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A Qualitative Study to Explain Middle School Student's Understandings of Nature of Science

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ABSTRACT

This study was conducted with the aim to explain 7th grade middle school students' nature of science understandings by employing qualitative measuring tools of an interview and a questionnaire. In this context, the participants were 17 7th grade students. In order to explain the participants' nature of science understandings, first a nature of science questionnaire to explain their nature of science was conducted. Following, in depth interviews were conducted with the students. The four facets of the students' nature of science understandings were categorized using three dimensions: informed-transitional-naïve and by constantly comparing the data. The results gathered by the aforementioned analysis indicated that most students' nature of science understandings were weak or varying (78%) and only 22% of the students had adequate understandings. In this respect, it is suggested that the direct-reflective methods should be used instead of indirect ones for students to understand the real nature of science.

Keywords: Science; Nature of Science; Turkish Middle School Students.

INTRODUCTION

One of the main purposes of science education is to educate scientifically literate individuals. Scientifically literate individuals are individuals who are informed about the nature of scientific knowledge and who can effectively use the concepts, principles, theories and laws of science, in other words individuals who are aware of nature of science. In this regard, having adequate views about nature and attributes of science is being considered as one of the important steps towards being scientifically literate (Abd-El-Khalick & Lederman, 2000; Murcia & Schibeci, 1999; Tsai, 1999; Rubba, Homer & Smirt, 1996; McComas, 1996; Ryan & Aikenhead, 1992).

Numerous definitions of nature of science exist. Nature of science has been defined as a way of knowledge acquisition or rigid beliefs and values during knowledge development (Lederman, 1992). In another definition it is explained as what science is and what roles it contains, who the scientists are and what roles do they entail, scientific clues, observations, phenomenon, rules, laws and scientific methods, and understanding how science is executed (Taşar, 2003).

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Getting to understand nature of science is a way of getting to know science. The nature of scientific knowledge and the beliefs about how this knowledge is produced and evaluated affect the ways how students' try to learn science (Hammer, 1994; Hogan, 1999; Roth & Roychoudhury, 2003; Songer & Linn, 1991). Students' views about the nature and the strategies of learning science are developed through their schooling (Sandoval & Morrison, 2003). Therefore, the ways knowledge is presented to students through their schooling affect how they understand and build a relationship with it. If science is presented to students simply as proven facts or holistic truths, correspondingly, students start to memorize these facts and to think that all knowledge is proven though the use of scientific method. On the other hand, if students experience science as an on-going process of conceptual development, an interpretive attempt to decide what meaning the data carries and these meanings as a discourse process between individuals, it can be possible for them to focus more on the concepts and their change.

It is deemed useful to teach nature of science to students in every learning level to some extend as below mentioned angles. In this regard, learning nature of science;

- Can help people to understand science, scientific products and the daily methods of it.
- Can help people to involve in discussions on the problems about science and scientific decision making processes
- Understanding the nature of science can make people to value scientific enterprise which is one of the most effective scientific products of scientific culture and getting to know societal norms.
- Learning nature of science can help to learn science subjects more effectively.

In the literature, existing are many studies that investigate students', teachers', and preservice teachers' understandings of nature of science and that analyze the conceptual changes as a result of different instructional applications (Bell & Matkins, 2003; Brickhouse, Dagher, Letts & Shipman, 2000; Clough, 2003; Clough & Olson, 2001, Demirdöğen et al., 2015; Peters, 2012; Wahbeh, Abd-El-Khalick, 2014). When these studies were analyzed using content analysis it is found that questionnaire type measurement tools were used not to describe but to classify the nature of science understandings of individuals with different learning levels.

Before beginning to treat the students' nature of science understandings, first thing to do is to successfully reveal the identification process of this understanding. Therefore, it is believed that students' nature of science understandings can be better explained by qualitative measurement tools instead of quantitative ones which can be more appropriate to nature of social sciences. This study is planned regarding the reasons discussed up until here.

Nature of Science and Science Teaching

There has been an intense discussion about the elements of nature of science which receives many citations in science education and teaching studies and science education documents that have been received attention from international community. The first chapter of Benchmarks for Scientific Literacy Benchmarks (BFSL) (AAAS, 1993) and the sixth National Science Education Standards (NSES) (NRC, 1996) includes important explanations about what does nature of science mean, why it is important and how it can be taught. Subjects of the literature, especially studies after 1960s, focus on nature of science and scientific research. The results of these studies assert that there is a direct relationship between a person's values and assumptions about acquiring scientific knowledge and their beliefs about the nature of science.

Although there is no consensus about the definition of the nature of science, US education reform documents and prior science education research indicate that the following elements of nature of science can be easily accessed by K-12 science students and are important (Lederman, 1999, p.917):

- Scientific knowledge is tentative (subject to change)
- Scientific knowledge is empirically based (based on and /or derived from observations of the natural world)
- Scientific knowledge is subjective (theory laden)
- Scientific knowledge necessarily involves human inference, imagination, and creativity
- Scientific knowledge necessarily involves a combination of observations and inferences
- Scientific knowledge is socially and culturally embedded.

Another element that is added to these, not being touched upon in the reform documents but is closely related to understanding of observations and inferences, is the functions of scientific theories and laws and relationship between them.

BFSL (AAAS, 1993) and NSES (NRC, 1996) receive more citation when we look at the studies that investigates which above mentioned elements of nature of science are more suitable for middle school students. These documents include the expected elements that are stressed and expected from 6-8 and 5-8 grade students' to gain understanding about the nature of science.

According to BFSL report, teachers and students do not know the real nature of science. In this document, how ideas and concepts about the physical world is changed and developed as well as the role of observation, thinking, experiment, and evidence are comprehensively explained. This process is being accepted as the main element of the science and state how scientific knowledge differs from other knowledge types.

Researchers that prepare the BFSL report, assert that although the fundamental structure of the nature of science is established, the boundaries of it expands in time and grows when it is justified. In other words, natural laws, which are considered logical, exist everywhere in the physical world. Although the belief that the knowledge is considered to be produced by investigating the part of the world, there is a consensus that the only true piece is the time. For instance, it was known that the light particles traveled in the light speed, two physicists found that some "star materials" or cosmic materials travel in different speeds (Govett, 2001). This theory directly contradicts Einstein's theory. Hence, more effort should be spend on the fundamental elements of nature of science-the necessity of the questioning of science; tentativeness of scientific knowledge and the necessity of open-minded reactions to the science.

BFSL advocates the integration of mathematics and technology for the success of scientific enterprise. Although these initiatives have their own features and histories, each one is related to the other and reinforces the other. Many researchers agrees on the idea the scientific work is a mental and a social enterprise. In other words, science is an application of human intelligence towards explaining how world works. It is asserted that when how scientists work, how they reach scientific results and the limitation of these results are known; people would react to scientific claims more logically and would gain better knowledge about the real nature of science (Govett, 2001).

Another dimension of the nature of science is the scientific literacy. In BFSL document, there is a chapter not only on the important advancement in science but also a chapter that includes a historical perspective about the development of science and technology as an accumulation of knowledge throughout years. Science teaching would not be effective if it is taught as simple invention of laws, concepts and theories about knowledge accumulation about the knowledge accumulation about science. In case of behaving this way, it is not possible for science teaching to contribute to students' learning about the relationship between science and technological development.

Teaching nature of science has been considered as an important learning goal for students in every level and mostly towards science lessons. Statements about the nature of science teaching have been included in the Turkish science teaching programs. One of the general goals of the programs are "to establish [students'] understanding of the nature of science and technology, the interplay between science, technology, and society". However, there is no resource that has been provided to teachers and that include concrete examples, whose effectiveness are known and exist in the national literature. In this regard, it could be assumed that the students who participate in the science and technology curriculum activities that include inquiry-based learning activities and encourages students to construct their own knowledge would learn nature of science as a by-product.

When the literature is examined, inquiry-based learning programs, that have a significant place in students' academic achievement and performance, are not effective for students to adequately learn about nature of science (Jungwirth, 1970; McComas, 1996; Moss, Abrams & Robb, 1998; Moss, Abrams & Kull, 1998; Abd-El-Khalick & Lederman, 2000). In this regard, the current study can also reveal how much do the science teaching programs based on constructivist and inquiry based approach; can shape the students' nature of science understandings.

This study was conducted with the aim to explain 7th grade middle school students' understandings of the nature of science by employing qualitative measuring tools of an interview and a questionnaire.

METHODOLOGY

In this study, as the students' nature of science understandings are analyzed qualitatively, the research can be accepted as a qualitative study. Moreover, because the study focuses on the meanings that the participants, who are students, attribute to the different elements of the nature of science, the study is an interpretive one in nature (LeCompte & Preissle, 1993). It is accepted that actions and phenomenon can only be explained by interpretive research, which is one of the qualitative research approaches (McNabb, 2002).

In this approach researchers make interpretations about a phenomenon, by assigning meaning to social events or actions. The reason for choosing this type of research approach is that it enables us to understand people's actions when they execute them in social conditions and circumstances. If a research is built on the assumption that the meaning people attribute to social events is learned directly; it is assumed to be an interpretive research (McNabb, 2002). Therefore, the interpretive research is always context-laden. The reasons for considering the current study as interpretive research are that the researchers focus on the meanings that the students attribute to the elements of nature of science when they examine the concepts of nature of science and the researchers try to reveal these using different research methods. When examining sixth grade students' nature of science concepts Khishfe ve Abd-El-Khalick (2002) indicated the reason that they chose to use interpretive research as "the present study is interpretive in nature and focused on the meanings and participants ascribed to the emphasized aspects of nature of science" (p. 557) . The purpose of this research approach is to produce many explanations and interpretations about human experience.

a) The Study Group

The study group of this research is composed of 17 seventh grade students attending to a middle school 5 km away from Artvin city center. This school is also an educational institution that has students who commute to school as a result of transportation-education implementation. The average age for the students who are in the sample and are examined in this research is 13. 11 of them are female and 6 of them are male. When the prior studies about nature of science are examined, it is found that the students' nature of science understandings is greatly depended on science content and science and academic achievement factors in addition to cognitive and social variables such as logical thinking, qualitative and verbal understanding levels, and gender (Scharmann, 1988a, 1988b). Based on these results, interviews conducted with the teacher, who is the councilor teacher and the science and technology teacher of the class, revealed that the classroom that the study group chosen included students with different science achievement levels, social and personal characteristics, academic achievement and verbal skills.

The characteristics of the students in the study group were reported in Table 1.

Table 1. *The characteristics of the students in the study group*

Pseudonym	Science Achievement	Gender	Age	Socioeconomic Status	Place where the student lives
M1	High	Male	13	High	City center
M2	High	Male	13	High	City center
M3	Medium	Male	13	Medium	Village
M4	Medium	Male	14	Medium	Village
M5	Low	Male	13	Medium	Village
M6	Low	Male	13	Low	Village
F1	High	Female	12	Medium	Village
F2	High	Female	13	High	City center
F3	Medium	Female	15	Medium	City center
F4	Medium	Female	12	Medium	Village
F5	Low	Female	13	Low	Village
F6	Low	Female	12	Medium	Village
F7	Low	Female	12	Medium	Village
F8	Low	Female	13	Low	Village
F9	Low	Female	14	Low	Village
F10	Low	Female	15	Medium	Village
F11	Low	Female	14	Low	Village

M: Male; F: Female

In Table 1, regarding the students' socioeconomic statues an evaluation was done as high, medium and low. In this process, if one of the parents of the student's do not work or the family did not have a constant occupation or income, social status were decided as low; if at least one parent was working and monthly income could be considered as normal the social status were decided as medium; and if the monthly income could be considered as above normal, the social status were decided as high. In this regard, only three of the students were in high socioeconomic status, and the others were considered as low or medium socioeconomic status. From these students, K10 and K11 were not wanted to be sent to school by their parents for couple of reasons.

b) Data Collection Tools

Data was collected using a questionnaire –Nature of Science Student Questionnaire- that included open-ended questions aim to measure the concepts that the students have about the nature of science. After this questionnaire was employed, in-depth semi-structured interviews, which lasted for about 30-45minutes, were conducted to study the questions included in the questionnaires but wanted to be explained more and especially to meet validity and the reliability. During these interviews, a copy of the written questionnaires filled out by the student given and additional questions were asked to students for them to give more detailed answers to their written answer.

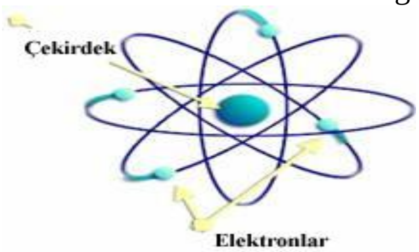
The questionnaire that is used to reveal the students' nature of science understanding and had six questions in total was gathered from the literature and used by adapting it to Turkish (Khishfe & Abd-El-Khalick, 2002). For this purpose, the readability of the questionnaire was checked by a linguist. Then, a pilot study was conducted in another 7th grade classroom of a school where the actual study was conducted and comprehensibility of the questions was tested. In this process, some of the sentence structures were adjusted. For instance, during the pilot studies the fourth question in the questionnaire asked students "how do scientists be certain about the way dinosaurs look?" 95% of the students answered the question by indicating that the scientists should be certain about the ways dinosaurs look. The purpose of asking this question was to reveal whether the students understand the tentative, creative and experimental nature of science. Therefore, this question item was changed as "do you think that scientists are certain about the way dinosaurs look? What makes scientists to be certain about the way dinosaurs look?" In this way the questionnaire's final version were developed and it is administered to the students by the teachers that the study was conducted with, in 40 minutes.

The questions in the questionnaires and the reasons for asking each question explained above.

1. Scientists produce scientific knowledge, some of this knowledge is found in your science textbooks.
   (a) Do you think this knowledge may change in the future?
   (b) If your answer is ''yes,'' explain why. If your answer is ''no,'' explain why. Give an example.

With this question, it is aimed to identify students' understanding about the tentative nature of scientific knowledge

2. The diagram below is taken from your science textbook. The diagram shows the atom as having a nucleus in the center with electrons moving around it.



Do you think scientists are certain about the structure of the atom? Why or why not?

With this question, it is aimed to identify students' understandings about the tentative, experiential, inferential, imaginary and creative nature of scientific knowledge.

3. The dinosaurs lived millions of years ago.
   (a)How do scientists know that dinosaurs really existed?
   (b) What evidence did scientists use to tell how dinosaurs look like
   (c) Do you think that the scientists are certain about the way dinosaurs look? What makes scientists to be certain about the way dinosaurs look?

With this question, it is aimed to identify students' understandings about the tentative, inferential, imaginary and creative nature of scientific knowledge.

4. What does the word imagination mean to you? Give an example

5. What does the word creativity mean to you? Give an example

With the 4th and 5th question, it is aimed to identify how the students perceive the terms imagination and creativity

6. Scientists try to find answers to their questions by doing investigations/experiments. Do you think that scientists use their imagination and creativity in their investigations/experiments? Explain your answer with an example.

In this last question, *it is aimed to identify students' understandings about the tentative, inferential, imaginary and creative nature of scientific knowledge.*

After administering the questionnaire used in this study, each questionnaire form was investigated and copied. These copies were given to the students and semi-structured interviews were conducted with them. In this way, the students who had a chance to read the answers given to the questionnaire were asked to support their answers with additional examples or clarify the answers given if needed. Data gathered through these interviews was used as a measurement tool that supports the validity of the questionnaire during the creation of the students' nature of science profiles. For instance, to explain the answer given to the questionnaire item about the ways scientists reach to a model in the science textbook, students were further exposed to questions such as "do you think the scientists saw this shape with their own eyes" or "what kind of investigations they conducted" etc.

c) Data Analysis

The group of 17 students' profiles of the nature of science was created based on the questionnaires and semi-structured interviews conducted with them. In this process, for the analysis of students' nature of science understandings, constant comparative analysis was employed (Strauss & Corbin, 1990). In the literature, it is found that many studies, which aim to detect both students' and teachers' nature of science understandings, employed this method (Khishfe & Abd-El-Khalick, 2002; Khishfe, 2004). Using this method, to clearly produce the participants' profiles on the elements of nature of science understandings were generated based on students' answers given in the questionnaires and interviews. In this process, both interview and questionnaire data were handled together so that the potential problems that might rise during generating students' nature of science profiles were solved. Based on both research data after students' nature of science profiles were generated, a profile was decided through the detailed analysis of data. In this way, both validity and the generated profile's reliability was controlled. In addition to the profiles of nature of science, the students' views about the elements of the nature of science were investigated broadly by using direct quotations from students' answers to the questionnaires and interviews and including frequencies and percentages.

The coding rule for categorizing the participants' views of nature of science was built on the perspective that the students' views have a constant change (Khishfe & Lederman, 2003). The participating students' views of nature of science have been categorized in three ways: naïve, transitional, and informed. Before explaining this analytical framework, we need to mention that multiple elements of nature of science were explained in more than one questionnaire item. The tentative nature of science are explained based on the students' answers given to the item about the change of scientific knowledge, the item about atom, and item about the dinosaurs; the first, second and third items. To categorize the participants' all views about the tentative nature of science as informed, they were asked to provide evidence that they have informed views in their answers given to the all items. If the participant did not provide enough views for the three items about the nature of science, the view held by the student was categorized as weak. If the participant provided some views to some items but not the others, the view held by the student was categorized as transitional. This categorization method was also used in a study conducted by Khishfe (2004).

FINDINGS

In this section, the findings gathered from the questionnaires and interviews conducted to reveal students' nature of science understandings were presented. In this regard, four expected elements- being tentative, experiential, inferential, and imaginary and creativity, which the 5^{th}-8^{th} grade students have about the nature of science constituted their profiles. Additionally, to enhance the discussion that will be done about the students' nature of science understandings, the answers given to the questionnaire and the semi-structured interview were extensively explained by using direct quotations from the students' own statements.

In Table 2, each student is defined by a pseudonym representing each student and their understandings of the four elements of nature of science is categorized by using one of the naïve, transitional, and informed categories.

