileşimine bakılması amaçlanmıştır. Görüşlerindeki değişiklikleri inceleyebilmek için katılımcılara, her haberden sonra küresel ısınmanın yansıtılan açısı hakkında dokuz yarı-yapılandırılmış mülakat soruları sorulmuştur. Bu sorular, Steward, Dickerson ve Hotchkiss (2009)'in çalışmasından bu çalışmaya uyarlamıştır. Aynı mülakat soruları bilim, toplum ve teknoloji yönleri için ayrı ayrı adapte edilerek katılımcılara yöneltilmiştir. Cevaplar daha sonra analiz edilerek sonuçlara ulaşılmıştır.

Çalışmanın sonuçları iki kısımda incelenmiştir. İlk kısımda, katılımcıların genel anlamda bilim, teknoloji ve bunların toplumla olan ilişkisini incelenmiştir. Verilen cevaplara bakıldığında, katılımcıların bilim tanımında hemfikir olmadığı görülmüştür. Katılımcılardan çoğu bilimi, doğanın bilinmeyen yüzünün açıklaması olarak tanımlarken, diğerleri insanların ve çevrenin doğası ve bilimsel süreç becerilerini kullanarak yapılan aktiviteler olarak tanımlamıştır. Katılımcılardan bir kısmı bilimi tanımlarken Bilimin Doğası konusunda fikirlerini paylaşmıştır. Cevaplara göre katılımcılar bilimi evrensel, objektif, kesin, deneye dayalı ve gözleme dayalı olarak görmektedir. Bu cevaplara bakıldığında katılımcıların bilim tanımında hemfikir olmasalar da bilim hakkında detaylı bilgiye sahip olduğu anlaşılmaktadır. Ancak katılımcıların açıklamalarından Bilimin Doğası ile ilgili bazı yanılgılara sahip olduğu tespit edilmiştir. Örneğin, Bilimin Doğası'na bakıldığında bilimin kesin olmadığı her yeni bilgi ile değişebildiği ve subjektif olduğu ifade edilmektedir. Bu çalışmada ise katılımcıların bu açılardan yanılgıya sahip olduğu anlaşılmaktadır. Ayrıca katılımcılar, bilim hakkında fikirlerini paylaşırken genel anlamda olumlu yönlerinden bahsettikleri gözlemlenmiştir. Sadece bir katılımcı bilimin olumsuz yönlerine de değinmiştir. Bu cevaplar gösteriyor ki fen bilgisi

118

öğretmen adaylarının bilime karşı görüş ve yaklaşımlarının çoğunlukla olumludur.

Katılımcıların bilimle ilgili derslerin, onların günlük hayatına yaptığı etkiyi öğrenmek için sorulan soruya verdikleri cevaplar da dikkat çekicidir. Katılımcıların hepsi üniersitede aldıkları bilimle ilgili derslerin onların hayatına olumlu katkı sağladığını söylemişlerdir. Ancak, üniversiteden önce aldıkları bilimle ilgili dersler için görüşleri değişkendir. Cevaplara göre katılımcıların yarısı bu derslerin olumlu katkı sağladğını düşünürken, diğerleri olumsuz etkilediğini ya da hiç etkilemediğini söylemişlerdir. Bu olumsuz etkinin ya da derslerin etkisizliğinin sebebi olarak da katılımcılar öğretim yöntemlerinin ya da materyallerin yetersizliğini öne sürmüşlerdir. Cevaplardan anlaşılıyor ki fen bilgisi öğretmen adayları üniversitede aldıkları bilimle ilgili derslerin günlük hayatlarına olumlu anlamda katkı sağladıkları konusunda hemfikir oldukları, ancak diğer seviyelerde aldıkları derslerin yetersizlikler sebebiyle üniversitedeki kadar olumlu katkı sağladığını düşünmektedir.