Table 2. *Categories of the students' elements of nature of science understandings*

Students	Tentative Nature of Science			Difference between Observation and Inference			Experiential Nature of Science			Creative and Imaginary Nature of Science		
	I	N	T	I	N	T	I	N	T	I	N	T
M1		X		X					X	X		
M2		X				X	X				X	
M1		X		X			X				X	
F2	X			X					X			X
M3			X	X			X			X		
M4			X			X		X			X	
F3	X			X			X			X		
F4		X			X			X		X		
M5		X				X		X			X	
F7		X			X			X			X	
F5		X				X		X			X	
F6		X				X			X		X	
F8		X			X				X		X	
F9		X			X			X			X	
F10		X			X			X			X	
F11		X			X				X		X	
M6			X		X			X			X	

I: Informed, N: Naïve, T: Tentative, M: Male, F: Female

Table 3. *Categorical distributions of the student's nature of science understandings*

Participants N:17	Tentative Nature of Science		Difference between Observation and Inference		Experiential Nature of Science		Creative and Imaginary Nature of Science	
	f	%	f	%	f	%	f	%
Informed	2	12	5	29	4	24	4	24
Naïve	11	65	7	41	8	47	12	71
Tentative	4	24	5	29	5	29	1	6

Investigating Table 3, it is found that 22% of the students have informed understanding of the tentative, experiential, imaginary and creative and inferential nature of science; 56% of had naïve understanding of the nature of science for the four elements investigated. Also, 22% of the students' answers which were given to the questionnaire and the interview about the elements investigated of the nature of science, could not be categorized as either "informed" or "naïve". The reason for this is that the students gave inconsistent answers to the questions. The answers of these students were classified during data analysis under "tentative" subheading and were accepted as "they have naïve understanding of the elements of nature of science investigated."

a) Tentative Nature of Science

65% of the participants had naïve understanding of the nature of science. It is found that most students in this group believe that the scientific knowledge is absolute or true and it never changes. When the students' understanding of nature of science about it being tentative was analyzed; two answers that they give in the questions in questionnaire and the semi structured interview. The first one is the first item on the questionnaire about "whether the scientific knowledge on science textbooks will change in the future."

53% of the students answered this question as "scientific knowledge would not change" [because] "*scientists would not put these [information] in the textbooks" [F8].* Another student's answer to the same question was

> Scientific knowledge is true, it is true because [scientists] do research and it is true because they experiment what they found. [F5]

It was found that these students believed the knowledge would not be put in the textbook if the scientist were not certain about the knowledge structure and if the knowledge was not accepted by everybody. One student answered to the question "do you believe the scientific knowledge can be changed" as "*No, [scientific knowledge] doesn't change because it is accepted by everybody [M1].*

The answers 71% of the students investigated gave to the second and third questions in the questionnaires indicate that they believe scientists are "certain" and "confident" about the structure of an atom and dinosaurs explained in the textbooks. Additionally, it has found that most students had inadequate content knowledge about dinosaur subject.

> Scientist researched and saw an atom's structure. [M2]
> Scientists saw an atom through a microscope explicitly. [F5]
> Scientists explicitly prove what dinosaurs looked like by looking at the remaining fossils from them [F6]

Secondly, a few of the students asserted that the scientific knowledge can be changed by adding new knowledge to the existing knowledge. One student explained this situation as

> When scientists conduct experiments they cannot be sure… Their results change when they conduct other experiments because they have more knowledge [F3].

It was found that only 12% of the participants had "informed" understanding of tentative nature of science. Students in this group asserted that scientists are not certain about the ways dinosaurs looked because scientists use imagination and creativity when picturing dinosaurs.

> Scientists are not certain about the ways dinosaurs look, this knowledge is not totally accurate as they make a prediction about them [M1]
> I don't believe in the explanations scientists make about the ways dinosaurs looked because it cannot be totally true as they didn't see dinosaurs [F2]

b) The Difference between Inference and Observation

70% of the participants did not have "informed" understanding about the difference between inference and observation. It is found that the students in this group used "knowing" as a synonym for "seeing". The students believe that for scientist to learn something about a phenomenon they simply need to observe it. 47% of the participants believe that scientists are certain about the structure of an atom because they can see an atom by using a microscope. Three of these students indicated their thoughts as

> [Scientists] know this knowledge about atom that has been spread to everyone, this knowledge is accepted. They saw this shape by using an electron microscope. [F9]
> As the [Scientists] saw this shape, the knowledge about the atom is certainly true. [F7]
> [Scientist] investigated the structure of an atom and saw it by looking through a microscope [M2]

Similarly, it is found that 41% of the participants thought that the scientists saw the dinosaurs with their own eyes and therefore the knowledge about what they look like is certainly true.

> [Scientists] saw dinosaurs by looking [F11]
> [Scientists] preserved dinosaurs for preventing them from extinction [F5]

When the interview data about this questions deeply, it is found that the students did not know about the difference between the way scientists explain the existence of dinosaurs (inference) and the fossil bones that these explanations endure (observation). For instance after the students' answers gathered as when the scientists decide on what dinosaurs look like "they simply gather bones of the skeleton"; the researcher asked the following question additionally: "but how does a scientist know about the color of a dinosaur?. Some of the answers given to this question this question were given below

> [Scientists] know the color of the dinosaurs by conducting some experiments with their bones [E5]
> [Scientists] find the color by conducting more research with the remaining bones of dinosaurs [E4]
> [Scientists] tell the color by looking at the structure in the bone of dinosaurs [F11]

In the interview, 47% of the students had "informed" understanding of the difference between observed (fossil) and the inferred (that they live in the past) on the question about the dinosaurs.

> [Scientists] say that the dinosaurs live in some time by looking at the remains of dinosaurs.[F4]

[Dinosaurs] have fossils, they have big bones, they know about the height by combining these bones [F2]
[Scientists] find bones when they do experiments and make calculations with them, through this way they reach some truths about the dinosaurs. [F3]

c) Experimental Nature of Science

47% of the participants have naïve understanding of the experimental nature of science. As stated in the previous section, 47% of the students used seeing synonymously with knowing. These participants could not make any connections between knowledge and evidence. Therefore, they failed to know some claims about some phenomena have several unexplained dimensions and even though the scientists could not observe these directly they can claim these based on the evidence. In the interview it is from the answers given to the question about the dinosaurs indicated that 41% of the students thought that the scientist really saw the dinosaurs with their own eyes and the role of evidence when generating images of dinosaurs were not understood:

Scientists imagine the way [dinosaurs] look by thinking [F4]
[Scientists] construct the knowledge about the dinosaurs in their head through their thoughts, it is doubtful that these are correct [M3]

It is found that 24% of the participants had "informed" concepts about the roles that data plays during the creation of scientific knowledge. These students asserted that scientists could generate some accurate images based on the fossil remains even though they cannor actually see the dinosaurs.

Scientists cannot prove the dinosaurs really exist but they can claim this by using fossils. On the other hand, they produce the style they look through their own thoughts [E3]
Scientists, not being so certain about it, try to explain what dinosaurs look by the evidence they found and the traces that they left [F3].

d) The Role of Imagination and Creativity In Creating Scientific Knowledge

It is found that 71% of the participants had "naïve" understanding of the imaginary and creative nature of science. Three different tendencies were emerged. First, as mentioned previously, 47% of the students asserted that scientists learn atomic nature of an atom by observing it under a microscope. Second, 41% of the students do not know the description of dinosaurs include creative and imaginary work. These students implied that the scientists certainly saw dinosaurs or their pictures.

If the comparison is made, only 35% of the students indicated that the scientist used imagination and creativity when they explain the structure of matter and the existence of dinosaurs. Still, students were not "informed" explaining the role of experimental evidence when generating this knowledge:

Scientists use imagination and creativity in their work. For example, they can't see an atom but they say the way it looks by imagining it [F1]
People can do different things by imagining and generate formulas [F2]

Third, it is found from the answer given to the question which is the last one in the questionnaire and about "whether scientists use imagination and creativity", 18% of the students asserted that science could not include human features such as creativity and imagination as it can lead to wrong conclusions.

> Scientists do not use imagination and creativity in their work. They don't acquire knowledge by thinking, they need to do experiments. On the other hand, they use their creativity but not their imagination [M2]

24% of the participants indicated that scientists use imagination and creativity in their work. However these students used the terms imagination and creativity with the purpose of citing some other activities and element instead of creating knowledge and idea. Fourth and fifth items in the questionnaire were asked for what they meant by these terms and to clarify the thing that they assert. 76% of the students used "imagination" and "creativity" in science synonymously as a person's ability to create a scientific product and an 'nterest'ng talent of doing an experiment:

> Scientists think about "would it be better if I do this" by using imagination and creativity in the work they will do [M3]
> Using these [imagination and creativity], they try to add some more beauty when they do a work. [F5]

DISCUSSION and CONCLUSION

Teaching science and nature of scientific knowledge adequately has become a mutual goal of science educators and science education researchers for a long time (Lederman, 1992). It is known that students who have an informed understanding of the nature of science can learn science content successfully and understand the phenomena that happen around them (Driver, Leach & Millar, 1996). Having adequate knowledge of nature of science help students to appropriate the scientific studies and to comprehend that more studies needed for scientific and technological advancements.

Based on these explanations, we tried to detect middle school students' knowledge about the nature of science in our country. It is concluded that a few studies exist about the subject that explain our country's educational situation. It is found that some studies identified the primary or university level students' while most studies identified the high school level students' nature of science understandings (Deng, Chai, Tsai, Lin, 2014; Oyman, 2002; Çelik & Bayrakçeken, 2004; Kılıç, Sungur, Çakıroğlu & Tekkaya, 2005; Khishfe, 2015a-b). These studies mostly used questionnaires to identify students' concepts regarding their nature of science (Macaroğlu, Taşar & Cataloglu, 1998; Yakmacı-Güzel, 2000). In these studies, it is concluded that almost all of the high school students thought scientific knowledge is whole and complete and believed that the scientific hypotheses and theories are absolute truths. Valuing scientific perspective, accepting science is not in a static but in a dynamic structure and therefore perceive science as a field that he/she can contribute can help students to be more successful in science lessons (Lederman, 1992).

In the current study middle school students' nature of science understandings were identified using nature of science student questionnaire and semi-structured interviews. With the six items in the nature of science questionnaire that determine students' understandings of experimental, tentative, inferential, imaginary and creative nature of science was aimed to be identified. A nature of science questionnaire prepared in this direction was administered to the students. Then, in depth interviews were conducted with the students based on the answers they gave in the questionnaire. In this way a profile was generated for each student regarding four elements of nature of science experimental, tentative, inferential, imaginary and creative. The students' profiles were categorized as "informed, tentative and naïve". This coding was used in a study conducted by Khsihfe (2004).

Based on the data gathered, a couple of students', whose scientific achievements and socioeconomic statuses were different, nature of science understandings (about the investigated elements) were naïve. This result is consistent with the results reached in the studies that evaluate the students' nature of science understandings in the international literature (Bady, 1979; BouJaoude, 1996; Smith, Maclin, Houghton & Hennessey, 2000; Meichtry, 1992). Data in Table 3 indicates that 22% of the students had "informed" understanding of tentative, experimental, inferential, imaginary and creative nature of science. After all, 56% of the students had "naïve" understanding of the elements that are investigated regarding nature of science. If we add a group of students (22%) who had "transitional" nature of science understanding, it is understood that 78% of the students had inadequate nature of science understanding. This result is similar when compared to international literature.

However, the reasons for middle school students' this level of inadequate nature of science understandings should be discussed. In science lessons, the purposes of scientific studies and nature of scientific knowledge should be explained. Teaching both the nature of science and the purposes of scientific studies in an adequate level is important. The lessons on scientific process skill are not sufficient to foster the concepts about the nature of science. Data in the current study supports that the inquiry-based science activities are not sufficient to teach students the nature of science effectively. This result requires finding some different ways to follow instead of using indirect attempts to teach students the nature of science. Herein, there is a need for using direct-reflective nature of science teaching which is successful to teach students sufficient level of nature of science (Rudge and Howe 2009; Akerson et al. 2008; Khishfe and Abd-El-Khalick 2002).

65% of the students have "naïve" understanding of the tentative nature of science. It is found that almost all students who share this thought believed that the scientific knowledge is absolutely true and therefore would never change. They provide their reasoning to this idea as "scientists would not put this knowledge in the textbooks if they are not certain about something." It is concluded from the answers the students gave to the second and third questions that the students believed that the knowledge scientists provide about the atomic structure and dinosaurs' extinction is 100% correct. The way an atom looks and what are atomic models were taught in a lesson prior to the current study. In this case, the participating students' ideas on scientists' knowledge about atomic structure is being absolutely true and believing that the structure of an atom given in the questionnaire 100% correct should be discussed. In this regard, there is a need for explaining the ways scientists reach to this knowledge or conducting activities portraying this. It is important that the teachers make an explanation about the structure of models when presenting students with models. In this way, students can succeed to understand that scientific knowledge is not the 100% true copies of the reality. A study conducted by Khishfe and Abd-El-Khalick (2002) found that 85% of the sixth grade students in their study had "naïve" understanding of tentative nature of science. It can be said that the number of students that had naïve understanding of tentative nature of science was even for the students in the study groups of this study and the current study. It is striking that the students thought the scientific knowledge will be absolutely true and will never change because the knowledge produced by scientists' work is a product of a scientific work. Thus, it can be said the students' knowledge about scientific work and their understanding of scientific process skills can negatively affect the understanding that they construct about the tentative nature of science. Additionally, the "scientific" word in the statement "to characterize something as true it should be scientific", which is stated in many resources, leads individuals to bias.

41% of the participants did not know the difference between observation and inference. Therefore, they adopt naïve understanding of the inferential nature of science and scientific knowledge. The students with naïve understanding about this perceive "knowing and seeing" synonymously. In addition to this, they think that in order to know something scientifically, it needs to be directly observed. It is striking that the students who believe scientists directly observe it when reaching scientific knowledge, state that “atomic structure of an atom is known through direct observation under a microscope” and also the it is known that the “dinosaurs lived once upon a time again through a direct observation”. Some students stated their idea about the question regarding dinosaurs in the questionnaire as “scientists decide whether the dinosaurs existed through investigating the fossils.” However, they could not answer the question “how scientists know about the ways dinosaurs look” in a way that reveals their sufficient understanding of inferential nature of science. However, it is found that 47% of the students had “informed” understanding of about the identification of the difference between the observed (fossils) and the inferred (they lived previously).

47% of the students had “naïve” understanding of the experimental nature of science. Investigating the students’ understanding of the experimental nature of science at the beginning of the study, 47% of the students thought “knowing as seeing” synonymously and this explained in the previous paragraphs. The students in this group failed to make or realize the relationship between data and evidence. As an example, none of the students answered questions about atom and dinosaurs as “scientists use data in other words evidence when they decide on the both types of knowledge.” The students in this group insisted on the idea that the scientists can only have knowledge about a subject by seeing in their own eyes. Supporting this, they explained that “scientists would not have any knowledge if they don’t see with their own eyes.” Everybody experienced how diversely students generate ideas about and make predictions about how events can occur in a setting. Students do not need to be present in these settings to in order to do so. However, when the subject is science and scientific knowledge “scientist should be able to see things in orders to know something about a subject” explanation should be discussed. In this result, it can be said that the students’ “naïve” understanding of the experimental nature of science affects their thoughts about the tentative nature of science. In other words, it can be interpreted that the students who adopt scientific knowledge as accurate, complete, and absolute truth; construct scientists in their mind as people who know everything accurately and observe directly. In this regard, there is a need for students to construct images of scientists in order to understand the tentative and experimental nature of science. Students need to abandon their ideas about scientist being people who can success everything and every time and do the right things every time. Students who succeed this or students who are provided with such experiences can abandon the thought “scientists observe things in order to know about them.”

At the beginning of the study, 71% of the students had “naïve” understanding of the imaginary and creative nature of science. There are three tendencies of the ideas that the students adopt about this element of the nature of science. First, most student (47%) think that when scientists reached to the model explained in the science textbooks about the structure of an atom, they observe it directly under a strong microscope. Second, most students (41%) do not know identifying the ways dinosaurs look includes creative work. The students in this group believe that scientist look at the pictures of dinosaurs in some way. From the answers given to the last question in the questionnaire, 24% of the students believed that scientists use imagination and creativity and 18% did not believe it. When the 18% of the students’ answers, students who did not believe scientists use imagination and creativity, were investigated; it is identified that they had an understanding as “it could lead to wrong results if the scientist use these”. Therefore, the students believe that the science would not include the humane features such as imagination and creativity. However, when interpreting the data gathered in every stages of their work, scientists use both their imagination and their creativity (Mccomas, 1996).

The answers given to the 4^{th} and 5^{th} questions by the students (24%) who think that the science includes creative and imaginary elements were analyzed. It was asked students to write what they understand from the concepts imagination and creativity. Based on the analysis of this data, it is found that most students, who believed that the scientific knowledge has imagination and creative features, used these concepts different than the purpose of these questions were being asked. Students used creativity for citing other activities rather than producing knowledge and idea. Imagination and creativity are explained as a tool that nobody knows or designing an interesting experiment. None of the students in this group, give "when deciding what atomic structure is and the ways dinosaurs look like scientists use imagination and creativity" as an example.

This can be interpreted as opportunities were not provided to students where they can use their imaginations and creativities in the previously conducted studies in the science lessons. In addition to this, there is a need for open and direct connections made between the effects of imagination and creativity on studies conducted with students and scientists. Meichtry (1992) asserted that if the connections were not made between the subjects students learn and the methods used and the elements of nature of science, students would not make these connections. If the attention was paid to these in the previous studies, students would answer as creating new knowledge and ideas when explaining these two concepts. To teach these elements of the nature of science sufficiently to students, there is a need for both giving opportunities and presenting personal and occupational features that the scientists have.

SUGGESTIONS

To date, in the science teaching programs prepared in our country, the necessity of nature of science learning has not been discussed in order for students to learn science content and gain positive views towards science. However, there has given a very brief reference to nature of science in the introduction section of the latest science and technology program which has been implemented in the schools as 2005. This program has been defined as an inquiry-based constructivist program. It is known that the inquiry-based learning approaches have an important effect on students use of scientific process skills and therefore to gain sufficient knowledge about scientific work.

However, teaching nature of science is different than teaching how to conduct scientific work. Nature of science concept is not easy as involving in research activities and learning it sufficiently a by-product of these activities (Abd-El-Khalick & Lederman, 2000; Khisfe & Abd-El-Khalick, 2002). For this reason, teachers should spare extra time and intensive effort to teach students nature of science. A more direct-reflective approach should be used to teach sufficient level of nature of science instead of an indirect approach. In other words, science and the nature of scientific knowledge should be approached as "cognitive learning goal" in the science learning programs and should be taught in the scope of different activities respectively (Abd-El-Khalick & Lederman, 2000).

REFERENCES

AAAS. (1993). American Association for the Advancement of Science, Project 2061: Benchmarks for Science Literacy. New York: Oxford University Press.

Abd-El-Khalick, F., & Lederman, N.G. (2000). Improving science teachers' conceptions of nature of science: a critical review of the literature. *International Journal of Science Education, 22(7),* 665-701.

Akerson, V. L., Buzzelli, C. A., & Donnelly, L. A. (2008). Early childhood teachers' views of nature of science: The influence of intellectual levels, cultural values, and explicit reflective teaching. *Journal of Research in Science Teaching, 45*, 748–770

Bady, R. A (1979). Students' understanding of the logic of hypothesis testing. *Journal of Research in Science Teaching, 16,* 61-65.

Bell, R.L., & Matkins, J.J. (2003). Learning about the nature of science in an elementary science methods course: content vs. context. Annual Meeting of the National Association for Research in Science Teaching (NARST), Philadelphia, Pa.

Boujaoude, S. (1996). Epistemology and Sociology of Science According to Lebanese Educators and Students, Annual Meeting of the National Association for Research in Science Teaching, St.Louis, Mo.

Brickhouse, N.W., Dagher, Z.R., Letts, W.J., & Shipman, H.L. (2000). Diversity of students' views about evidence, theory, and the ınterface between science and religion in an astronomy course. *Journal of Research in Science Teaching, 37(4),* 340-362.

Çelik, S., & Bayrakçeken, S. (2004). Öğretmen adaylarının bilim anlayışları ve "fen, teknoloji ve toplum" dersinin bu anlayışlara etkisi. VI. Ulusal Fen Bilimleri ve Matematik Eğitimi Kongresi, Marmara Üniversitesi, İstanbul.

Clough, M.P., & Olson, J.K. (2001). Structure of a course promoting contextualized and decontextualized nature of science ınstruction. Annual Meeting of the Association for the Education of Teachers, St.Louis, MO.

Clough, M.P. (2003). Explicit but insufficient: additional considerations for successful nos ınstruction. Annual Meeting of the Association for the Education of Teachers, St.Louis, MO.

Demirdöğen, B., Hanuscin, D.L., Uzuntiryaki-Kondakci, E. & Köseoğlu, F. (2015). Development of preservice chemistry teachers' pedagogical content knowledge for nature of science. *Research in Science Education, doi: 10.1007/s11165-015-9472-z*

Deng, F., Chai, C.S., Tsai, C., Lin. T. (2014). Assessing South China (Guangzhou) high school students' views on nature of science: a validation study. *Science & Education, 23,* 843-863

Driver, R., Leach, J., Millar, R., & Scott, P. (1996). Young People's Images of Science. Buckingham, UK: Open University Press.

Govett, A.L. (2001). *Teacher's Conception of the Nature of Science: Analyzing the Impact of A Teacher Enhancement Program in Changing Attitudes And Perceptions of Science And Scientific Research* (Unpublished Phd Thesis). College of Human Resources And Education, West Virginia University.

Hammer, D. (1994). Epistomological beliefs in introductory physics. *Cognition and Instruction, 12,* 151–183.

Hogan, K. (1999). Relating students' personal frameworks for science curriculum. *Science Education, 72,* 19–40.

Jungwirth, E. (1970). An evaluation of attained development of the ıntellectual skills needed for understanding of the nature of scientific ınquiry by BSCS pupils ın Israel. *Journal of Research in Science Teaching, 7,* 141-151.

Khishfe, R., & Abd-El-Khalick, F. (2002). Influence of explicit and reflective versus ımplicit ınquiry-oriented ınstruction on sixth graders' views of nature of science. *Journal of Research in Science Teaching, 39(7),* 551-578.

Khishfe, R., & Lederman, N. (2003). The development of students' conceptions of nature of science. Annual Meeting of the American Educational Research Association (AERA), Chicago, Il.

Khishfe, R.F. (2004). *Relationship between students' understandings of nature of science and ınstructional context.* (Unpublished Phd thesis). Graduate College of The Illinois Institute of Technology. Chicago, Illinois.

Khishfe, R.F. (2015a). Relationship between nature of science understandings and argumentation skills: A role for counterargument and contextual factors. *Journal of Research in Science Teaching, 49(4),* 489-514

Khishfe, R.F. (2015b). A look into students' retention of acquired nature of science understandings. *International Journal of Science Education, 37 (10),* 1639-1667

Kılıç, K., Sungur, S., Çakıroğlu, J., & Tekkaya, C. (2005). Ninth grade students' understanding of the nature of scientific knowledge. *Hacettepe Üniversitesi Eğitim Fakültesi Dergisi, 28,* 127-133.

Lecompte, M. D., & Preissle, J. (1993). Ethnography and Qualitative Design in Educational Research. (2nd Ed). San Diego: Academic Press.

Lederman, N.G. (1992). Students' and teachers' conceptions of the nature of science: a review of the research. *Journal of Research in Science Teaching, 29(4),* 331-359.

Lederman, N.G. (1999). Teachers' understanding of the nature of science and classroom practice: factors that facilitate or impede the relationship. *Journal of Research in Science Teaching, 36(8),* 916–929.

Macaroglu, E., Taşar, M. F., & Cataloglu, E. (1998). Turkish preservice elementary school teachers' beliefs about the nature of science. Annual Meeting of National Association for Research in Science Teaching (NARST), San Diego, CA.

Mccomas, W. (1996). Ten myths of science: reexamining what we think we know about the nature of science. *School Science and Mathematics, 96,* 10-16.

Mcnabb, D.E. (2002). Research Methods in Public Administration and Nonprofit Management: Quantitative and Qualitative Approaches. M.E. Sharpe, Armonk, Newyork.

MEB. (2005). İlköğretim Fen Ve Teknoloji Dersi Öğretim Programı. Ankara: Milli Eğitim Bakanlığı Yayınları.

Meichtry, Y.J. (1992). Influencing student understanding of the nature of science: data from a case of curriculum development. *Journal of Research in Science Teaching, 29(4),* 389-407.

Moss, D.M., Abrams, E.D., & Kull, J.R. (1998). Describing students conceptions of the nature of science over an entire school years. Annual Meeting of the National Association for Research in Science Teaching. San Diego, CA.

Moss, D.M., Abrams, E.D., & Robb, J. (2001). Examining student conception of the nature of science. *International Journal of Science Education, 23(8),* 771-790.

Murcia, K., & Schibeci, R. (1999). Primary student teachers' conceptions of the nature of science. *International Journal of Science Education, 21(11),* 1123-1140.

NRC (1996). National Research Council, National Science Education Standards. Washington, DC: National Academic Press.

Oyman, N.Y. (2002). *İlköğretim Fen Bilgisi Öğretmenlerinin Bilimin Doğası Hakkındaki Anlayışlarının Tespiti.* (Yayınlanmamış Yüksek Lisans Tezi). Marmara Üniversitesi, İstanbul.

Peters, E. E. (2012). Developing content knowledge in students through explicit teaching of the nature of sceince: Influences of goal setting and self-monitoring. *Science & Education, 21,* 881-898

Roth, W.M., & Roychoudhury, A. (2003). Physics students' epistemologies and views about knowing and learning. *Journal of Research in Science Teaching, 40,* 114–139.

Rubba, P., Horner, J. K., & Smith, J. M. (1981). A study of two misconceptions about the nature of science among junior high school students. *School Science and Mathematics, 81,* 221-226.

Rudge, D. W., & Howe, E. M. (2009). An explicit and reflective approach to the use of history to promote understanding of the nature of science. Science & Education, 18, 561–580.

Ryan, A. G., & Aikenhead, G.S. (1992). Students' preconceptions about the epistemology of science. *Science Education, 76,* 559-580.

Sandoval, W.A., & Morrison, K. (2003). High school students' ideas about theories and theory change after a biological inquiry unit. *Journal of Research in Science Teaching, 40(4),* 369-392.

Scharmann, L.C. (1988a). Locus of control: a discriminator of the ability to foster an understanding of the nature of science among preservice elementary teachers. *Science Education, 72,* 453-465.

Scharmann, L. C. (1988b). The influence of sequenced instructional strategy and locus of control on preservice elementary teachers' understanding of the nature of science. *Journal of Research in Science Teaching, 25,* 589-604.

Smith, C. L., Maclin, D., Houghton, C., & Hennessey, M.G. (2000). Sixth-grade students' epistemologies of science: the impact of school science experiences on epistemological development. *Cognition and Instruction, 18,* 349-422.

Songer, N.B., & Linn, M.C. (1991). How do students' views of science influence knowledge integration?. *Journal of Research in Science Teaching, 28,* 761–784.

Strauss, A., & Corbin, J. (1990). Basics of Qualitative Research: Grounded Theory Procedures And Techniques. Ondon: Sage Publications.

Taşar, M.F. (2003). Teaching history and the nature of science in science teacher education programs. *Pamukkale Üniversitesi Eğitim Fakültesi Dergisi, 1(13),* 30-42.

Tsai, C.-C. (1999). The progression toward constructivist epistemological views of science: a case study of the STS instruction of Taiwanese high school female students. *International Journal of Science Education, 21(11),* 1201-1222.

Wahbeh, N. & Abd-El-Khalick, F. (2014). Revisiting the translation of nature of science understandings into instructional practice: Teachers' nature of science pedagogical content knowledge. *International Journal of Science Education, 36(1),* 425-466.

Yakmacı-Güzel, B. (2000). Fen alanı (biyoloji, kimya ve fizik) öğretmenlerinin bilimsel okur-yazarlığın bir boyutu olan "bilimin doğası" hakkındaki görüşleriyle ilgili bir tarama çalışması. IV. Fen Bilimleri Ve Matematik Eğitimi Kongresi, Hacettepe Üniversitesi, Ankara.

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An Evaluation of the Effectiveness of the Authentic Task on Students' Learning Achievement of Plant Anatomy Concepts in Surabaya State University

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ABSTRACT

To promote the knowledge of plant anatomy which is frequently taught using traditional method, students need to be involved in authentic learning by providing them an authentic task. Therefore, the aims of this current research are to implement a certain authentic task of plant anatomy; to evaluate the effectiveness of the task on the students' learning achievement includes their performances, knowledge mastery, and perceptions of the task; This case study research involved a single class consisted of 25 bachelor degree students as the subjects of this research. Observation, interview, and test were implemented to collect variety information during implementation of the authentic task. The findings showed that the students' performance scores and the percentage of mastered indicators met the minimum mastery criteria, but the percentage of classical mastery was less than the criteria. It means the authentic task had positive impact only on students' performance, but it could not help the whole students to master the topic. However, regarding to perception, both higher and lower achiever students thought the task was authentic.

Keywords: Plant Anatomy; Authentic Task; Students' Learning Achievement.

INTRODUCTION

Mostly, teaching of plant anatomy at university still relies on teacher centered management Cutler, D. F. et al (2007); *Timmerman, B. E. et al, (2008).* The emphasis of these conventional approaches has been on rote learning and teaching them in abstract and decontextualised forms. As a result, students are less able to integrate and to apply the concepts that they have learned to solve problems in their daily life since the knowledge was stored only as an information rather than as a tool for solving problems (Herrington, J., 2010).

For that reason, it is thought that students need to be involved in the learning activity which allows them to get real experiences and the relevancy of real world to their work. One

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of the alternative approaches to achieve these purposes is by involving students in authentic learning. According to Herrington et al (2010), the authentic learning refers to a learning method which encourages students to involve in real-world relevant tasks. Thus, students can be involved in authentic learning experiences by providing them appropriate authentic tasks. A well-designed authentic task does not only provide an opportunity to practice learning and to develop certain skills (Herrington et al 2010), but also affects their involvement and motivation toward learning process (Lodewyk, K. R., & Winne, P. H. 2005; Lodewyk, K. R., & Winne, P. H. 2005). As Neo and Neo (2010) in their study of multimedia project found that authentic task can encourage students to be active and highly motivated learners. Similarly, Gulikers et al (2006) observed that increasing the task authenticity can encourage students to learn deeply. In other words, the authentic tasks can affect students' learning achievement by increasing their motivation to learn.

However, Gulikers et al (2006) warned that authenticity is a subjective matter which means that different students may have different perceptions of the same authentic tasks. Furthermore, Biggs (as cited in Gulikers et al (2006) asserted that students' perception of learning enable to affect their learning outcomes. Thus, in order to provide a meaningful authentic task for improving students' learning, educators in designing the task need to think about students' perception.

In addition to perception, the authentic tasks will be more useful, fair, and equitable for students if they are assisted by a precise type of assessment [24], that is, authentic assessment. Wiggins (as cited in Darling-Hammond et al (1995) defined the authentic assessment as one alternative of students' performance evaluation on the tasks which are relevant to their real life. According to Darling-Hammond et al (1995), this assessment enabled to assess the actual students' abilities, such as performance, higher order thinking, and problem solving, which cannot be assessed by traditional paper-and-pencil test which focuses only on memorizing knowledge. However, since Indonesian government still uses standardized test in civil workers recruitment to measure the employability. Hence, in this case, the two types of assessment, the authentic assessment and the paper-and-pencil test, will be more useful if they are implemented together.

As such reasons, this study was established by implementing a certain authentic task that simulated botanist' jobs as an alternative teaching method for plant anatomy subject. The objectives of this study were: a) to implement a certain authentic task of plant anatomy; b) to evaluate the effectiveness of the task on the students' learning achievement includes their performances, knowledge mastery, and perception of the task; and c) to describe some difficulties that occurred during the implementation of the authentic task.

The aims of this current research are to implement a certain authentic task of plant anatomy; and to evaluate the effectiveness of the task on the students' learning achievement includes their performances, knowledge mastery, and perceptions of the task

METHODOLOGY

a) Participants

This case study research involved a single class that consisted of 25 bachelor degree students of Surabaya State University studying plant anatomy as subject of research. The class was selected because it was a small class and the students were considered by many lecturers had better learning ability rather than the others. Therefore, arguably, the class was suitable for implementation of new teaching method.

b) Procedure

The current research was conducted within two phases. The first phase was designing of teaching materials and research instruments. The teaching materials included lesson plan and authentic task were designed in order to guide implementation of the authentic task in the class, whereas the research instruments functioned to collect data. The second phase was development of them. This phase consisted of two stages, they were validation and implementation. The former functioned to get some suggestions from the experts in designing as perfect teaching materials and research instruments as possible, while the second aimed to gain deep description about effectiveness of the authentic task.

For this current study, the authentic task consisted of five activities, that is, investigating morphological structure of a certain plant that theoretically has anomalous structure in stem, identifying anatomical structure of the plant, writing a scientific journal about the plant, presenting orally the important aspects of the plant, and presenting a poster about the plant. In this case, the students' performance included scientific journal writing, oral presentation, and poster presentation were assessed by authentic assessment.

c) Data collection

For collecting data, this current study relies on three techniques. The first was observation which aimed to collect information about obstacles that occurred during implementation of the authentic task. The observation result was recorded by observation sheet and field notes. The second was semi-structured interview which was conducted for collecting data included students' feeling, opinion, and experience during implementation of the authentic task. During the activity, four respondents were involved. They were the highest and the lowest achiever group members, and the highest and lowest achiever students. The last was test of students' learning achievement included performances on the authentic task consisting of scientific journal writing, oral presentation, and poster presentation which were assessed by authentic assessment and knowledge mastery of topic under study that was assessed by paper-and-pencil test. In this case, the authentic assessment was designed in form of numerical rating scale with four levels of achievement and was completed by the lecturer. Differently, the paper-and-pencil test consisted of multiple choice, short answer, fill-in-the blank, and essay questions and was completed by students.

d) Data analysis

This study collected both qualitative and quantitative data. The former was collected from observation sheet, field note, and interview. Those original data, then, were analyzed descriptively. The second data were collected from authentic assessment and paper-and-pencil test. The raw data of students' performance were counted firstly using formula as follows:

$$\text{Students}'\text{score} = \frac{\text{score}}{\text{maximum score}} \times 100\%$$

The students' performance was good if the score met the minimum mastery criteria which were determined by the experienced lecturer, that is, 75%. Furthermore, the raw data of paper-and-pencil test were counted using the following formulas.

$$\%\ \text{Individual Mastery} = \frac{\sum \text{indicators mastered by each student}}{\text{total number of indicators}} \times 100\%$$

$$\% \text{ Classical Mastery } = \frac{\sum \text{mastered students for each indicator}}{\text{total number of students}} \times 100\%$$

$$\% \text{ Mastered Indicator } = \frac{\sum \text{indicator mastered by the class}}{\text{total number of indicators}} \times 100\%$$

If the values met the minimum mastery criteria which were determined by the experienced lecturer, that is, 75%, it can be said that the students had mastered the topic of study.

FINDINGS and DISCUSSION

a) Students' Performance Result

For this study, the assessed students' performance included scientific journal writing, oral presentation, and poster presentation skills. The result of the students' performance is shown briefly in the following chart.

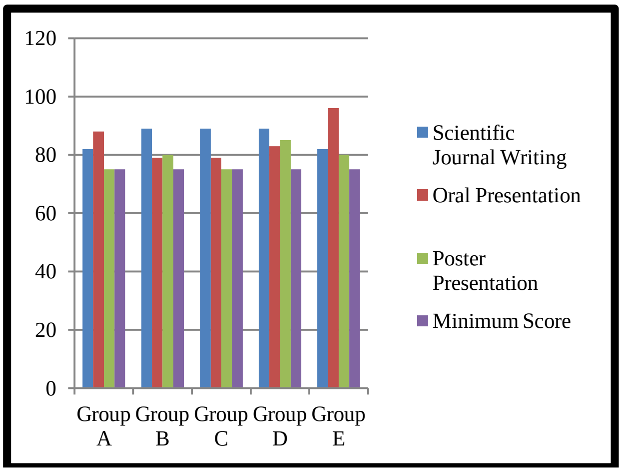

Figure 1. *The Chart of the Students' Performance Result*

Based on the students' performance result as shown in Figure 1, the performance scores included journal writing, oral presentation, and poster presentation of the five involved groups in this study were in the upper level of the minimum score, except to group C's and group D's poster presentation scores which were in the same level of it. Thus, based on the performance scores, overall, the students had good performance on the authentic task. It means that the implemented authentic task had good impact on students' performance. The similar findings were also reported by Gulikers et al (2006); by Koenders (2006); by Woo et al (2006); and by Neo and Neo (2010) in their study using an authentic task.

The good performances of the students in this study can be explained for two reasons. Firstly, the authentic task increases students' motivation toward learning. As students commented in the interview section "*I thought that the task was interesting because it was a new thing…*". The statement describes students' intrinsic motivation, that is, a motivation to take action due to personal interest, curiosity, enjoyment, or satisfaction (Arends, R. I. (2004); *Slavin, R. E. (2012)*; Woolfolk et al (2008).

The explanation is also supported by studies conducted by Koenders (2006) and Neo and Neo (2010). According to them, the authentic task encouraged students to become active and highly motivated learners. Furthermore, Cumming and Maxwell (1999) argued that motivation enables to enhance learners' cognitive engagement and thereby increase learning achievement. Similarly, Woolfolk et al (2008) asserted that students' interest toward learning has positive effect on the higher learning achievement. Secondly, the authentic task provides an authentic context (Herrington et al 2010) in which students' learning process and performance occur best (Brown, J. S., et al1989). Similarly, Honebein et al (1993) in their study observed that learning will be easier when students are engaged in authentic context since the context helps them to construct their own understanding.

b) Students' Knowledge Mastery Result

In this study, the students' knowledge mastery of stem anatomy topic was assessed by paper-and-pencil test. The students' mastery level of the topic was determined by percentage of classical and indicators mastery as shown in the following table.