Bilimle ilgili bir diğer soru da çevre bilimi ile diğer bilimler arasında fark olup olmaması ile ilgili görüşlerini öğrenmek için sorulmuştur. Cevaplara göre katılımcıların yarısı çevre biliminin diğer bilimsel çalışmalardan bir farkının olmadığı yönündedir. Bu katılımcılar tüm bilimsel çalışmaların aynı amaca yönelik olduğunu ve birbirleriyle yakın ilişkili olduğunu düşünmektedir. Diğer katılımcılar ise çevre biliminin diğer bilimlerden farklı olduğunu düşünmüştür. Bu katılımcılara göre çevre bilimine herkes katkı sağlayabilir ama diğer bilimsel çalışmaları gerçekleştirebilmek için bilim uzmanı olmak gerekliliğini söylemişlerdir. Katılımcılara göre diğer farklar ise çevre biliminin diğer tüm bilimleri kapsaması, çevre biliminin değişken özellikte olması, çevre biliminin diğerlerine göre daha kolay anlaşılması ve çevre biliminin tek amacının çevreyi kurtarmak olması yönündedir. Bu cevaplara göre fen bilgisi

öğretmen adaylarının çevre bilimi ve diğer bilim alanları hakkında görüşlerinin aynı doğrultuda olmadığı görülmektedir.

Fen bilgisi öğretmen adaylarının teknolojiye yönelik görüş ve yaklaşımlarını öğrenmek için iki soru sorulmuştur. Tanım olarak teknoloji sorulduğunda katılımcıların teknolojiyi bilimin uygulaması olarak tanımlamakta hemfikir olduğu görülmüştür. Teknolojiyi tanımlarlarken teknolojinin kullanım alanları hakkında görüşlerini de paylaşmışlardır. Katılımcıların çoğu teknolojinin olumlu anlamda kullanıldığını gösteren örnekler vermişlerdir. Cevaplara göre teknoloji, hayatı kolaylaştırır, bilimi geliştirmeyi sağlar, eğitimde ve sağlık alanında kullanılır. Katılımcıların küçük bir kısmı teknolojinin kötü kullanım alanlarına örnek vermiştir. Cevaplara göre teknoloji silah olarak, haksız kazanç olarak ve insanları tembelliğe sevk etmesi yönünden olumsuzluklara sebep olur. Ayrıca katılımcılardan bazıları, teknolojiyi tanımlarken teknolojinin sebep olduğu sıkıntılar hakkında da yorum yapmışlardır. Cevaplara göre teknoloji çevre kirliliğine, sağlık problemlerine, geleceğe endişe vermesi anlamında, etik anlamda, kalıtıma etki anlamında ve yenilenemez enerji kaynaklarına etkisi anlamında sıkıntı oluşturabilir. Bu cevaplara bakıldığı zaman fen bilgisi öğretmen adaylarının genel anlamda teknolojiye karşı olumlu görüşlerinin olduğu ama bazı katılımcıların teknolojiden kaynaklanabilecek bazı sıkıntılardan dolayı endişe taşıdığı anlaşılmaktadır.

Teknoloji ile ilgili bir diğer soru da teknolojik gelişmelere kimin karar verdiği ile ilgiliydi. Verilen cevaplara göre katılımcıların neredeyse yarısı ekonomik sebeplerden dolayı devlet yönetiminin karar mekanizması olduğunda hemfikir olduğu ortaya çıkmıştır. Diğer katılımcılar insanların gereksinimlerinden dolayı toplumun ya da ekonomik güçlerinden dolayı büyük firmaların karar mekanizması olduğunu öne sürmüştür. İlginç bir sonuç olarak sadece iki katılımcı bilim adamlarının teknolojik gelişmelere karar verme hakkına sahip olduğunu düşünmektedir. Cevaplar gösteriyor ki

fen bilgisi öğretmen adayları teknolojik gelişmelerde ekonomik gücün önemli olduğunu düşünmektedir. Bu gücün de devlete ait olduğuna inanmaktadırlar.