Table 1. *Percentage of Classical and Indicators Mastery*

	Indicators												**Exp.**
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	
1	1	1	1	1	0	0	1	0	1	1	1	0	nm
2	0	1	1	1	0	0	1	1	1	1	1	0	nm
3	1	1	1	1	1	1	1	0	1	1	1	0	m
4	0	1	1	1	0	0	1	0	1	0	1	0	nm
5	1	1	1	1	1	1	1	1	1	1	1	1	m
6	1	1	1	1	1	0	1	0	1	1	1	0	m
7	1	1	1	1	1	0	1	0	1	1	1	1	m
8	1	1	1	1	1	1	0	1	1	1	1	1	m
9	0	1	1	1	1	1	0	0	1	1	1	0	nm
10	1	1	1	1	1	1	1	1	1	1	1	1	m
11	1	1	1	1	1	0	1	0	1	1	1	1	m
12	1	1	1	1	1	1	1	1	1	1	1	1	m
13	1	1	1	1	1	0	1	0	1	0	1	0	nm
14	1	1	1	1	1	1	1	1	1	1	1	0	m
15	1	1	1	1	1	1	1	1	1	1	1	1	m
16	1	1	1	1	1	1	1	1	1	1	1	0	m
17	0	1	1	1	0	0	1	0	1	1	1	1	nm
18	0	1	1	1	1	0	1	0	1	1	1	0	nm
19	1	1	1	1	1	1	1	0	1	1	1	0	m
20	0	1	1	1	0	0	1	1	1	1	1	0	nm
21	1	1	1	1	0	0	1	0	1	1	1	0	nm
22	1	1	1	1	1	0	1	1	1	1	1	0	m
23	0	1	1	1	0	0	1	0	1	1	1	0	nm
24	1	1	1	1	1	1	1	1	1	1	1	0	m
25	1	1	1	1	1	1	1	1	1	1	1	1	m
Exp.	m	m	m	m	m	nm	m	nm	m	m	m	nm	**%CM = 60**
%MI	**75**												

Notes:

Indicators:

1. To determine the meaning of primary stem.
2. To determine three kinds of primary meristem which develop to three kinds of tissues in primary stem.
3. To identify tissues which build a general structure of primary stem.

4. To analyze difference between primary stem structure of dicotyledon and monocotyledon.
5. To determine the meaning of secondary stem.
6. To determine secondary growth process that occurs in dicotyledon’s stem.
7. To explain secondary growth process that occurs in monocotyledon’s stem.
8. To identify tissues which arrange a general structure of dicotyledon’s secondary stem.
9. To explain the meaning of anomalous structure in stem.
10. To analyze characteristic of anomalous structure in primary stem of various plants.
11. To analyze characteristic of anomalous structure in secondary stem of various plants.
12. To analyze the cause of anomalous structure in secondary stem of various plants.

1 = m (mastered)
0 = nm (not mastered)
%CM (percentage of classical mastery)
%MI (percentage of mastered indicators)

Table 1 shows that the percentage of classical mastery of the topic, that is 60%, was less than the minimum mastery criteria which was determined by the experienced lecturer. It means that the class as a whole had not mastered yet this topic. Nevertheless, based on the percentage of mastered indicators, that is, 75% which met the minimum mastery criteria, it can be said that the topic of study had been mastered by students. Since it was criterion referenced test which was indicated by individual and classical mastery (Slavin, R. E., 2012), therefore, overall the involved students had not mastered yet this topic.

It means that, contrary to the previous research finding that students who learned through authentic learning experiences got better scores on traditional paper-and-pencil test than the students who were taught using traditional transmission method (Blum, K.,2003), the implemented authentic task of this study could not help students to master the topic. However, the similar finding was also reported by Albanese and Mitchell (1993) in their study about problem-based learning. They found that students were better in problem solving skills, but they were worse in basic knowledge acquisition.

The fact can be explained for four reasons. Firstly, in this case, the students were required to construct their own knowledge by themselves based on the observation and related concepts. However, because most students’ skill in making microscope slides could not develop well and the secondary stem was hard enough, their cross section picture of secondary stem was unclear and could not be identified. As a result, students cannot learn the secondary stem structure well. It was proved by three secondary stem anatomy indicators (No. 6, 8, and 12) that had not mastered yet by the students (see Table 1). Besides, the students did not learn the subtopic from the available textbooks since usually they learn topics from the lecturer’s explanation at the beginning of the lesson. It was supported by research which was conducted by Good and Brophy (2008). In their study, they reported that students got more knowledge from teachers’ explanation. Furthermore, Albanese and Mitchell (1993) in their study concluded that students who got less “cognitive scaffoldings” tend to got low scores in basic content examination (p. 57).

Secondly, since the task was conducted in groups and each group should identify different specimen so that students were difficult to understand the anomaly structure occur in the other groups’ specimens. It was proved by indicator number 12 that had not mastered yet (see Table 1). In accordance with this view, Engelkamp and Dehn (2000) in their study concluded that learning was easier when students do the task physically rather than only read the task instructions or observe the task demonstration.

Thirdly, the students were anxious during implementation of the authentic task, as a student's comment "*I am afraid I will get bad score in this subject…*". The similar finding was also reported by Cassady and Johnson (2002) in a study about the effect of anxiety on academic performance. They found that there was a significant association between higher levels of test anxiety and lower test scores. Related to it, Bandalos et al (1995) proposed three reasons. First of all, anxiety makes students difficult to receive new information in the first place. Besides, anxious students tend to have difficulty to transfer their learning. Consequently, anxiety makes students difficult to demonstrate their knowledge during test.

Finally, due to limited time, the students had not enough time to construct well their own understanding. As an experienced lecturer explained in the field notes that students need enough time to build understanding. Similarly, Woolfolk et al (2008) asserted that for successful learning, students need more time for active constructing knowledge activities and social interaction for knowledge construction. Besides, Claxton (as cited in Blum, K. 2003) suggested "an authentic task needs ample time for reflection and maturation" (p. 319).

c) Interview Result

Based on the interview result, at the beginning of the authentic task implementation, three respondents felt afraid. However, when conducting the task, they could complete it enjoyably due to the collaboration among the group members and lecturer's assistance. It means that this task could provide successfully the opportunity for students to collaborate. The similar findings were also observed by Arends (2004) and Woolfolk et al. (2008). According to them, collaboration during authentic task encouraged students to be motivated learners, and thereby increasing their involvement toward the complex task. Moreover, according the respondents except the 4th respondent, the task was interesting. It means that the task could motivate intrinsically the students to learn.

Regarding to the task authenticity, the interview result shows that the four respondents thought the task was authentic and useful for their future life. Thus, the developed task was authentic not only in researcher' view as developer, but also in students' perceptions. Those facts might be one of the reasons why the students in this study had good performance on the authentic task. As Herrington and Herrington (1998) revealed that a task will affect positively on students' learning when they think that the task are relevant to their real-life. Equally, Huang (as cited in Gulikers, J. T. M.,2005) thought that tasks which relevant to the reality can encourage students to intensively include in the learning process, so that it will increase their learning outcome. In a similar fashion, Gulikers et al (2006) proved that as students think the task is relevant to their real future life, they will be motivated to deeply learn the material which would give the best performance.

Furthermore, related to the students' comprehension toward the concepts, two respondents showed different perceptions. The 3rd respondent who got the highest score stated that the task could improve her understanding toward the concepts because it enabled students to connect their prior knowledge to the new information. Conversely, the 4th respondent who got the lowest score thought that the concepts could not be understood well since there was no explanation about them at the beginning. Based on the fact, the higher achiever student tends to perceive the task positively, whereas the lower one perceives the task negatively. Thus, students' perception of the learning can affect their learning achievement. This finding is also supported by studies which were conducted by Lizzio et al. (2002), Gulikers et al. (2006), and Gulikers et al. (2008). Furthermore, Biggs (as cited in Gulikers et al., 2006) clarified that students' perception can affect learning in two ways.

Firstly, it affects directly on students' outcome. Secondly, it influences on learning outcomes indirectly by affecting students' study approach, that is, deep or surface learning.

d) Observation Result

The observation result proposed several main obstacles during implementation of the authentic task. Firstly, some students still confused with the task. Arguably, it was resulted from ill-define characteristic of the authentic task. As Doyle (as cited in Good, T., & Brophy, J., 2008) argued that ill-structured task can cause students' ambiguity about the appropriate action and the task goal. Besides, the learners' confusing occurs because they were usually provided with structured-learning tasks. It was in accordance with Herrington et al. (2010) statement that students are commonly provided with well-designed leaning tasks which have straightforward steps, procedures and hints to get one correct answer. As a result, students confuse when they are required to identify the tasks, related sub-tasks, and related appropriate performance by themselves, as the characteristics of the ill-structured task. Secondly, students' difficulty to make microscope slides may be caused by it is new activity for the students. As Billett (2010) argued that in order to be professionals, students need to be involved in "an extensive period of practice" (p. 1).

Lastly, the available time was not enough for implementing the authentic task optimally. According to Herrington et al. (2006), an authentic task is suitable to be implemented for one semester or for entire course. Similarly, Neo and Neo (2010) and Woo et al.(2007) conducted their studies about authentic task for 13-14 weeks. Furthermore, Claxton (as cited in Blum, K.,2003) suggested "an authentic task needs ample time for reflection and maturation" (p. 319).

CONCLUSION

In conclusion, the implemented authentic task in this study had positive impact on students' performance, but it could not help the whole students to master the topic of study. Nevertheless, the task was perceived as authentic one by both the developer and the students.

Therefore, in designing a well authentic task, the educators or developer need to think not only the task, but also students' skills and time allocation.

REFERENCE

Albanese, M., & Mitchell, S. (1993). Problem-based learning: A review of literature on its outcomes and implementation issues. *Academic Medicine*, *68*, 52-61.

Arends, R. I. (2004). *Learning to teach* (6th ed.). New York: McGraw-Hill.

Bandalos, D. L., Yates, K., & Thorndike-Christ, T. (1995). Effects of math self-concept, perceived self-efficacy, and attributions for failure and success on test anxiety. *Journal of Educational Psychology*, *87*(4), 611-623.

Billett, S. (2010). Learning through practice. In S. Billett (Ed.), *Learning through practice: Models, traditions, orientations, and approaches* (pp. 1-20). New York: Springer.

Blum, K. (2003). Enhancing understanding and attitude by authentic learning experiences. In D. Fisher & T. Marsh (Eds.), *Proceedings of the Third Conference on Science, Mathematics and Technology Education 2007* (pp. 317-328). Perth: Curtin University of Technology.

Brown, J. S., Collins, A., & Duguid, P. (1989). Situated cognition of and the culture of learning. *Educational Researcher, 18*(1), 32-42.

Cassady, J. C., & Johnson, R. E. (2002). Cognitive anxiety and academic performance. *Contemporary Educational Psychology, 27*, 270-295.

Cumming, J. J., & Maxwell, G. S. (1999). Contextualizing authentic assessment. *Assessment in Education: Principles, Policy & Practice*, *6*(2), 177-194.

Cutler, D. F., Botha, T., & Stevenson, D. W. (2007). *Plant anatomy: An applied approach*. Malden, USA: Balckwell Publishing.

Darling-Hammond, L., Ancess, T., & Falk, A. (1995). *Authentic assessment in action: Studies of schools and students at work*. New York: Teacher College Press.

Engelkamp, J., & Dehn, D. M. (2000). Item and order information in subject-performed tasks and experimenter-performed tasks. *Journal of Experimental Psychology: Learning, Memory, & Cognition, 26*, 671-682.

Good, T., & Brophy, J. (2008). *Looking in classrooms* (10th ed.). Boston: Allyn & Bacon.

Gulikers, J. T. M., Bastiaens, T. J., & Martens, R. L. (2005). The surplus value of an authentic learning environment. *Computer in Human Behavior, 21*, 509-521.

Gulikers, J. T. M., Bastiaens, T. J., Kirschner, P. A., & Kester, L. (2006). Relations between student perceptions of assessment authenticity, study approaches and learning outcome. *Studies in Educational Evaluation, 32*, 381–400.

Gulikers, J. T. M., Kester, L., Kirschner, P. A., & Bastiaens, T. J. (2008). The effect of practical experience on perceptions of assessment authenticity, study approach, and learning outcomes. *Learning and Instruction*, *18,* 172-186.

Herrington, J., & Herrington, A. (1998). Authentic assessment and multimedia: How university students respond to a model of authentic assessment. *Higher Educational Research & Development, 17*, 305-322.

Herrington, J., Reeves, T. C., & Oliver, R. (2006). Authentic tasks online: A synergy among leaner, task, and technology. *Distance Education 27*(2), 233-247.

Herrington, J., Reeves, T. C., & Oliver, R. (2010). *A guide to authentic e-learning*. New York: Routledge.

Honebein, P. C., Duffy, T. M., & Fishman, B. J. (1993). Constructivism and the design of learning environments: Context and authentic activities for learning. In T. M. Duffy, J. Lowyck, & D. H. Jonassen (Eds.), Designing environments for constructive learning (NATO ASI Series F: *Computer and systems sciences*, 105, 87-108). Berlin: Springer-Verlag.

Koenders, A. (2006). An authentic online learning environment in university introductory biology. In T. Herrington & J. Herrington (Eds.), *Authentic learning environment in higher education* (pp. 48-60). Hershey, USA: Information Science Publishing.

Lizzio, A., Wilson, K., & Simons, R. (2002). University students' perceptions of the learning environment and academic outcomes: Implications for theory and practice. *Studies in Higher Education, 27*, 27-51.

Lodewyk, K. R., & Winne, P. H. (2005). Relations among the structure of learning tasks, achievement, and changes in self-efficacy in secondary students. *Journal of Educational Psychology, 97*(1), 3-12.

Neo, M., & Neo, T-K. (2010). Students' perceptions in developing a multimedia project within a constructivist learning environment: A Malaysian experience. *The Turkish Online Journal of Educational Technology, 9*(1).

Parker, L., & Rennie, L. (1998). Equitable assessment strategies. In B. J. Fraser & K. Tobin (Eds.), *International Handbook of Science Education* (pp. 897-939). Dordrecht: Netherlands: Kluwer Academic Publishers.

Slavin, R. E. (2012). *Educational psychology: Theory and practice* (10th ed.). New Jersey: Pearson Education.

Timmerman, B. E., Strickland, D. C., & Carstensen, S. M. (2008). Curricular reform and inquiry teaching in biology: where are our efforts most fruitfully invested?. *Integrative and Comparative Biology, 48*(2), 226-240.

Woo, Y., Herrington, J., Agostinho, S., & Reeves, T. C. (2007). Implementing authentic tasks in web-based learning environments. *Educause Quarterly, 30*(3), 36-43.

Woolfolk, A., Hughes, M., & Walkup, V. (2008). *Psychology in education.* London: Pearson Education.

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The Opinions of Science and Technology Teachers Regarding the Usage of Out-Of-School Learning Environments in Science Teaching

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ABSTRACT

The goals of this study are to explore and document the science and technology teachers' opinions regarding (a) the out-of-school learning environments, (b) the contribution of these environments make to science teaching, (c) the aims of their usage in science teaching, and (d) why they are not being used in science teaching. Semi-structured interviews were conducted to elicit teachers' opinions about the current situation of out-of-school learning environments in science teaching. Study data were collected from 36 science and technology teachers in the Gölcük district of Kocaeli province in 2011-2012 academic year. Interview analyses revealed that teachers were cognizant about the role of out-of-school learning environments in the teaching and learning processes. Participants associated out-of-school learning environments with numerous examples. The teachers stated that out-of-school learning environments have a positive effect on students' cognitive and affective development. They pointed out that due to various problems that arose while carrying out these activities, they could not use these environments at the desired level. The teachers recommended solutions to these problems and stated that out-of-school learning environments could be used more often in the field of education to resolve these problems.

Keywords: Informal Learning Environments; Out-of-School Learning; Science Teaching; Teacher's Opinion.

INTRODUCTION

Today's rapidly evolving and developing knowledge base requires individuals to obtain various qualifications. The role of education is critical at this point as education means helping individuals to intentionally gain the necessary knowledge and skills, within a specific period of time, and the framework of a curriculum, in order to reach certain goals (Laçin Şimşek, 2011). In this regard, formal education plays as much an important role as informal education in bringing these qualifications to individuals (Chin, 2004; Balkan Kıyıcı & Atabek Yiğit, 2010). Learning is not only about all of the processes between teacher and student within a specific programme, it also takes place outside of school. Informal education, which means life-long learning, also involves all of the learning that exists outside of school (Eshach, 2007). In this regard, as with formal education, informal education enhances

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individual development, increases the welfare of society, and helps the individual learn by creating a perfect environment (Türkmen, 2010).

Both formal and informal education play an important role in achieving specified goals and producing qualified individuals. Informal education includes the unintended learning that happens in the informal learning environment, such as outside of the classroom, either voluntarily or involuntarily, without any plans or programmes being set for learning time, learning support, and reaching goals (Borat, 2009). Meanwhile, learning, which is the result of educational and training activities performed within informal learning environments (according to certain plans and programmes in order to reach specific goals), is called out-of-school learning (Laçin Şimşek, 2011). Thus, Hannu (1993) describes out-of-school learning as learning that takes place within school time, within the scope of institutions and environments but outside of the physical borders of the school, yet in-line with the curriculum. Hence, informal learning and out-of-school learning differ in terms of whether or not the learning occurs within a certain plan and programme. In this regard, informal learning environments are used for out-of-school learning; these environments are called out-of-school learning environments (Wellington, 1990; Hannu, 1993). Therefore, the use of out-of-school learning environments in educational activities will help attain the goal of producing qualified individuals (Ramey-Gassert, 1997; Melber & Abraham, 1999; Anderson, Lucas & Ginns, 2003; Chin, 2004; Türkmen, 2010).

In our current technological era, it is vital to raise individuals who follow advances in science and technology, understand the natural world, use scientific knowledge, and follow scientific processes to solve problems (MEB, 2006, MEB, 2013). Hence, these individuals will be able to construct scientific knowledge, value society and nature, and are literate in science.The natural sciences taught in formal education are essential. Science confronts us with events and phenomena that occur in daily life, while involving practical applications and abstract subjects (Doğru & Balkan Kıyıcı, 2005, MEB, 2006). Consequently, science, which allows human beings to identify themselves and their surroundings, is usually recognized as one of the courses in the school curriculum, yet from time to time students may have a hard time understanding it (Kaptan & Korkmaz, 2002). Science is found in everyday life. While improvements in science help advance technology, another notion is that science is at the centre of human life; every new step in technology helps science to advance (Demirci, 1993).

For a nation’s future and the progress of society, interrelated scientific and technological concepts were integrated within education, highlighting the importance of science and technology education (Tan & Temiz, 2003). Thus, the aims of science and technology education for individuals are to make sense of the nature and natural occasions, to create solutions for problems using the five senses, and to be science literate (Türkmen, 2010). However, if formal education in the classroom is applied away from real objects, facts, and events; understanding subjects related to science, and constructing them in their minds in meaningful way, may become difficult for students. A science and technology course that lacks authentic activities will not be meaningful for students. Students may develop negative attitudes towards science. Hence, the aims, objectives, and necessary learning will most likely be difficult to reach within the framework of a science and technology course. Supporting formal education with out-of-school learning environments will be a key solution in order to prevent these problems. This is because individuals interact with objects and realize facts within science topics in order to accomplish accurate and meaningful learning with the use of out-of-school learning environments (Ramey-Gassert, 1997).Thus, in order to provide accurate and meaningful learning, the use of out-of-school learning environments, for example, zoos, museums, and science centres, is attracting the attention of science educators (Smith, McLaughlin & Tunnicliffe, 1998). Many studies presented in the literature show that using out-of-school learning environments to support formal education presents an authentic experience for students. This allows students to interact with real objects, maintains their interest, keeps their curiosity alive (Pedretti, 1997; Meredith, Fortner & Mullins, 1997), allows individuals to understand scientific concepts, and also helps students take responsibility in their later learning (Olson, Cox-Petersen & McComas, 2001). Accordingly, it is possible to list museums, nature camps, botanical gardens, planetariums, zoos, industrial institutions and national parks as the main out-of-school learning environments that will ease the process of formal science education (Hannu, 1993; Howe & Disinger, 1998; Hill, Hannafin & Domizi, 2005; Laçin Şimşek, 2011).

Studies about out-of-school learning in Turkey are limited, and usually involve studies conducted in museums, science centres, and Nature camps. Therefore, it is necessary to carry out research that investigates the effect of using out-of-school learning environments in science education, which identifies problems using these environments, and which investigates issues that limit the use of out-of-school learning environments. The importance of these learning environments for educational goals is increasing day by day. In this regard, it is necessary for teachers to be aware of these out-of-school learning environments and their effects on learning. Identifying the opinions of teachers who are executors of activities regarding out-of-school learning environments, the problems they come across, and their solutions to these problems will address their perception of out-of-school learning environments. The goals in this study are to present the opinions of teachers regarding out-of-school learning environments, and to define the issues teachers may have encountered during the application of practices in out-of-school learning environments, together with solutions they have created in order to overcome these issues.

METHODOLOGY

This research is a descriptive qualitative study where the opinions of science and technology teachers regarding the current state of out-of-school learning environments in science teaching are gathered through semi-structured interviews.

a) Participants

The study participants were 36 science and technology teachers from Gölcük, Kocaeli, during the 2011-2012 academic year. Gölcük district is close to many out-of-school learning environments. We purposively chose the Golcuk district because of its characteristic. The purposive sampling method, which allows studying information-rich groups in-depth and in-detail (Yıldırım & Şimşek, 2011) was used while selecting the study group.

Table 1. *Demographic information about the participants*

	N	%
Sex		
Female	25	69.44
Male	11	30.56
Total	36	100
Years Taught		
1-5 years	18	50
6-10 years	10	27.78
11-15 years	5	13.89
16-30 years	3	8.33
Total	36	100
BS degrees		
Science and Technology Education Graduate	33	91.67
Chemistry Education Graduate	2	5.55
Biology Graduate	1	2.78
Total	36	100

Our participants were 25 female (%69.44) and 11 male (%30.56) science and technology teachers. Eighteen of them taught 1-5 years (%50); 10 of them taught 6-10 years (%27.78); 5 taught 11-15 years (%13.89); and 3 taught 16-30 years (8.33). While 33 of the teachers were science and technology education graduates (91.67), one of the remaining three teachers was a chemistry education graduate (%2.78) while the other two were biology graduates (%5.55).

b) Instrument

In order to research the importance, usage and current state of out-of-school learning environments in science teaching, semi-structured interviews were conducted with 36 science and technology teachers. (Patton, 2002).

A review of literature on informal learning, out-of-school learning, informal learning environments, out-of-school learning environments, and the science and technology course curriculum was conducted as the semi-structured interview protocol was designed. Subsequent to the review, in the second stage, topic titles were determined. After that, an item pool which is containing the questions related to the titles was established. In the third stage, a draft protocol was generated by choosing proper semi-structured interview questions and three experts in science education reviewed the protocol. Based on the feedback, we modified the interview protocol and re-organized the questions. The final interview protocol included seven questions. Thirty-six science and technology teachers volunteered participating in the interviews. The interviews were conducted in two months. Each of the interviews took, on average, one to one-and-a-half hours, and were audio-recorded on a digital recorder. The interview data were transcribed verbatim within the next three months. Next, we analyzed the transcriptions

c) Data Analysis

We employed content analysis. The purpose of the content analysis is to adjust and explain similar and relevant information from the gathered data into a certain concept and theme. In light of this, the organized logical facts are transformed into a format that is understandable by the reader. With content analysis, data are gathered through four phases (Yıldırım & Şimşek, 2011; Charles ve Mertler, 2002). At the stage of the codification of data, the information written and edited by the researcher is divided into meaningful parts and the conceptual meaning of every single part is investigated. These parts are defined by codes (Creswell, 2003). The codes gathered from the data are classified under certain categories called themes. In the process of defining themes (Şencan, 2005), and at the stage of editing and defining the data parallel to codes and themes, the codified and themed data are edited and reformatted to be more simply understood by the reader. Within the stage of interpretation of the findings, different inferences are made from the gathered data and the findings reach significance by creating relationships between the gathered information. The data of the teachers' opinions gathered through this research is symbolized as: T1, T2, T3,........T36. Statements gathered through content analysis are presented in *italic*, and parts that could not be defined in the teachers' opinions are presented in a series of dots.

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FINDINGS

Findings obtained from the interviews carried out with the teachers are presented in this section.

The first interview question directed to the teachers at the interviews and analysed within the research was "What are your opinions about out-of-school learning environments?" A codification diagram based on the teachers' answers is presented in Table 2.

Table 2. *Teachers' opinions regarding out of school learning environments*

Theme	Code	Teachers	Frequency (f)	Percentage (%)	Total Percentage (%)
Learning	Learning by Doing	T1, T2, T3, T4, T5, T7, T14, T16, T17, T19, T21, T23, T24, T28, T30, T31, T32, T34	18	11.32	30.81
	Permanent Learning	T5, T,30, T31, T34, T35	5	3.14	
	earning in the Medium	T7, T12, T19, T36	4	2.51	
	Testing What is Learnt	T5, T24	2	1.26	
	Learning by Discovery	T34	1	0.63	
	Active Learning	T21	1	0.63	
	Implicit Learning	T10	1	0.63	
	Learning Well	T1, T11	2	1.26	
	Learning through Senses	T1, T5, T6, T7, T10, T12, T14, T17, T18, T30	10	6.29	
	Interpretation of Science	T4, T7, T10, T30	4	2.51	
	Acquiring various Behaviours	T28	1	0.63	
Supporting	Supplement the Course	T5, T9, T12, T15, T19, T20, T22, T26, T27, T30, T32, T33, T34, T35, T36	15	9.43	27.67
	Solidify Abstract Knowledge	T1, T4, T7, T14, T19, T20, T25, T32, T35	9	5.66	
	For the Purpose of Reinforcement	T2, T9, T11, T13, T33	5	3.14	
	Contribute to Education	T2, T8, T11, T28	4	2.51	
	Increase Retention	T4, T34	2	1.26	
	Increase Motivation	T8, T20, T24	3	1.89	
	Simplify Learning	T21, T30, T35	3	1.89	
	Take Attention in Learning	T27, T36	2	1.26	
	Implementation in curriculum	T5	1	0.63	
Affective Domain	Loving the Teacher	T6	1	0.63	9.43
	Increase Love to the Course	T6, T7, T14	3	1.89	
	Increase Interest to the Course	T8, T10, T14, T20	4	2.51	
	Students Enjoy the Course	T6, T8, T10, T14, T17, T24, T30	7	4.40	
Affect	Effect to Success	T14, T17, T33	3	1.89	4.41
	Effect Social Interaction	T9,T28	2	1.26	
	Generate Misconception	T4	1	0.63	
	Students Join Society	T11	1	0.63	
Purpose	Relate Theoretical Knowledge with Daily Life	T5, T7, T9, T10, T11, T16, T26, T27, T30, T32, T35	11	6.92	11.95
	Use Theoretical Knowledge with Daily Life	T5, T9, T12, T16, T30, T35	6	3.77	
	Recognize the Benefits of Theoretical Knowledge to Daily Life	T5, T30	2	1.26	

Table 2. *Continued*

Theme	Code	Teachers	Frequency (f)	Percentage (%)	Total Percentage (%)
Quality	Out of School	T1, T4, T5, T6, T9, T10, T11, T12, T13, T14, T16, T22, T25, T26, T27, T28, T30, T31, T36	19	11.95	15.73
	Out of Class	T1, T6, T36	3	1.89	
	Trip	T8	1	0.63	
	Observation	T5, T19	2	1.26	
			159	100	100

In Table 2, when the teachers' answers are examined it is possible to see that 30.81% of the answers contain terms about *learning* in out-of-school learning environments, 27.67% of the answers tell us that these environments are supportive, 15.03% of the answers are about the quality of out-of-school learning environments, 11.95% of the answers contain the purposes about the usage of these environments and 9.43% are about the affective domain. The remaining 4.41% mention the effects of out-of-school learning environments. When the teachers' statements are examined it is seen that the teachers' opinions are supportive about learning in out-of-school learning environments.

Some excerpts from the interviews with teachers:

Teachers	Theme	Excerpts
T14	Quality Learning Supporting Affective Domain Affect	*"… So, even if it is at home, when it is out-of-school, the lesson is considered not to be boring anymore…"*
T30	Quality Learning Supporting Affective Domain Purpose	*"I think that the things kids see outside let them be more open and learning is easier. It (outdoor learning) is considered to be in the category of learning by living and making; making learning more permanent."*
T35	Learning Supporting Purpose	*"Informal learning environments are the most permanent learning places. The most permanent learning category, which proposes the students to give live and concrete examples."*

The second interview question was "Can you give examples of out-of-school learning environments?" The coding scheme created from the answers given by the teachers during the interview is presented in Table 3.

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Table 3. *Teachers' opinions regarding examples of out of school learning environments*

Theme	Code	Teachers	Frequency (f)	Percentage (%)	Total Percentage (%)
Industrial Organizations	Wind Power Plant	T10	1	0.63	10.06
	Power Station	T20, T23	2	1.26	
	Factory	T3, T8, T9, T10, T11, T12, T19, T32	8	5.03	
	Recycling Plants	T9, T10, T11, T21, T27	5	3.14	
Multipurpose Institutions and Organizations	Zoos	T1, T2, T5, T6, T8, T9, T10, T14, T17, T18, T19, T20, T21, T24, T26, T27, T29, T30, T31, T32, T33, T34, T36	23	14.46	33.32
	Museums	T8, T14, T17, T23, T24, T26, T27, T31, T33	9	5.66	
	Botanical Gardens	T1, T5, T7, T14, T20, T21, T26, T34	8	5.03	
	Science and Technology Museums	T2, T3, T21, T34	4	2.51	
	Monuments	T1	1	0.63	
	Observatories	T3, T5, T16, T36	4	2.51	
	Aquariums	T5	1	0.63	
	Science Centres	T3, T5	2	1.26	
	Meteorological Station	T18	1	0.63	
Health Organizations	Hospitals	T7, T12, T17, T18, T35, T36	6	3.77	4.40
	Hot Springs	T1	1	0.63	
Information Communication Technologies	Newspaper	T24	1	0.63	7.56
	Television/	T25, T27, T30	3	1.89	
	Radio	T29, T30	2	1.26	
	Computer Software	T26, T28, T33	3	1.89	
	Internet	T27, T33	2	1.26	
	Computer Games	T4	1	0.63	
Agencies that Support Education	Private Teaching Institution	T13, T15, T33	3	1.89	11.32
	Study Centres	T13	1	0.63	
	Laboratory	T2, T5, T7, T19, T20, T34	6	3.77	
	Student Knowledge Hall	T15	1	0.63	
	Science and Technology Club	T1, T8, T16, T24, T26, T27	6	3.77	
	Private Lessons	T33	1	0.63	
Organizations	Science Fair	T1, T8, T14	3	1.89	7.55
	Science Festival	T2, T5, T7, T17, T31	5	3.14	
	Exhibition	T5, T7, T12	3	1.89	
	Book Fair	T8	1	0.63	
Open Public Space	Nature	T5, T9, T10, T14, T19, T28, T30, T35	8	5.03	15.73
	Garden	T6, T9, T16, T27, T30, T31, T36	7	4.40	
	Lakeshore	T11, T26	2	1.26	
	Picnic Place	T12, T35	2	1.26	
	Forest	T19	1	0.63	
	Sea	T19	1	0.63	
	Vegetable Glasshouse	T19, T27	2	1.26	
	Street	T22, T35	2	1.26	
Places of Entertainment	Cinema	T6, T14	2	1.26	3.78
	Circus	T6	1	0.63	
	Theatre	T8	1	0.63	
	Ice-Skating Rink	T10	1	0.63	
	Sound Studio	T18	1	0.63	
Nearby Environments	Family	T28	1	0.63	6.29
	Home	T9, T13, T14, T15, T22, T27, T29, T30, T33	9	5.66	
			159	100	100

In Table 3, when the teachers' answers are examined, it possible to see that 33.32% of the examples were related to multi-purposed foundations-corporations and centres, 15.73% of the examples were related to open public spaces, 11.32% of the examples were related to school-assistant units and 10.06% of the examples were related to industrial foundations. A further 7.56% emphasized information communication technologies in order to illustrate out-of-school learning environments, 7.55% exemplify the organizations that are made, 6.23% exemplify the near surroundings, and 4.40% exemplify health corporations. The rest: 3.78% mention recreation areas.

Some excerpts from the interviews with the teachers:

Teachers	Theme	Excerpts
T1	Multipurpose Institutions and Organizations Health Organizations Organizations Agencies that Support Education	*"…In order to find it out about how to use thermal energy sources, nearby places such as the zoo in Darıca, the Science and Technology fair in Kocaeli, 'Yuruyen Kosk' and the botanical park in Yalova, the natural statue in Uluçınar, Bursa, could be visited."*
T8	Industrial Organizations Multipurpose Institutions and Organizations Places of Entertainment Organizations Agencies that Support Education	*"For example, even a school garden could be an informal learning environment because it involves a science lesson." "… Additionally, we have our tours to the factories here…"*
T22	Open Public Space Nearby Environments	*"So, by mentioning informal learning environment, if you don't say it is definitely here, and ask is it anywhere informal, I'd say everywhere. Home, streets, every place you step, even everywhere you breathe is a learning environment, in my opinion."*

The third interview question was "How do you think the usage of out-of-school learning environments would contribute to the learning process?" The coding scheme created from the answers given by the teachers during the interviews is presented in Table 4.

Table 4. *Teachers' opinions regarding the contribution of out-of-school learning environments to education*

Theme	Code	Teachers	Frequency (f)	Percentage (%)	Total Percentage (%)
Learning	Permanent Learning	T3	1	1.22	32.94
	Individual Learning	T3, T16, T17, T28	4	4.88	
	Learning by Doing	T3, T10, T16, T17, T19, T21, T29, T31, T33, T35	10	12.20	
	Learning through Senses	T3, T8, T17, T20, T23, T33, T35	7	8.54	
	Easily Learning	T28	1	1.22	
	Comprehensive Learning	T30	1	1.22	
	Short Term Learning	T36	1	1.22	
	Learning through Multiple Intelligence	T1, T35	2	2.44	
Affective Domain	Feel Comfortable	T7, T30	2	2.44	9.76
	Love to the Course	T10	1	1.22	
	Prevent Get Boring	T14, T24, T30	3	3.66	
	Increase Interest to the Course	T30	1	1.22	
	Increase Interest to Science	T26	1	1.22	
Affect	Prevent Forgetting	T8, T20, T21, T28, T30, T31	6	7.32	14.64
	Increase Success	T14	1	1.22	
	Increase Retention	T4, T33, T34, T35	4	4.88	
	Increase Motivation	T8	1	1.22	
Scientific Process Skills	Problem Solving Skills	T22	1	1.22	6.12
	Make inferences	T22	1	1.22	
	Have different perspectives	T22, T28	2	2.44	
	Observation	T3	1	1.22	
Supporting	Supplement the Teacher	T2, T11	2	2.44	36.60
	Supplement the Course	T5, T11, T12, T20, T33	5	6.10	
	Solidify Abstract Knowledge	T3, T23, T25	3	3.66	
	Create a Basilar to Future Learning	T34	1	1.22	
	Provide Discovery Chance	T4, T20	2	2.44	
	Provide Opportunity for Socialization	T7	1	1.22	
	Rehearsal / Reinforcement of Course	T13, T32	2	2.44	
	Provide Opportunity for Self Knowledge	T7, T22	2	2.44	
	Provide Opportunity for Self Assessment	T7	1	1.22	
	Provide Opportunity to Practice Theoretical Knowledge	T5, T9, T16, T17, T33	5	6.10	
	Choice of Profession	T12	1	1.22	
	Provide Opportunity to Relate Knowledge with Daily Life	T15, T27	2	2.44	
	Prevent Rote Learning	T15, T27	2	2.44	
	Set Intellectual Connections	T28	1	1.22	
			82	100	100

In Table 4, when the teachers' answers are examined, it is possible to see that 36.60% of the teachers think that it is supportive, 14.64% think it is effective, 32.94% think it is about learning, 9.76% mention about affective domains, and the remaining 6.12% mention about scientific process skills. Analyses revealed that a lot of the teachers state that usage of out-of-school learning environments supports teaching and eases/enriches learning.

Some excerpts from the interviews with teachers:

Teachers	**Theme**	**Excerpts**
T3	Learning Scientific Process Skills	*"… In the school environment everything is theory. This makes things stay abstract. It subjects) will provide a permanent learning for children to see, touch, live and investigate things themselves."*
T7	Affective Domain Supporting	*"… In a different environment, the child will both feel free and get the chance to explain the issue. …Will get a chance to analyse what he/she could and could not learn…"*
T8	Learning Affect	*"… Its effect is huge, its effects reach 90%, maybe even 100%. The student cannot forget what he/she has experienced, cannot forget what he/she had seen…"*

The fourth interview question asked "Are you using out-of-school learning environments?" When the teachers' responses were coded, 61.11% of the teachers reported that they use out-of-school learning environments, but 38.89% mentioned they did not use out-of-school learning environments. Analyses revealed that that most of the teachers use out-of-school learning environments.

Teachers who mentioned they were using out-of-school learning environments were asked "For what purpose do you use them?" The code schemes emerged from the teachers' answers are presented in Table 5.