Fen bilgisi öğretmen adaylarının bilim-toplum-teknoloji ilişkisine yönelik görüş ve yaklaşımlarını öğrenmek için bilimin toplumla ve toplumun teknolojiyle ikili ilişkilerine yönelik sorular sorulmuştur. Bunun için ilk olarak toplumun bilim üzerinde etkisi katılımcılara sorulmuştur. Verilen cevaplara bakılacak olursa katılımcıların çoğu toplumun bilim üzerinde olumsuz bir etkisi olduğuna inanmaktadır. Buna sebep olarak da toplumun katı gelenek ve kurallarını ifade etmişlerdir. Bunun tersine katılımcılara göre toplumun teknolojiye etkisi olumlu anlamda görülmektedir. Katılımcılar toplumun ihtiyaçlarının teknolojiye olumlu etkilediğini düşünmektedir. Diğer yandan katılımcıların çoğu bilimin toplumun problemlerini çözdüğünden dolayı olumlu yönde etkilediğini düşünmektedirler. Aynı şekilde teknolojinin de toplumu konforlu bir yaşam sağladığından dolayı olumlu yönde etkilediğini düşünmektedirler. Bu cevaplara bakıldığı zaman fen bilgisi öğretmen adaylarının bilim-toplum-teknoloji ilişkisine yönelik görüşlerinin benzerlik taşıdığı görülmektedir. Toplumun bilimi olumsuz yönde etkilediğini buna karşılık teknolojiyi olumlu etkilediğini, aynı zamanda bilimin ve teknolojinin toplumu olumlu yönde etkilediğini düşünmektedirler.

Çalışmanın ikinci kısmında fen bilgisi öğretmen adaylarının sosyo-bilimsel konulara yönelik görüşlerinin konu ile ilgili haberlerin etkisiyle nasıl değiştiğini gözlemlemek için küresel ısınma konusu örnek konu olarak seçilmiş, bu konunun bilim, toplum ve teknolojik yönlerini yansıtan haberler sırası ile katılımcılarla paylaşılmıştır. İlk kısımda katılımcılar ile küresel ısınmanın bilimsel yönünün konu yapıldığı, içinde olumlu ve olumsuz iki kısımdan oluşmuş haber katılımcılar ile paylaşılmış, ardından onların görüşlerini öğrenmek için mülakat soruları sorulmuştur. Verilen

121

cevaplara bakıldığı zaman katılımcıların pekçoğunun küresel ısınmanın bilimsel yönü ile ilgili olumlu ifadelerin yer aldığı haberle ilk kez karşılaştığı, olumsuz ifadelerin yer aldığı haberle ise aşina oldukları görülmüştür. Katılımcıların çoğu bu habelerlerin en önemli noktasının küresel ısınmanın doğal dengeye olan zararları olarak değerlendirmişlerdir. Diğerleri ise haberlerdeki insanların davranışlarının önemli olduğunu, haberlerin onlar için yeni olduğundan dolayı önemli olduğunu ve haberlerdeki bilimsel çalışmalara ait ifadelerin önemli olduğunu söylemişlerdir.

Katılımcıların haberleri okuduktan sonra geleceğe yönelik hislerinin nasıl olduğunu sorduğumuzda neredeyse tüm katılımcılar geleceğe yönelik karamsar hisler içerisinde olduklarını söylemişlerdir. Buna sebep olarak da insanların davranışlarının doğal dengeye olan zararını öne sürmüşlerdir. Haberlerin katılımcıların görüşlerini değiştirip değiştirmediği sorulduğunda ise katılımcıların çoğunun haberleri daha önce bildiğini bu yüzden haberlerin onların görüşlerini desteklediğini söylemişlerdir. Diğerleri ise yeni bilgiler öğrenmelerine karşılık küresel ısınmanın bilimsel yönü ile ilgili görüşlerini değiştirmedikleri gözlemlenmiştir. Diğer yandan katılımcıların bu haberleri başkaları ile konuşurken nasıl kullanacaklarına yönelik soruya katılımcıların çoğu kendi görüşlerini desteklemek amaçlı kullanacaklarını söylemişlerdir. Katılımcıların küresel ısınmanın bilimsel yönü ile ilgili görüşlerini değiştirmek için ihityaç duydukları eksiklikler sorulduğunda, katılımcıların yarısına yakını hiçbir eklemenin sahip oldukları görüşleri değiştiremeyeceğini söylemişlerdir. Diğerleri ise haberlerde daha çok olumlu ifade ile görüşlerinin değişebileceğini söylemişlerdir. Bu cevaplara bakılacak olursa fen bilgisi öğretmen adaylarının küresel ısınmanın bilimsel boyutu ile ilgili olarak sağlam görüşlere sahip oldukları, yeni bilgilerle karşılaşmalarına rağmen görüşlerinin bunlardan etkilenmedikleri gözlemlenmiştir.

122

Katılımcıların çoğunun küresel ısınmanın bilimsel yönü ile ilgili haberlerde bilimin yer alış şekline bakarak bilimi, bilimsel süreç becerileninin kullanıldığı aktiviteler olarak değerlendirmişlerdir. Diğerleri ise bilimin doğasından yola çıkarak bilimi değişken, subjektif ve sorgulamaya dayalı olduğunu ifade etmişlerdir. Bu cevaplara bakılacak olursa, katılımcıların çalışmanın ilk kısmında bilimin tanımı için benzer tanımlarda bulundukları sadece bilimin doğasına yönelik görüşlerinde farklılık olduğu ortaya çıkmıştır. Son olarak bilimin çevre ile ilişkisi sorulduğunda katılımcıların çoğu arada hem pozitif hem negatif ilişki olduğunu söylemişlerdir. Bu noktada bilim hem çevreye zarar vermektedir aynı zamanda bilim çevrenin problemlerine çözümler sağlamaktadır.

Fen bilgisinin küresel ısınmanın toplumsal yönü ile ilgili görüşlerinin haberlerin etkisi ile nasıl değiştiğini gözlemlemek için, olumlu ve olumsuz ifadelerin yer aldığı toplumsal haberler katılımcılar ile paylaşılmıştır. Bu kısımda da katılımcıların çoğu olumlu ifadelerin yer aldığı haberi ilk kez okuduğunu ifade ederken, katılımcıların tamamı olumsuz haberle daha önce karşılaştığını söylemişlerdir. Katılımcıların çoğu bu haberlerde, tarıma ve susuzluğa sebep olmasından dolayı küresel ısınmanın önemli olduğunu düşünmektedirler. Diğerleri ise insanların zararlarının bu haberlerin önemli noktası olduğunu ifade etmişlerdir.

Küresel ısınmanın toplumsal boyutunu yansıtan haberlerden sonra geleceğe yönelik hisleri sorulduğunda katılımcıların çoğu karamsar hisler içerisinde olduklarını söylemişlerdir. Buna sebep olarak da küresel ısınmanın zararlarını öne sürmüşlerdir. Bu haberlerin görüşlerine etkisi sorulduğunda ise katılımcıların neredeyse yarısı haberler ile benzer düşüncelere sahip olduklarını bu sebeple bu haberlerin sahip oldukları görüşleri desteklediklerini söylemişlerdir. Diğer katılımcılar ise yeni bilgiler okumalarına rağmen bu haberlerin görüşlerini değiştirmediğini söylemişlerdir. Bu haberleri başkaları ile paylaşma noktasında ise haberler

ile benzer görüşe sahip olanlar da olmayanlar da sahip oldukları görüşleri desteklemek ve başkalarının görüşlerini kendi düşünceleri ile değiştirmek için kullanacaklarını söylemişlerdir. Katılımcıların yarıya yakını hiçbir eklentinin kendi görüşlerini değiştiremeyeceğini öne sürerken, diğerleri daha çok bilimsel açıklamalar ya da ikna edici ifadeler ile görüşlerinin etkilenebileceğini söylemişlerdir. Bu cevaplara bakılacak olursa fen bilgisi öğretmen adaylarının küresel ısınmanın toplumsal yönü ile ilgili güçlü görüşlere sahip oldukları ve bu görüşleri yeni edindikleri bilgilerin etkisiyle değiştirmedikleri gözlemlenmiştir.

Bu haberlerde yer alan toplumsal boyutla ilgili olarak katılımcıların çoğunun insanların küresel ısınmaya sebep oldukları aynı zamanda onun zararlarından yine kendilerinin etkilendiklerini düşündükleri görülmüştür. Aynı zamanda küresel ısınmanın toplum üzerinde direk etkiye sahip olduğunu da eklemişlerdir. Toplumun çevre ile ilgili ilişkisine ise katılımcıların çoğu arada hem pozitif hem de negatif ilişki olduğunu söylemişlerdir. Aradaki ilişkinin toplumun davranışlarına ve insanların eğitim seviyelerine bağlı olduğunu söylemişlerdir.