Table 5. *Opinions of teachers who use out-of-school learning environments, regarding the purpose of using these environments*

Theme	**Code**	**Teachers**	**Frequency (f)**	**Percentage (%)**	**Total Percentage (%)**
Supplement to Subjects	In Velocity Unit	T1, T19	2	5.41	51.35
	Subjects Related to Flowering and Non-Flowering Plants	T7, T9	2	5.41	
	In Environment Related Subjects	T26	1	2.70	
	In Light Unit	T35	1	2.70	
	In Units Related to Animals	T30, T32	2	5.41	
	In Chemical Equations Unit	T36	1	2.70	
	In Pressure Unit	T36	1	2.70	
	In Related Units	T22	1	2.70	
	While Teaching a Lesson	T5, T6, T11, T12, T14, T19, T20, T22	8	21.62	
Contribution to Students	Review the Course	T13	1	2.70	21.62
	Solidify Abstract Knowledge	T3, T19, T20	3	8.11	
	Inform	T26	1	2.70	
	Supplement to the Homework	T35	1	2.70	
	Trip/Observe	T1, T8	2	5.41	

Table 5. *Continued*

Theme	Code	Teachers	Frequency (f)	Percentage (%)	Total Percentage (%)
Affect	Boring	T14	1	2.70	10.80
	Success	T14	1	2.70	
	Interest	T2	1	2.70	
	Curiosity	T2	1	2.70	
Learning	Learning of Plant Species	T7, T20	2	5.41	10.82
	Permanent Learning	T8, T19	2	5.41	
Learning Environment	Environment for Learning Well	T27	1	2.70	5.40
	Create Different Learning Environments	T24	1	2.70	
			37	100	100

Table 5 represents that 51.35% of the teacher participants viewed the use of these environments is helpful for the subjects taught, 21.62% of the teachers think that they benefit students, 10.82% think that they have a role in learning, 10.80% think that they have positive effects and 5.40% think that they provide a learning environment. Half of the participants mentioned that the purpose of using out-of-school learning environments is that they are beneficial to the subjects.

Teachers who mentioned they were not using them (out-of-school learning environments) were asked "Why don't you use them?" The coding schemes emerged from the teachers' responses are presented in Table 6.

Table 6. *Teachers' opinions regarding reasons for not using out-of-school learning environments*

Theme	Code	Teachers	Frequency (f)	Percentage (%)	Total Percentage (%)
Teachers Quality	Served for a Long Time	T15	1	5.88	47.05
	Being Newly Appointed	T23, T25, T29, T34	4	23.53	
	Do not Feel the Need	T18	1	5.88	
	Feel Anxious	T33	1	5.88	
	Express Verbally	T4	1	5.88	
School's Condition	Financial Difficulties	T17, T21, T28	3	17.65	29.41
	Transporting Students Daily to a Central School	T10	1	5.88	
	Laboratory Sufficiency	T34	1	5.88	

Table 6. *Continued*

Theme	Code	Teachers	Frequency (f)	Percentage (%)	Total Percentage (%)
Process	Problems Experienced in Planning	T10	1	5.88	11.76
	Being in Planning Stage	T16	1	5.88	
The Content of Science and Technology Programme	Covering the Last Units	T31	1	5.88	11.76
	Shortage of Time	T28	1	5.88	
			17	100	100

In Table 6, 47.05% of the teachers give the reason as teacher quality, 11.76% give condition of school and 11.76% give content of the science and technology programme as the reason. Nearly half of the teachers think the reason for not using out-of-school learning environments is the qualification of the teachers.

Some excerpts from the interviews with teachers:

Teachers	Theme	Excerpts
T18	Teachers Quality	*"No, I did not use them. I did not really need to use them, they are indeed necessary, but I simply didn't."*
T35	Contribution to Students	*"If it is something to observe only in daytime, we have lessons in the school garden."*

The fifth interview question asked "While using out-of-school learning environments as an educational resource what problems have you encountered, or may encounter, and what do you suggest in order to solve these problems?"

Teachers' opinions about existing problems and problems they may possibly run into while using out-of-school learning environments were identified from the interview data. The codification diagram, based on the teachers' answers, is presented in Table 7.

Table 7. *Teachers' opinions regarding problems they faced/will face while using out-of-school learning environments*

Theme	Code	Teachers	Frequency (f)	Percentage (%)	Total Percentage (%)
Parents	Socio-Economic Condition	T1, T6, T7, T16, T17, T18, T21, T22, T23, T24, T35	11	7.48	9.52
	Unconsciousness of the Parents	T13, T15, T31	3	2.04	
Student	Private Teaching Institution	T3, T21	2	1.36	2.04
	Students' Readiness	T32	1	0.68	

Table 7. *Continued*

Theme	Code	Teachers	Frequency (f)	Percentage (%)	Total Percentage (%)
School's Condition	Crowdedness of Students	T4, T13, T14, T21, T34	5	3.40	19.04
	Dual System in Education	T3	1	0.68	
	Attitude of Executives	T6, T7, T17, T20, T22, T28, T34	7	4.76	
	Financial Impossibility	T1, T5, T7, T8, T12, T15, T16, T19, T21, T25, T26, T28, T29, T30, T32	15	10.20	
Teachers	Responsibility	T1, T24, T25	3	2.04	12.92
	Student Control	T9, T14, T20, T21, T25, T27, T28, T31, T34	9	6.12	
	Safety of Students	T14, T17	2	1.36	
	Being Organized	T15, T20, T26, T27, T31	5	3.40	
Science and Technology Programme	Lack of Class Hours	T1, T23, T24	3	2.04	8.16
	Insufficiency in Time to Teach all Units in the Curriculum	T2, T11	2	1.36	
	Mismatch of Class Hours with the Content	T23, T30	2	1.36	
	Not Teaching a Lesson	T8, T10, T21, T27, T30	5	3.40	
Time	Length of Time Spent Getting Permission	T8, T10, T11, T12, T28, T31	6	4.08	5.44
	Students' Readiness	T32	1	0.68	
	Length of Time Spent in Intervention	T20, T29	2	1.36	
Transportation	Transportation Problem	T3, T16, T25, T30, T32	5	3.40	10.88
	Supply of Vehicle	T5, T9, T12, T26, T32	5	3.40	
	Road Safety	T9	1	0.68	
	Distance of Environments	T1, T2, T8, T12, T32	5	3.40	
			147	100	100

From Table 7, it is seen that 31.96% of the teachers' answers were about official correspondence, 19.04% about school situations, 12.92% emphasize the teachers, 10.88% are about transportation, 9.52% about the parents, 8.16% about the science and technology curriculum and 5.44% about time; finally 2.04% are about the students. The answers show that most of the teachers associated the problems they run into (or will run into) with official correspondence

Some excerpts from interviews with the teachers:

Teachers	Theme	Excerpts
T17	Parents School's Condition Teachers	*"Student security, because I take responsibility for the student..."*
T21	Parents School's Condition Teachers Student Science and Technology Programme	*"...for example in schools where there are only two or three classes, you can't perform all of them at the same time, you need to divide them into days, but time is a constrain*
T23	Parents Science and Technology Programme	*"...Because of matters about the student being ready, insufficient weekly course hours, the inconsistency between the syllabus and course hours."*

Teachers' opinions about suggestions for overcoming problems they may possibly run into (or the problems they already have) while using out-of-school learning environments are presented in Table 8.

Table 8. *Teachers' opinions regarding overcoming the problems they faced/will face while using out-of-school learning environments*

Theme	Code	Teachers	Frequency (f)	Percentage (%)	Total Percentage (%)
Parent	Raising Awareness of Parents	T6, T13, T15, T23, T25, T27, T32, T36	8	9.52	11.90
	Parents Can Take Their Children Away	T7	1	1.19	
	Parents Can Come to Trip	T9	1	1.19	
School's Condition	Class Size Can Be Diminished	T3, Ö13	2	2.38	4.76
	Schools Can Allocate Money	T17, T18	2	2.38	
Teacher	Briefing about the Use of Environments	T5	1	1.19	14.28
	Moral Support	T17, T20, T28, T36	4	4.76	
	Doing Organization Well	T26	1	1.19	
	Prefer Nearby Environments	T22, T36	2	2.38	
	School Principle's Support	T20, T28	2	2.38	
	Activities Can Be Flexible	T20	1	1.19	
	Grouping Students	T34	1	1.19	

Table 8. *Continued*

Theme	Code	Teachers	Frequency (f)	Percentage (%)	Total Percentage (%)
Official Correspondence	Permission Can Be Made Easier	T8, T11, T33	3	3.57	3.57
Student	Should Be Informed	T28, T31	2	2.38	2.38
Science and Technology Programme	Reducing Content	T2	1	1.19	13.09
	Can Be Added to the Programme	T1, T3, T4, T19, T24	5	5.95	
	Can Be Made Obligatory	T5	1	1.19	
	Education Programme Can Be Arranged	T14, T26, T23, T35	4	4.76	
Financial Possibility	Ministry of Education Can Be Sponsor	T1, T16, T21, T29	4	4.76	23.80
	Sponsors Can Be Found	T20, T29, T30	3	3.57	
	School Council Can Support	T20, T29, T30	3	3.57	
	Parents Can Support	T20, T28, T32	3	3.57	
	City Hall Can Support	T16, T21, T25, T26, T29, T30	6	7.14	
	Activities Can Be Conducted by City Hall	T7	1	1.19	
Time	Permission Can Be Taken Soon	T10, T33	2	2.38	9.52
	Extra Time	T1, T3, T5, T24	4	4.76	
	Can be at the Weekend	T21, T34	2	2.38	
Ministry	Programme Can Be Monitored	T4	1	1.19	14.28
	Exam Based Education Should Be Given Up	T3, T5, T7, T10, T11, T12	6	7.14	
	Extra Teachers Should Be Charged	T13, T36	2	2.38	
	Class Hours Should Be Extended	T18	1	1.19	
	Take These Environments to School	T7, T12, T19	3	3.57	
Environments' Features	Out of School Learning Environments Should Be Improved	T1	1	1.19	1.19
			84	100	100

Table 8 shows that 23.8% of the statements were about finances resources. It also shows that 15.47% of the statements mentioned the Ministry of Education, 14.28% put emphasis on teachers, 13.09% were about a science and technology programme, 11.9% were about parents and 9.52% were about time. In addition to these 4.76% were about the condition of the school, 3.57% were about official correspondence, 2.38% were about students, and the remaining 1.19% of the statements mentioned features of the environment. The majority of the teachers related their suggestions to problems that have emerged (or may emerge) while using out-of-school learning environments with money (or finances).

Some excerpts from the interviews with teachers:

Teachers	Theme	Excerpts
T17	School's Condition Teacher	*"...The school for example, sparing the resource for this class. Sparing the resource for science and technology class, saying that they are giving this resource to us, and we will teach this, this and that."*
T20	Teacher Financial Possibility	*"To resolve, we need the families to be present in the same area, because they somehow collect their children when they are around, we need to work in cooperation with the families..."*
T24	Science and Technology Programme Time	*"...Informal learning environments need to be included in the syllabus and time should be allocated. May be included into the programme. Every week, four hours can be allocated for science and one hour can be allocated for these kind of activities."*

DISCUSSION

The goals of this study were to elicit teachers' opinions about out-of-school learning environments, the contribution of these environments to science education, and why teachers use them or why they do not use them. Most of the teacher participants' opinions were classified under the themes of "learning that takes place in out-of-school learning environments; using out-of-school learning environments to support formal education; the effects of these environments on students; and their for reasons going to these environments." In addition, other opinions emphasize the quality of out-of-school learning environments. In their studies, Randler, Kummer and Wilhelm (2012), similar to the opinions of the teachers in this study, emphasized that out-of-school learning environments have a positive effect on students' learning processes and should be used supplementary to formal education.

Similarly, when the educational attainments and activities included in the curriculum of science and technology teaching of the MEB Head Council of Education and Morality were analysed, it is apparent that most of the topics included in the science and technology course are associated with out-of-school learning environments. Various educational trip-observation activities were included in the curriculum in order for students to gain knowledge and skills. Among the units these activities included are Reproduction, Growth and Development in Animals, What does the Earth's Crust consist of? in 6th grade; the units Human and Nature, Solar System and Beyond: Space Puzzle in 7th grade; and the unit Matter and its Features in 8th grade. According to the curriculum, these activities can be carried out in out-of-school learning environments, for example, zoos, observatories, hydroelectric plants, national parks, lakesides and field areas such as streams and soil (MEB, 2006; MEB, 2013).

It can be stated that teachers took part in this study were aware of the positive effects of out-of-school learning environments on students' learning. When the opinions of teachers using out-of-school learning environments were considered and that they were asked why they used them, along with their opinions regarding the contribution of these environments to education, it was apparent that they supported the use of out-of-school learning environments in education. They felt that these environments eased and enriched learning, while also positively affecting the student's affective and cognitive domain development. Several studies in the literature have presented similar findings with the present study (Falk & Adelman, 2003; Chin, 2004; Lukas & Ross, 2005; Braund & Reiss, 2006; Randler, Baumgärtner, Eisele

& Kienzle, 2007; Kenny, 2009; Randler, Kummer & Wilhelm, 2012; Dohn 2013; Khalil & Ardoin, 2011; Yavuz & Balkan Kıyıcı, 2012). In this study, examples of out-of-school learning environments asserted by the teachers are multipurpose institutions and centres, public places, industrial institutions, training units, organizations, information communication technologies, immediate surroundings, recreation spaces and health institutions. The examples out-of-school learning environments asserted by the teachers are coherent with literature. Hence, Laçin Şimşek (2011) and Hill, Hannafin and Domizi (2005) stated that these aforementioned environments present opportunities for out-of-school learning. Private teaching institutions, etude centres, laboratories, student information houses, science and technology societies, private lessons and such kind of education units and activities were among the examples. These environments were perceived as out-of-school learning environments by the teachers simply because educational activities also occurred in these areas as well as outside of the classroom.

The quality of teachers, a school's condition, the process and content of science and technology programmes were stated as reasons for not using out-of-school learning environments in teaching. While teachers were able to associate out-of-school learning environments with educational activities, a finding not to be overlooked is that 38.89% of the teachers did not use out-of-school learning environments. When the reasons for not using these environments were analysed, the findings show that it was mostly about the qualification of the teachers who conducted these activities. Financial limitations, not believing that it is necessary, and lacking the experience of conducting these kinds of activities before were reported as the main reasons why teachers did not use the environments.

As emphasized by Dewitt and Osborne (2007), the main reason is the great responsibility teachers need to take in order to reach the goals when using out-of-school learning environments, and the factors that need to be taken into consideration. In this regard, the biggest problem encountered by teachers who want to use out-of-school learning environments is the process related with the official correspondence. Although they are aware of the positive effects of out-of-school learning environments on students, they choose not to use these kinds of environments due to the length, complexity, and sometimes the negative results, of the administration process. Teachers reported the following problems: the prolonged dual education system, excessive number of students, the attitude of current school managers, and lack of financial opportunities in schools.

Similarly, Meiers (2010) stated that budget cuts and standardized test applications lowered the number of trips to the informal learning environments. Meiers provided the reasons as managers, teachers, application length in programme, and attitudes towards trips. The problems that relate to the quality of the teachers were defined as the teachers' organisational capabilities, supervising, and providing security for them. Griffin and Symington (1997) stated that trips to out-of-school learning environments can be stressful for teachers due to the trip itself, together with its organisation. Suggested solution for overcoming these problems can be listed as: improvements in finances, improvements that can be done under the control of the Ministry of Education, and improvements related to the role of the teacher in this process. A connection can be seen between the problems stated by teachers and solutions suggested by teachers.

CONCLUSION and SUGGESTIONS

Teachers stated that they are aware of the necessity of using out-of school learning environments in educational activities and provided many examples. At the same time, they put emphasize on the fact that out-of-school learning environments can contribute to teaching by easing and enriching the learning process, and affect the various affective and cognitive features of the students. Even though science and technology teachers are aware of the importance of using these kinds of environments in the science and technology curriculum, they have mentioned that they are not able to do so (or will not be able to do so), primarily due to difficulties in the processes of administrative permissions and for many other reasons.

Teachers have stated that if the current problems were eliminated, out-of-school learning environments would be more usable in education activities, and suggested solutions to the problems that might emerge or had already emerged. Therefore, in addition to this study, similar long term and extensive empirical studies concerned with the effects of out-of-school learning environments should be conducted with different age groups, different grade levels, different topics and courses. At the same time, studies should be designed to define the proficiency of teachers related to their level of ability in using out-of-school learning environments.

REFERENCES

Anderson, D., Lucas, K. B., & Ginns, I. S. (2003). Theoretical perspectives on learning in an informal setting. *Journal of Research in Science Teaching 40*(2), 177-199.

Balkan Kıyıcı, F.,& Atabek Yiğit, E. (2010). Science education beyond the classroom: A field trip to wind power plant. *International Online Journal of Science Education, 28*(12),1373-1388.

Borat, O. (2009). *İnformal öğrenme sisteminin kurulması için örgün ve yaygın öğrenme sistemlerinin incelenmesi.* "Hayat Boyu Öğrenme Kapsamında Türkiye'de İnformal Öğrenme Üzerine Ortak Bir Anlayış Geliştirme ve Farkındalık Oluşturma" projesi konferansları bildiri kitabı. Ankara: MEB TTK yayınları.

Braund, M.,& Reiss, M. (2006). Towards a more authentic science curriculum: The contribution of out-of-school learning. *International Journal of Science Education, 28*(12), 1373-1388.

Charles, M. C.,& Mertler, C. A. (2002). *Introduction to educational research* (4th ed.). Boston, MA: Allyn & Bacon.

Chin, C-C. (2004). Museum experience: A resource for science teacher education. *International Journal of Science and Mathematics Education, 2*, 63-90.

Creswell, J. (2003). *Research design: Qualitative, quantitative and mixed methods approaches* (2nd ed.). Thousand Oaks, CA: SAGE Publications.

Demirci, B. (1993). Çağdaş fen bilimleri eğitimi ve eğitimcileri. *Hacettepe Üniversitesi Eğitim Fakültesi Dergisi, 9*, 155-160.

DeWitt, J.,& Osborne, J. (2007). Supporting teachers on science-focused school trips: Towards an integrated framework of theory and practice. *International Journal of Science Education, 29*(6), 685-710.

Doğru, M. & Kıyıcı, T. (2005). İlköğretimde fen ve teknoloji öğretimi. M. Aydoğdu ve T. Kesercioğlu (Editör), *Fen eğitiminin zorunluluğu* s. 1-24. Ankara: Anı Yayıncılık.

Dohn, N. B. (2013). Upper Secondary Students' Situational Interest: A case study of the role of a zoo visit in a biology class. *International Journal of Science Education, 35*(16), 2732-2751.

Eshach, H. (2007). Bridging in-school and out-of-school learning: Formal, non-formal, and informal education. *Journal of Science Education and Technology, 16*(2), 171-190.

Falk, J.H.,& Adelman, L.M. (2003). Investigating the impact of prior knowledge and interest on aquarium visitor learning. *Journal of Research in Science Teaching, 40*(2), 163-176.

Griffin, J.,& Symington, D. (1997). Moving from task-oriented tolearning-oriented strategies on school groups. *Science Education, 81*, 763-779.

Hannu, S. (1993). Science Centre Education. Motivation and Learning in Informal Education. Unpublished doctoral dissertation. Helsinki University, Finland.

Hill, J.R., Hannafin, M. J.,& Domizi, D. P. (2005). Resource-based learning and informal learning environments: Prospects and challenges. L.T. Wee Hin, & R. Subramaniam (Ed.). *E-learning and virtual science centers*. USA, PA: Information Science Publishing.