Küresel ısınmanın teknolojik boyutu ile ilgili olarak da diğerlerinde olduğu gibi olumlu ve olumsuz ifadelerdein yer aldığı haberler katılımcılar ile paylaşılmış ardından mülakat soruları sorulmuştur. Bu kısımda katılımcıların çoğunun olumlu ve olumsuz haberleri ilk kez okudukları gözlemlenmiştir. Bu haberlerde önemli kısımların neler olduğu sorulduğunda ise insanların davranışlarının, üretilecek çevre dostu ürünlerin, internet kullanımının zararlarının önemli noktalar olduğunu söylemişlerdir.

Katılımcıların küresel ısınmanın teknolojik boyutu ile ilgili olarak geleceğe yönelik hisleri sorulduğunda ise eşit miktarda katılımcının olumlu ve olumsuz hislere sahip oldukları gözlemlenmiştir. Olumlu hislere sahip olan katılımcılar buna sebep olarak da insanların isterlerse doğayı

124

koruyacak işler yapabileceklerini bu haberler sayesinde gördüklerini, olumsuz hislere sahip olanların ise teknolojinin her zaman çevreye zarar verdiğini söylemişlerdir. Katılımcıların görüşlerindeki değişiklikler sorulduğunda ise haberleri önceden bilen katılımcılar bu haberlerin görüşlerini desteklediklerini ifade ederlerken, diğerleri bu haberlerin görüşlerini değiştirdiğini söylemişlerdir. Başkaları ile bu konuda konuşurlarken haberleri ile aynı görüşlere sahip olanlar fikirlerini desteklemek için kullanacağını ifade ederken diğerleri yeni olan bilgileri başkalarını bilgilendirmek ve diğerlerinin de fikirlerini değiştirmek için kullanacaklarını ifade etmişlerdir. Görüşlerini değiştirmek için gerekli olan kısımlar katılımcılara sorulduğunda ise katılımcıların az bir kısmı hiçbir şeyin görüşlerini değiştirmeyeceğini ifade ederken bir kısım katılımcı ikna edici açıklamalar ile görüşlerinin değişeceğini söylemişlerdir. Diğerleri ise zaten görüşlerinin değiştiğini, daha fazla eklentiye ihtiyaç duymadıklarını söylemişlerdir.

Bu haberlerde küresel ısınmanın teknolojik boyutu ile ilgili olarak teknolojinin çevreye hem olumlu hem olumsuz etkisi olduğunu düşünmektedirler. Bu etkinin teknolojinin kullanım amacına ve teknolojiyi kimin kullandığına göre değişeceğini öne sürmüşlerdir. Son olarak katılımcılara teknolojinin çevre ile ilişkisi sorulmuş bu kısımda bir önceki soruyla benzer cevaplar alınmıştır. Cevaplara göre teknolojiyi kullanım amacına göre aralarındaki ilişki değişmektedir. Aynı zamanda teknoloji hem doğaya zarar vermekte hem de onu kurtarmak için gerekli adımları atmaktadır.

Çalışmanın ikinci kısmında verilen cevaplar gösteriyor ki fen bilgisi öğretmen adaylarının sosyo-bilimsel konulara yönelik bilimsel ve toplumsal görüşleri birbiri ile benzerlik göstermektedir. Katılımcılara hem pozitif hem de negatif açılara ait haberler paylaşılmasına rağmen katımcıların büyük çoğunluğunun küresel ısınmanın hem bilimsel hem de toplumsal açılardan

hazırlanmış haberlerin olumsuz kısmına aşina oldukları, olumlu açıdan haberlerle ise yeni karşılaştıkları görülmüştür. Bu haberleri okuyan katılımcıların ilginç olarak olumlu kısmından etkilenmedikleri, aksine haberlerin olumsuz kısımlarını sahip oldukları görüşlerle bağlantı kurarak değerlendirdikleri gözlemlenmiştir. Bu bağlamda katılımcıların olumsuz kısmını kendi görüşlerinin ispatı olarak değerlendirmişlerdir. Bu anlamda bilimsel ve toplumsal haberlerin fen bilgisi öğretmen adaylarının görüşlerini destekleme yönünden etkilediği gözlemlenmiştir. Bunların tersine sosyo-bilimsel konuların teknolojik yönü ile ilgili olarak fen bilgisi öğretmen adaylarının olumlu ve olumsuz haberleri yeni okudukları gözlemlenmiştir. Bu anlamda diğerlerinden farklı olarak teknolojik boyuta ait görüşlerinin hem olumlu hem olumsuz haberlerden etkilendiği gözlemlenmiştir. Bu anlamda katılımcılardan haberlerle daha önceden benzer görüşlere sahip olduğunu iddia eden katılımcıların görüşlerinin bu haberler ile destenme yönünden etkilendiğinin, diğerlerinin ise bu haberlerin etkisi ile görüşelerinin değiştiği gözlemlenmiştir. Bu anlamda görülüyor ki sosyo-bilimsel konular hakkında bilimsel, toplumsal ve teknolojik açılardan hazırlanmış haberlerin fen bilgisi öğretmen adaylarının görüşlerini etkilediği, bilimsel ve toplumsal açıdan sahip oldukları görüşleri desteklerken teknolojik anlamda görüşlerini değiştirme etkisine sahip olduğu görülmüştür.

Fen bilgisi öğretmen adaylarının bilimsel ve toplumsal açılardan haberlerden benzer, teknolojik açıdan ise farklı etkilenmesine sebep olarak katılımcıların sahip oldukları alt yapı olduğu tahmin edilmektedir. Buna örnek olarak bu çalışmanın ilk kısmında katılımcılara bilim ve teknolojinin tanımları sorulduğu zaman katılımcıların sahip oldukları alt yapı gözler önüne serilmektedir. Verilen cevaplara göre katılımcıların bilimin tanımı ile birlikte bilimin doğası, bilimsel süreç becerileri, bilimin ilgili olduğu alanlara kadar detaylı açıklamalar yaptıkları görülmüştür. Bunların tersine

126

teknolojinin tanımı sorulduğunda cevaplarının teknolojinin amacı ve teknolojinin kısıtlamaları olarak sınırlandığı, teknoloji konusunda detaylı ilgiye sahip olmadıkları gözlemlenmiştir. Bu anlamda bilim ve toplum anlamında güçlü alt yapılarının olmasının, görüşlerinin tersi yönde haberler ile karşılaştıklarında görüşlerini değişmeme sebebi olduğu düşünülmektedir. Aynı bağlamda, katılımcıların teknoloji konusunda zayıf alt yapıları sebebi ile görüşlerinin aksi haberlerden etkilendilendiği ve değiştiği tahmin edilmektedir.

Benzer şekilde katılımcıların alt yapılarında yer alan düşüncelerinden dolayı haberleri yorumlama noktasında farklılıklar gözlemlenmiş olabilir. Örneğin, bilimsel ve toplumsal haberler katılımcılar ile paylaşıldığında, katılımcıların çoğu olumsuz yönde ifade edilen haberlere aşina olduklarını söylemişlerdir. Haberleri yorumlamalarına bakıldığında ise katılımcıların çoğunun olumlu ifadelerin yer aldığı haberleri değil olumsuz haberleri baz alarak yorum yaptıkları gözlemlenmiştir. Aynı şekilde, haberlerin katılımcıların düşünceleri üzerine etkisi onların düşüncelerini destekleme yönlü olmuştur. Teknolojik haberlerde ise katılımcılar hem olumlu hem olumsuz ifadelerin yer aldığı haberleri ilk kez okuduklarını söylemişler, haberleri yorumlarken hem olumlu hem olumsuz anlamda görüşlerini paylaşmışlardır. Bu fark da gösteriyor ki katılımcıların alt yapılarında sahip oldukları görüşler onların haberleri yorumlamalarında da etkisini sürdürmüştür.

Bu çalışmada ortaya çıkan bir diğer önemli sonuç ise öğretmen adaylarının haberleri kullanım amaçlarıdır. Katılımcıların verdikleri cevaplara bakılacak olursa bilimsel ve toplumsal haberlerden sonra katılımcıların görüşleri değişmek yerine var olan görüşleri desteklenmiştir. Aynı şekilde öğretmen adayları bu haberleri başkaları ile konu hakkında konuşurken kendi görüşlerini desteklemek amacı için kullanacaklarını söylemişlerdir. Teknolojik haberden sonra ise katılımcıların görüşleri