Howe, R.W. & Disinger, J.F. (1998). Teaching environmental education using out-of-school settings and mass media. ERIC/SMEAC *Environmental Education Digest*, No. 1, ED 320 759.

Kaptan, F. ve Korkmaz, H. (2002, Eylül). *Probleme dayalı öğrenme yaklaşımının hizmet öncesi fen öğretmenlerinin problem çözme becerileri ve öz yeterlik inanç düzeylerine etkisi*. V. Ulusal Fen Bilimleri ve Matematik Eğitimi Kongresi, Ankara.

Kenny, H.A. (2009). Monkeying Around: Examining the Effects of a Community Zoo on The Science Achievement of Third Graders. Unpublished dissertation. The University of Toledo, Ohio, USA.

Khalil, K.,& Ardoin, N. (2011). Programmatic evaluation in association of zoos and aquariums–accredited zoos and aquariums: A literature review. *Applied Environmental Education & Communication, 10*(3), 168-177.

Laçin Şimşek, C. (2011). Okul dışı öğrenme ortamları ve fen eğitimi. C. Laçin-Şimşek (Editör), *Fen öğretiminde okul dışı öğrenme ortamları* (1.Baskı.), s. 1-23. Ankara: PegemA.

Lukas, K. E.,& Ross, S.R. (2005). Zoo visitor knowledge and attitudes toward gorillas and chimpanzees. *The Journal of Environmental Education*, *36*(4), 33-48.
MEB (2006).*Talim ve Terbiye Kurulu Başkanlığı, İlköğretim Fen ve Teknoloji Dersi (6, 7 ve 8. Sınıflar) öğretim programı*. Ankara: MEB Yayınları.
MEB. (2013). *İlköğretim Kurumları (İlkokullar ve Ortaokullar) Fen Bilimleri Dersi (3, 4, 5,6,7 ve 8. Sınıflar) Öğretim Programı*. Ankara: MEB Yayınevi.
Meiers, N.J. (2010). *Designing effective field trips at zoos and aquariums: A literature review*. Middlebury College, Vermont. 16.01.2012 tarihinde http://middlab.middlebury.edu/files/2010/08/LitReviewmeiers.pdf adresinden erişilmiştir.
Melber, L.H. & Abraham, L.M. (1999). Beyond the classroom: Linking with informal education. *Science Activities*, *36*, 3-4.
Meredith, J.E., Fortner, R.W.,& Mullins, G.W. (1997). Model of affective learning for non formal science education facilities. *Journal of Research in Science Teaching, 38*(8), 805-818.
Olson, J.S., Cox-Petersen, A.M.,& McComas, W.F. (2001). The inclusion of informal environments in science teacher preparation. *Journal of Science Teacher Education, 12*(3), 155-173.
Patton, M. Q. (2002). *Qualitative research and evaluation methods* (3rd ed). Thousand Oaks, CA: Sage Publications.
Pedretti, E. (1997). Septic tank crisis: A case study of science, technology and society education in an elementary school. *International Journal of Science Education, 19*(10), 1211-1230.
Ramey-Gassert, L. (1997). Learning science beyond the classroom. *The Elementary School Journal*, *4*, 433-450.
Randler, C., Baumgartner, S., Eisele, H.,& Kienzle, W. (2007). Learning at workstations in the zoo: A controlled evaluation of cognitive and affective outcomes. *Visitor Studies, 10*(2), 205-216.
Randler, C., Kummer, B.,&Wilhelm, C. (2012). Adolescent learning in the zoo: Embedding a non-formal learning environment to teach formal aspects of vertebrate biology. *Journal of Science Education and Technology*, *21*(3), 384-391.
Şencan, H. (2005). *Sosyal ve davranışsal ölçümlerde güvenilirlik ve geçerlilik* (1.Basım). Ankara: Seçkin Yayıncılık Sanayi ve Ticaret AŞ.
Smith, W.S., McLaughlin, E.,& Tunnicliffe, S.D. (1998). Effect on primary level students of in-service teacher education in an informal science setting. *Journal of Science Teacher Education*, *9*(2), 123-142.
Tan, M.,& Temiz, K.B. (2003). Fen öğretiminde bilimsel süreç becerilerinin yeri ve önemi. *Pamukkale Üniversitesi Eğitim Fakültesi Dergisi,13*(1), 89-101.
Türkmen, H. (2010). İnformal (sınıf-dışı) fen bilgisi eğitimine tarihsel bakış ve eğitimimize entegrasyonu. *Çukurova Üniversitesi Eğitim Fakültesi Dergisi, 3*(39), 46-59.
Wellington, J. (1990). Formal and informal learning in science: The role of the Interactive Science Centres. *Physics Education*, *25*, 247-252.
Yavuz, M.,& Balkan Kıyıcı, F. (2012). Science and technology teachers' opinions regarding the usage of zoos in science teaching. *The Online Journal of New Horizons in Education*, *2*(4), 21-33.
Yıldırım, A.,& Şimşek, H. (2011). *Sosyal bilimlerde nitel araştırma yöntemler*i (8.Baskı). Ankara: Seçkin Yayıncılık.

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Some Suggestions for Turkey within the Scope of Outdoor Education Success of New Zealand

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ABSTRACT

Outdoor education is evaluated a complementary component of the formal education. New Zealand is one of the most successful countries in terms of outdoor education. Therefore the author conducted interviews with three people who have been working at the outdoor education foundations in New Zealand. The aim of this study is to determine how New Zealand is successful at outdoor education and what Turkey can do in order to improve outdoor education. Qualitative approach and semi-structured interview were used in this research. 14 questions were prepared according to two main points. One of them was Taba-Tyler Model. The other point was intuitional management. 2 themes and 8 codes were determined at the end of the evaluations. The themes were named ‘programme development and management’. There were four codes under programme development: aim, content, learning experiences, evaluation. There were four codes under management: staff, collaboration and professional development of teachers, first aid, and expenditure. Turkey realizes the importance of outdoor education and funds some outdoor education via TUBITAK but this is not enough. Outdoor education in Turkey needs to be institutionalisation. This is important to get sustainability of outdoor education.

Keywords: Outdoor Education; Environment; Sustainability; New Zealand; Turkey

INTRODUCTION

‘School’ concept comes to mind when somebody mentions education. The schools are set up for mass education at the beginning of the 19th century and their duties are to educate people in order to have critical perspective, curiosity for research, to take active role for solving of environmental and political problems (Stevenson, 2007). School education is formal education and mostly based on theoretical knowledge; on the other hand practical lessons might be supported with outdoor education (Kassas, 2002). However outdoor education is mostly based on informal education (Miller, 2008; Mann, 2003).

Informal education is considered a kind of unplanned education but outdoor education is not unplanned education. Recently the outdoor education is considered complementary of the formal education (Dori &Tal, 1998). Outdoor education helps to develop environmental awareness, attitude, knowledge, time management, social relationship, success motivation, emotion control of people etc. (Carrier, 2004; Cumberbatch, 1999; Halligan, 2006; Miller,

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2008; Murdock, 2007; Schmitt, 2005). Piller (2002) says that outdoor education is a method in order to teach environmental subject however it is not clear that outdoor education is the most effective way to teach the environmental subject. On the other hand Okur (2012) finds that outdoor education is effective method in order to teach environmental subjects especially in terms of environmental awareness, environmental attitude, gaining holistic perspective and behavioural change. Outdoor education is even used interchangeable with environmental education (Ford, 1986). Hence outdoor education should be researched as a learning area or method. 'Outdoor education' term will be also used rest of the paper for environment education.

The outdoor education is considered complementary of the formal education of the schools. On the other hand natural environment comes to mind when the outdoor education is mentioned. Whereas the outdoor education might be used within zoos, museums, science centres, aquariums, botanic gardens, forests etc. (Bozdoğan, 2007; Fadigan & Hammrich, 2004; Koran, Koran & Ellis, 1989). The applications of outdoor environment education in the world and in Turkey expand (Carrier, 2004; Cumberbatch, 1999; Halligan, 2006; Miller, 2008; Murdock, 2007; Okur-Berberoglu, Yalcin-Ozdilek, Sonmez, & Olgun, 2014; Okur-Berberoglu, Guder, Sezer, & Yalcin-Ozdilek, 2013; Schmitt, 2005; Yalcin & Okur, 2014).

Why is the outdoor education important for Turkey?

Turkey is a developing country as one of the members of G-20 (UN, 2009) and adopts the Mickey Mouse economic model like the other developing countries (SANZ, 2009). In other words, the economic development is in front of the sustainable development. These countries say 'laissez faire' in order to earn much more money so use environmental resources unsustainable (SANZ, 2009).

On the other hand Turkey is like a bridge between continents and has biodiversity richness among European and Middle Eastern countries because Anatolia has a special geographical location (Baskent, Kose, Terzioglu, Baskaya, & Altun, 2005; Cepel, 2008; Erten, 2004). This special location gives rise to ecosystem diversity, eventually genetic and species richness. At this point, the sustainable development and economic development of Turkey are a big dilemma because it is quite difficult to manage sustainable economic development without missing natural resources. Turkey has specific geographical characteristics, environmental resources and richness so the outdoor education is a very valuable tool in order to teach sustainable environmental development.

Why New Zealand (NZ)?

NZ is among the developed countries (UN Statistics Division, 2013). Sustainable environmental development is also very important for NZ because it has many more endemic species. These species are under protection by laws. Biodiversity Strategy Plan is published in 2000 by the Ministry of Environment of NZ. (The New Zealand Biodiversity Strategy, 2000) NZ is one of the most successful countries in terms of using outdoor education as an alternative education and supportive education. The educators often mentions sustainable development of NZ within their courses. (The New Zealand Curriculum, 2007)

The aim of this research is to determine how NZ is successful at outdoor education and give some suggestions for Turkey. Within this research, I interviewed three people who have been working at the outdoor education centres in NZ.

METHODOLOGY

Qualitative approach and semi-structured interview were used in this research. 14 questions (Appendix) were prepared according to two main points. One of them was Taba-Tyler Model. This model is used in order to design education programme and there are four steps in the model: aims (2nd), content (6th, 7th), learning experiences (8th, 9th) and evaluation (10th) (Demirel, 2005). 2, 6, 7, 8, 9, and 10th questions proposed these steps. The other point was intuitional management and rest of the questions aimed at this point. The questions were checked out by two specialist, environmental education and linguistic at the last stage.

Firstly outdoor education centres in New Zealand googled. An e-mail was sent to them which explained the research's aim and requested an interview. Some people gave positive feedbacks and interviewer list was prepared. Hilary Chidlow from Auckland City Council, Dr. David Irwin from Christchurch Polytechnic Institute of Technology and Ruth Millar from Canterbury Environmental Trust (CET) accepted the interview invitation.

Auckland City Council is one of the biggest city council of New Zealand. The interview with Hilary Chidlow was hold on the 25 of November, 2011 at the city council building. Hilary Chidlow is the team leader at education department of the centre. She is a teacher and has been working there for 17 years.

The interview with Dr. Irwin was held on the 29th of November, 2011 at Christchurch Polytechnic Institute of Technology building. Dr. Irwin was selected because either his PhD was about outdoor education or he has been working as an academic at the outdoor education department.

The interview with Ruth Millar was held at the CET on the 29th of November, 2011. Ruth Millar used to be a primary school teacher for 20 years. She is enthusiastic to the environmental subjects so she has started to work at CET.

All the interviews were recorded with consent of the interviewees and by a voice recorder. The records were decoded after each interview. The researcher and environmental education specialist coded the interview document separately. The coherent level of the two decoding was evaluated Cohen kappa index (Wood, 2007). This index should be between 0.60- 0.70 in order to have satisfactory coherent (Wood, 2007). The index was calculated on SPSS and found 0.67. Its mean the coherent level of two researchers were satisfactory.

FINDINGS

2 themes and 8 codes were determined at the end of the evaluations. The themes were named 'programme development and management'. There were four codes under programme development: aim, content, learning experiences, evaluation. There were four codes under management: staff, collaboration and professional development of teachers, first aid, and expenditure.

1. Auckland City Council (Hilary Chidlow)

Auckland has many more outdoor education centres. Probably this might be related to Auckland's situation because it is the biggest city of New Zealand. There are 3 education centres depending upon the city council. These are Ambury Regional Park, Waitakere Ranges Regional Park and Auckland Botanic Gardens. These three centres are open to public and have been organising educations for 20 years.

1.1. Programme development

1.1.1. Aim

The centres serves outdoor education for primary school students and nearly 25,000 students each year are educated at these centres. The students can have education throughout the day or half of the day. The aims of the centres are to educate the students in order to have environmental responsibility and take active role for solving environmental problems.

1.1.2. Content

All the programmes are coherent with the curriculum of the Ministry of Education of New Zealand. The environmental subjects in the curriculum are very comprehensive so it is not difficult to organise the content of the programme.

1.1.3. Learning experiences

The education programme is designed by Hilary Chidlow because she has outdoor education experience. The trainee teachers also work with her in the office. Each team works on an education programme and under Hilary Chidlow's responsibility. After each education programme, the feedbacks are provided from the students and in-service teachers in order to evaluate the programmes. The programme is changed if it does not work for the aims. However some education programmes which works for the aims have been using for 16 years. On the other hand everybody accepts that the programme should be changed according to the needs.

Some farms, agriculture areas, gardens are used for the educations. Hilary Chidlow says that there are some students who do not know milk is getting from a cow or who have never seen farm life. These students can experience farm life at these educations and join to some activities. The activities are based on experiential learning however some methods such as drama, role play are also used at the educations.

1.1.4. Evaluation

The educations are evaluated via the feedbacks but these evaluations are not based on scientific basis. They are just related to understanding of the education process or how the educations work. Some questions are asked students and in-service teachers at the beginning, in the middle or at the end of the programme. On the other hand the student capacity of the centres are high so they cannot follow up them. The teams do not have any collaboration with academician for the programme evaluation. Some team members have PhD degree so the evaluation is done with them. The programmes are just for half day or one day so the teams do not expect any environmental behaviour change in this short term. Hence the interview results of the students and in-service teachers are enough for the teams.

1.2. Management

1.2.1. Staff

There are 3 full- time, permanent teachers and 3 or 4 full-time, temporary teachers. The city council looks for some points from the teachers such as teaching experience, enthusiastic to environmental subjects, liking outdoor education and having experience about outdoor education etc.

1.2.2. Collaboration and professional development of in-service teachers

The centre also organises workshops for the in-service teachers. Next year's workshop programme is organised from previous year. All the in-service teachers are volunteers in order to join the workshops. The content of the workshop programme is organised according to the in-service teachers' needs. The centre team has interview with the in-service teachers and ask them which environmental subject should be in the programme in terms of their professional development. The workshops are mostly for one day and at the theoretical level.

1.2.3. First aid

There are medical teams at the education centres and all the teachers in the centres have outdoor first aid training. If something happens, the teachers do emergency treatment. If serious events happen the medical team takes in charge.

1.2.4. Expenditure

The most difficult side of the programme process is the budget. The three education centre of the Auckland City Council had been funding by the Ministry of Education until last 3 years. This fund was cut according to the last political laws. Now the only financial resource of the centres is the city council. The programmes' budgets are supported according to the feedback which is provided from students and in-service teachers. Each student pays money when they join to the programme. This money is usually 2 NZ $ but some programmes' prices might be 4 NZ $, 5 NZ $ or 15 NZ $.

The pamphlets are published and renewed for each year. Each pamphlet explains which education program is carried out in which centre, which activities are used and suitable for which age group, what the price of the programme is for per student and contact details for the reservation. The internet page of the centre is also renewed so the people can easily reach to the centre. For example, if the in-service teacher decides for a programme, s/he can easily reach the programme director very easily and can have appointment. The time table of the centres are very busy because they are very popular among the students and in-service teachers. It is recommended that the in-service teachers should have the appointment least 6 months before the education.

The education centres of the Auckland City Council use some buildings in the regional parks but it is not cheap to direct an outdoor education centre. The cost of an outdoor education centre might be roughly 70,000- 80,000 NZ $.

2. Christchurch Polytechnic Institute of Technology (CPIT) (Dr. David Irwin)

CPIT is under Christchurch University. Polytechnic schools are equal to vocational schools in Turkey. Polytechnic schools have educations for 3 years, 1 year and 6 months. CPIT has been graduating students since 1995.

2.1. Programme development

2.1.1. Aim

The environmental education was a course under the adventure education however the outdoor environmental education has become an independent course over the time. Each certificate and diploma programme have own aims. On the other hand the common aim of these programmes is to educate people in order to have awareness to the natural environment.

2.1.2. Content

The programme of 'Sustainability and Outdoor Education' is for 3 years and CPIT gives bachelor degree diploma at the end of the programme. There are two more course options for one year in order to support professional development of the in-service teachers, these are 'Graduate Diploma in Sustainability and Outdoor' and 'Graduate Certificate of Environmental and Outdoor Leadership'. There are also two other course for 6 months for in-service teachers, these are 'Certificate of Outdoor Recreation' and 'Certificate of Skiing Teaching'. The outdoor education of New Zealand has started within adventure education.

Some topics overlap within adventure education, outdoor education and environmental education. Some topics are specific for each education. Hence sometimes it might be difficult to determine content of the education programme. The programme development team is very careful when they determine the aims and contents of the programmes.

2.1.3. Learning experiences

The education programme is designed according to the aims of the department by 5 academicians who works there. The main point here is the programme should be based on experiential learning. The education experiences of these academicians are also effective on development of the programme.

2.1.4. Evaluation

The feedback is provided from the students at the end of each year and the programme is revised according to these feedbacks. The educators get specific feedbacks after graduation or they can evaluate the students' scores as feedback. The feedbacks are mostly qualitative.

2.2. Management

2.2.1. Staff

11 people are working at the Sustainability and Outdoor Education department. These people have bachelor, master, PhD degree or having on master or PhD education. The graduation research area of these people are related to academic or industrial branch of outdoor education. These people are assigned according to the department's need.

Each department has a head of department. This person depends upon the manager; the manager depends upon the dean. Each department has own security responsibility. There is also a technician who is responsible on equipment at the department.

2.2.2. Collaboration and professional development of in-service teachers

CPIT has collaboration with many local schools in Christchurch. These schools are supported in terms of outdoor education. There are also international exchange programmes for students and academicians at the department.

Environmental education consists of many more sub-subjects so it is very open to change and development. Environmental education was a sub-subject under adventure education and is a discipline on its own now. Especially in-service teachers needs professional development in terms of environmental education because the change and development are very fast at environmental subjects and their effects. These professional development subject might be related to increase outdoor experience of the in-service teachers or to increase graduated number of Sustainability Education Department.

2.2.3. First aid

Each educator has first aid certificate at the department.

2.2.4. Expenditure

The budget of the department consists of students' tuition and university budget. Annual fee per students is about 5,000 NZ $. When the students graduate from the department they can especially work at some outdoor education centres in Australia. The graduated students might work as a teacher at the primary and secondary schools. There also many more eco-schools in New Zealand and all of them have 'environmental education' course. There are also many more environmental activities within this course. However there is not any obligation to have outdoor education certificate or diploma in order to be teacher at these eco-schools. If a teacher is enthusiastic to the environmental subjects, s/he can easily be a teacher for this course. The eco-schools or the other schools might be a good job vacancy for the graduated students.