değişmiş, katılımcılar bu haberleri de başkalarının görüşlerini değiştirmek amacı için kullanacaklarını söylemişlerdir. Bu verilen cevaplar gösteriyor ki fen bilgisi öğretmen adayları haber materyallerini kendi sahip oldukları görüşler doğrultusunda kullanmayı tercih ediyorlar. Bu önemli sonuç özellikle fen bilgisi dersleri içerisinde sosyo-bilimsel konular hakkında öğretmenlerin sahip oldukları görüşlerin ders dizaynında ne kadar etkili olduğunu göstermektedir. Özellikle sosyo-bilimsel konular kendi doğaları gereği açık uçlu, kesin cevabı olmayan ve tartışmaya açık konular olması itibariyle derslerde öğrencilerin bu konular hakkında bağımsız fikir sahibi olabilme şansının öğretmen görüşleriyle bağlantısı gözler önüne serilmektedir. Öğretmenler bu konudaki görüşlerinin etkisiyle öğrencilere konuları sunabilecekleri materyalleri seçmekte, bu şekilde öğrenciler de yanlı olarak dizayn edilmiş sosyo-bilimsel ders dizaynlarından etkilenerek kendi görüşlerini şekillendirmektedirler.

Bu çalışmada fen bilgisi öğretmen adaylarının kendi görüşlerinin etkisiyle sosyo-bilimsel ders dizaynı yapma eğilimleri gözler önüne serilmektedir. Aynı şekilde sosyo-bilimsel konuları yorumlarlarken kendi sahip oldukları olumlu ya da olumsuz görüşlerin etkisiyle kendi görüşlerini yansıttıkları, materyal seçiminde de yine kendi görüşlerini destekleme amacı ile haber materyallerini kullanma tercihleri anlaşılmaktadır. Bu sonuçlar ile sosyo-bilimsel konuların öğrencilere aktarılmasında öğretmenlerin etkisi açıkça görülmektedir.

Fen bilgisi öğretmen adayları geleceğin fen bilgisi öğretmenleri olarak ders içi kazanımları elde etme noktasında önemli bir yere sahiptirler. Bu çalışmada da görüldüğü gibi sosyo-bilimsel konular hakkında kendi sahip oldukları görüşlerin onların bu konuları öğrencilere aktarırken kullandıkları iletişim yöntemlerine etkilerinin farkında olmaları sosyo-bilimsel konuların yansız bir şekilde öğrencilere aktarılması noktasında önemlidir. Bunun için fen bilgisi öğretmen adayları, kendi görüşlerinin bu

konular üzerinde etkisinin kontrolünü yapabilmeleri gerekmektedir. Aynı şekilde, fen bilgisi öğretmenleri de bu konuları öğrencilere aktarırken kendi sahip oldukları görüşlerden etkilenmekte olabilirler. Bunun için bu çalışmanın sonrasında fen bilgisi öğretmenlerinin sosyo-bilimsel konular üzerinde görüşlerinin benzer şekilde değerlendirilmesi ve eğer bir etki ortaya çıkmışsa bunun en aza indirilmesi için gayret sarfetmeleri gerekmektedir.

Benzer şekilde, fen bilgisi öğretmenlerinin yetiştirilmesinde sorumlu olan öğretim elemanlarının da bu etkinin farkında olmaları ve eğer mümkünse öğretmen adaylarının kendi görüşlerinin farketmelerini sağlayacak ya da görüşlerini kontrol etmeyi sağlayacak ders dizaynları yapmaları gerekmektedir. Bu şekilde eğitim görmekte olan ya da eğitim görecek öğretmen adayları sosyo-bilimsel konular ile ilgili kendi görüşlerinin farkında olarak yetiştirilmiş ve bu görüşlerin öğrencilere yansıtılmaması gereğinin farkında olarak hizmete başlaması gerçekleştirilebilir.

Daha sonraki çalışmalar için bu çalışmanın benzeri başka sosyo-bilimsel konu seçilerek de uygulanabilir. Bu şekilde, fen bilgisi öğretmen adaylarının daha tarafsız yaklaşacakları konular üzerinde de haberlerin etkisi üzerinde yorum yapılmış olacaktır çünkü küresel ısınma konusu gereği itibariyle olumsuz bir çerçeve çizmekte ve yanlı bir şekilde çalışmaya başlanmış olabilmektedir. Daha yansız yaklaşabilecekleri bir sosyo-bilimsel konu, öğretmen adaylarının görüşlerindeki değişimi gözlemlemek için yansız bir bakış açısı sağlayabilecektir.