3. Canterbury Environmental Trust (CET) (Ruth Millar)

CET has been servicing since 1992 and especially focuses on outdoor education. The outdoor education is especially used for environmental education.

3.1. Programme development

3.1.1. Aim

The target group of the education is 11-12 years old students. CET aims the students to like natural environment, to evaluate the environmental subjects as scientifically and to take active role for solving environmental problems.

3.1.2. Content

The sustainability is the main concept within environmental education in NZ so every topic under sustainability takes part in the education programme. CET is also very careful about to design an education programme which is coherent with curriculum of the Ministry of Education. The environmental subjects in the curriculum are very broad so they can easily choose any environmental subject.

3.1.3. Learning experiences

There are no specific education programme within the CET. There is a small committee with 4 or 5 people. These people have environmental education experience so they decide which and how the programme should be used. Each teacher carries out own education programme. The main and the first part of the outdoor education is experiential education. Experiential education is used for each education. The other educational methods are at the second level.

3.1.4. Evaluation

A survey is given to the students at the end of the programme and their opinion are taken as feedback.

3.2. Management

3.2.1. Staff

The staff structure of the CET is a bit complicated. Sometimes the CET gets support from academicians or NGOs. The management system of the CET is very simple. There is an administrative board and there are 6 or 7 people at this board. All the board members are working as volunteer.

3.2.2. Collaboration and professional development of in-service teachers

CET usually have collaboration with academicians (for example from Lincoln University) or NGOs (for example Untouched World).

3.3.3. First aid

The other important point is the security of the students. The educators of the CET are responsible for the security so if any medical problem happens, the educators contact directly to the related departments.

3.2.4. Expenditure

The CET and has an internet web-site. The schools can have an appointment via this web site. The CET does not have any other advertisement tool but it accepts donations. It is like an NGO so sometimes it can use some governmental buildings. The CET also takes money from the students for joining to the education programmes. The cost of a founding like the CET is around 20,000- 30,000 NZ $ if the building construction is excluded.

RESULT

Auckland City Council, Christchurch Polytechnic Institute of Technology and Canterbury Environmental Trust are carried out outdoor environmental education successfully. It is thought that their education programmes and applications are important at this success:

- The target groups of Auckland City Council and Canterbury Environmental Trust are primary school students. Hanna (1995) emphasizes that environmental education should start at early ages. These two institution’s target groups are coherent with the literature.
- Especially Auckland City Council carries out CIPP evaluation model. There are four main concepts at this model: context, input, process, and product (Stufflebeam, 2003) so the education programmes of the Council should be analysed detailed.
- Auckland City Council also selects the environmental subjects from daily life. Palmberg and Kuru (2000) and Piller (2002) say that outdoor environmental education subjects should be selected from daily life and the subjects should be problem-based.
- All these institutions carries out experiential education. The literature emphasizes that outdoor education should be experiential (Brookes, 2004; Goudie, 2008, Auer, 2008).
- Goudie (2008) emphasizes that there should be collaboration between universities, NGOs and governmental institutions and these three institutions have collaborations.

SUGGESTIONS

1. The outdoor education is open to new developments. Turkey knows the importance of outdoor education because some outdoor environmental education projects are funded by TUBITAK (The Scientific and Technological Research Council of Turkey) within 4004 coded science and society projects. On the other hand the funding of these projects is not enough, the outdoor education in Turkey needs to institutionalisation. This institutionalisation is important to have sustainable environment education in Turkey.
2. NGOs, private and governmental sectors should support the outdoor education activities in terms of money and morally. Each outdoor activity needs time, budget and security. The institutions and educators should be supported in terms of outdoor education. United Nations (UN) within Global Compact wants private sector to support some environmental organisations. For example Garanti Bank supports WWF (The World Wide Fund for Nature) or Koc Holding looks after monk seal ‘Badem’ and funds Badem’s looking after. UN within Global Compact can force the private sector in order to fund the outdoor education centres.
3. The outdoor education departments and centres should be opened within universities. The Sports Vocational Schools at the universities have camp activities. These schools have essential backgrounds and infrastructure so the outdoor education departments might be opened within these schools. The adventure education and the environmental education departments might be under The Sports Vocational Schools. The graduated students from the outdoor education departments might work various outdoor education centres.
4. The National Ministry of Education of Turkey (MEB) and Higher Education Council of Turkey (YOK) might revise the curriculum. Environmental education course might be

compulsory course at the primary, secondary and tertiary levels. There is eco-school project of MEB so it needs environmental education teachers. The deficiency of teachers might be supplied from graduated students from the outdoor education departments of the universities.

5. The outdoor educations centres should be opened at the universities. The outdoor environmental education covers different disciplines such as Biology, Education, Geology, Geography, Tourism, Economy, History, Culture, Anthropology etc. It might be unsufficient to think and place the outdoor education under a department. If an outdoor education centre is set up then it would be easy to work with different disciplines (Bunderson& Cooper, 1997; Piller, 2002; Brookes, 2004). There are thesis researches which are directed collaboration with different disciplines at the Otago University of New Zealand.

6. Otago University is the most successful university in terms of carrying out sustainability in NZ. There is a Sustainability Centre of the Otago University (Otago University, 2012) and interdisciplinary researches are happened at the centre. The vice chancellors of the universities came together in order to discuss sustainable using of the natural environment in Tallories, France in 1990. They decided what the responsibility of the universities are for sustainable development under 10 topics (Tallories Declaration Action Plan, 2012). One of the topics was related to what the universities' strategic plans should be for sustainability, to develop new education programmes, collaboration with NGOs and schools, to support primary, secondary and tertiary levels for environmental education. The Tallories Agreement was signed by 436 vice chancellors of the universities from 52 countries. The Ankara University is the one university which signed the agreement from Turkey (Tallories Declaration, 2012). The universities in New Zealand have own 'sustainable strategic plan' although none of them signed this agreement. These universities carry out recycling, compost production, pick up the waste according to the components, plant the local flowers and trees, green building designs, alternative energy resources, using energy efficiently in the campus. They also organise different educations and activities for the students, employees and academicians.

- The activities of the Ankara University are not known. YOK might want the universities to have a sustainable strategic plan, carry out it and to share their acquisitions with the other universities.

- A sustainable centre might be set up like Otago University. The scientific researches, various educations and activities might be carried out there.

7. The University of Waikato Teaching Development Unit organises some workshop for the academicians in order to develop their professional development. One of the topics of these workshops was "Integrating 'sustainability' concept into teaching: How can I teach sustainability if I do not know its meaning". I attended to this workshop on the 14th of February, 2012 and there were academicians from management, ecology, education, tourism, natural science, engineering, law, economy departments. All these academicians were mentioning sustainability within their courses so I thought that it should be more useful to set up an independent sustainability centre instead of having a department under a faculty.

8. It is very obvious that it is not easy to set up and open a department or centre, to organise staff, education programme, technical infrastructure etc. However if the universities start to outdoor education somewhere, it will be develop slowly slowly in further times. Each feedback from the academicians, employees, students or in-service teachers will help to improve more developed education programmes, have favourable outputs.

9. There are no 'one size fits all' education programme so each country can consider own outdoor education situation. The countries can develop own education programmes and use own infrastructure because the outdoor environmental education programmes should be placed-based (Brookes, 2004; Emmons, 1997; Harrison, 2010; Irwin, 2010; Lugg & Slattery, 2003; Piller, 2002) and problem-based (Palmberg& Kuru, 2000; Piller, 2002). Every country

might have various environmental resources and problems so they can develop various outdoor education activities.

10. The target groups of Auckland City Council and Canterbury Environmental Trust are primary school students; the target group of Christchurch Polytechnic Institute of Technology is university students. There might be held an interview with some institution whose target group is secondary school students. Their programme and outputs might be different.

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REFERENCES

Auer, M. A. (2008). Sensory perception, rationalism and outdoor environmental education. *International Research in Geographical and Environmental Education, 17* (1), 6-12.

Baskent, E. Z., Kose, S., Terzioglu, S., Baskaya, S. & Altun, L. (2005). The complete the biodiversity with the forest amenajman: The reflection of 'GEF' projects. Retrieved from http://www.orman.ktu.edu.tr/om/abds/oamenajmani/downloads/amenajman/eserler/bc_tasarim.pdf on the 14th of December, 2014.

Bozdoğan, A. E. (2007). "Bilim ve Teknoloji Müzelerinin Fen Öğretimindeki Yeri ve Önemi". PhD Thesis, Gazi University Educational Science Institute, Ankara.

Brookes, A. (2004). Astride a long-dead horse: Mainstream outdoor education theory and central curriculum problem. *Australian Journal of Outdoor Education, 8* (2), 22-33. Retrieved from http://proquest.umi.com.ezproxy.waikato.ac.nz/pqdweb?index=0&did=1058624701&SrchMode=1&sid=4&Fmt=6&VInst=PROD&VType=PQD&RQT=309&VName=PQD&TS=1317861588&clientId=8119 on the 14th of December, 2014.

Bunderson, E. D.& Cooper, J. G. (1997). An environmental education partnership for Utah Secondary Schools: A plant species ınventory for the Box Death Hollow Wilderness Area. *The American Biology Teacher, 59* (6), 332-336.

Carrier, A. M. (2004). "The Emergence of Democratic Educational and Experiential Educational Philosophies in the Practice of Outdoor Education". Master of Art Thesis, University of Toronto, Canada.

Cepel, N. (2008). *Ecological problems and solutions* (3rd Press) Ankara: TUBITAK Popular Books Series.

Cumberbatch, A. R. (1999). "The Effect of Outdoor Environmental Education on In-Class Behaviors of Sixth, Seventh and Eighth Grade Students". PhD Thesis, The Union Institute Graduate College, Cincinnati, Ohio, USA.

Demirel, Ö. (2005). *Eğitimde Program Geliştirme*. Ankara: PegemA Yayıncılık.

Dori, Y. J. &Tal, R. T. (1998). Formal and informal collaborative projects: Engaging in industry with environmental awareness. *Informal Science, 84* (1), 95- 113.

Emmons, K. M. (1997). Perceptions of the environment while exploring the outdoors: A case study in Belize. *Environmental Education Research, 3* (3), 327-344. Retrieved from http://www.tandfonline.com/doi/pdf/10.1080/1350462970030306 on the 14th of December, 2014.

Erten, S. (2004). Biodiversity as a rising value in the international scale. *The Journal of Hacettepe University Faculty of Education, 27,* 98-105. Retrieved from http://www.efdergi.hacettepe.edu.tr/200427SİNAN%20ERTEN.pdf on the 14 of December, 2013.

Fadigan, K. A. & Hammrich, P. L. (2004). A longitudinal study of the educational and career trajectories of female participants of an urban informal science education program. *Journal of Research in Science Teaching, 4* (8), 835- 860.

Ford, P. (1986). Outdoor education: Definition and philosophy. *ERIC Information Analyses Products,* RC 015661, 1986, 1-15. Retrieved from http://www.ericdigests.org/pre-923/outdoor.htm on the 28th of January 2012.

Goudie, C. A. (2008). Institutionalizing ecological literacy: A critical component of the new "Green" Economy". *Business Perpectives, 19* (3), 16- 21.

Halligan, M. W. (2006). "Outdoor Education for Middle School Youth: A Grant Proposal Project". Master of Social Work Thesis, California State University, USA.

Hanna, G. (1995). Wilderness- related environmental outcomes of adventure and ecology education programming. *The Journal of Environmental Education*, 27 (1), 21-32.

Retrieved from http://www.d.umn.edu/~kgilbert/educ5165-731/Readings/Wilderness%20Outcomes%20Adv%20-Ecology%20-%20Hanna.pdf on the 29th of September 2011.
Harrison, S. (2010). Why we are here? 'Taking Place' into account in UK outdoor environmental education. *Journal of Adventure Education and Outdoor Learning, 10* (1), 3-18. Retrieved from http://www.tandfonline.com.ezproxy.waikato.ac.nz/doi/pdf/10.1080/14729671003669321 on the 14th of December, 2014.
Irwin, D. (2010). "Weaving the threads of education for sustainability and outdoor education", Published PhD Thesis, 2010, University of Canterbury, Christchurch, New Zealand. Retrieved from http://www.signsofchange.org.nz/abode/685/documents/14_David_Irwin_Outdoor%20Education%20CPIT.pdf on the 14th of December, 2014.
Kassas, M. (2002). Environmental education: Biodiversity. *The Environmentalist*, *22*, 345-351.
Koran, J. J., Koran M. L. & Ellis, J. (1989) Evaluating the effectiveness of field experiences 1939-1989. *Visitor Behavior*, *4* (2), 7- 10.
Lugg, A., & Slattery, D. (2003). Use of national park for outdoor environmental education: An Australian case study. *Journal of Adventure Education& Outdoor Learning*, *3* (1), 77-92. Retrieved from http://www.tandfonline.com.ezproxy.waikato.ac.nz/doi/pdf/10.1080/14729670385200261 on the 14th of December, 2014.
Mann, K. (2003). A Snapshot of Outdoor Leadership Preparation Opportunities in Australia. 13. National Outdoor Education Conference (s. 121-128), April 14-16, Australia: University of South Australia.
Miller, T. J. (2008). "The Alaska Factor: Outdoor Educatıon Program Desıgn In Alaska". Master of Education Thesis, University of Alaska, USA.
Murdock, M. L. (2007). "Outdoor Education As A Protective School-Based Intervention For "At-Risk" Youth: A Case Study Examining The Muskoka Woods Leadership Experience For "Students Of Promise" Program". PhD Thesis, University of Windsor, Ontario, Canada.
Okur, E. (2012). "Outdoor Experiential Teaching: Ecology Application". PhD Thesis, Canakkale Onsekiz Mart University, Turkey.
Okur- Berberoglu, E., Guder, Y., Sezer, B., & Yalcin-Ozdilek, S. (2013). An outdoor hydrobiology activity's effect on student's affective perspective, Case study: Canakkale, Science camp. *Kastamonu University Kastamonu Education Journal, 21* (3), 1177-1198. Retrieved from http://79.123.169.199/ojs/index.php/Kefdergi/article/view/33/35 on the 3rd of September, 2013.
Okur-Berberoglu, E., Yalcin-Ozdilek, S., Sonmez, B., Olgun, O. S. (2014). Theatre and sea turtles: An intervention in biodiversity education. *International Journal of Biology Education, 3* (1), 24- 40. http://www.ijobed.com/3_1/vol3issuepart3.pdf, 29.04.2013.
Otago University (2012). Retrieved from http://www.csafe.org.nz/ on the 12th May 2012.
Palmberg, I. E., & Kuru, J. (2000). Outdoor activities as a basis for environmental responsibility. *The Journal of Environmental Education, 31* (4), 32-36. Retrieved from http://proquest.umi.com.ezproxy.waikato.ac.nz/pqdlink?Ver=1&Exp=09-26-2016&FMT=7&DID=59564817&RQT=309 on the 14th of December, 2014.
Piller, N. (2002). "Outdoor education: A dialogue between theory and practice, and ımplementation suggestions for the Discovery 10 Program at St. George's School." The University of British Columbia, The Faculty of Education Department of

Curriculum Studies, Master of Arts Thesis, Canada. Retrieved from https://dspace.library.ubc.ca/bitstream/handle/2429/13379/ubc_20020534.pdf?sequence=1 on the 14th of December, 2014.

SANZ (Sustainable Aotearoa New Zealand INC) (2009). *Strong Sustainability for New Zealand: Principles and Scenarios*. Auckland, New Zealand: Nakedize Limited Publication.

Schmitt, T. R. (2005). "Teachers' Perceptions of Value and Effects of Outdoor Education During an Age of Accountability". PhD Thesis, Loyola University, Chicago.

Stevenson, R. B. (2007). Schooling and environmental education: contradictions in purpose and practice. *Environmental Education Research, 13* (2),139- 153.

Stufflebeam, D. L. (2003). The CIPP Model for Evaluation, in *International Handbook of Educational Evaluation*, Part I (Ed. Thomas Kellagan, Daniel L. Stufflebeam, Lori A. Wingate). Netherlands: Kluwer Academic Publishers.

Tallories Declaration (2012). Retrieved from http://www.ulsf.org/programs_talloires_signatories.html, on the 21st of April, 2012.

Tallories Declaration Action Plan (2012). Retrieved from http://www.ulsf.org/pdf/TD.pdf on the 21st of April 2012.

The New Zealand Biodiversity Strategy (2000). Retrieved from http://www.biodiversity.govt.nz/pdfs/picture/nzbs-whole.pdf on the 14th of December, 2014.

The New Zealand Curriculum (2007). Retrieved from file:///C:/Users/bilber/Downloads/The-New-Zealand-Curriculum.pdf on the 14th of December, 2014.

UN (United Nations) (2009). Investment policy developments in G-20 countries. Retrieved from http://unctad.org/en/Docs/webdiaeia20099_en.pdf on the 18th of May, 2013.

UN Statistics Division (2013). Composition of macro geographical (continental) regions, geographical sub-regions, and selected economic and other groupings. Retrieved from http://unstats.un.org/unsd/methods/m49/m49regin.htm#developed on the 14th of December, 2014.

Wood, J. M. (2007). *Understanding and computing Cohen's Kappa: A tutorial. WebPsychEmpiricist.* Retrieved October 11, 2009 from http://wpe.info/papers_table.html

Yalcin, S. & Okur-Berberoglu, E. (2014). The effects of electromagnetic field (EMF) education within ecopedagogy on EMF awareness. *Pamukkale University Journal of Education, 35* (1), 143-156. Retrieved from http://pauegitimdergi.pau.edu.tr/Makaleler/1553776384_10.makale.pdf, on the 1st of February, 2014.

APPENDIX

Interview questions

Permission: Could you please give me permission to record your voice?:

1. How many years has this centre/ foundation been going?
2. What are the aims of this centre/ foundation?
3. How many staff are there working in your centre/ foundation?
4. What sort of qualifications do you look for when you take on staff/ when you interview staff?
5. Could you tell me about your management structure?

Could you tell me how this centre is managed?

6. I understand that you run a special environmental education program.

Could you please tell me about the design of this program?
For example; Who designed? Have there been any changes over time?

7. Do you think there would be further changes in the future?(about education program)
8. Have you had any problems/ difficulties with your education programs?

Could you please explain these problems/ difficulties?
How did you solve these problems/ difficulties?

9. I know that some centres use drama, role playing, hand-on activities etc. What about you? Which activities do you use?
10. Do you have follow up procedures after a group has gone through a course? For example; course assessment?
11. Can you tell me about safety procedures?
12. How do people find out about your centre, and your programs that you offer?

What sort of information do you give people who contact you?

13. Can we talk about funding? Can I ask about funding?

I would like to know are you privately funded, government funded, grant funded..?

14. How much does the establishment/running cost such as a centre/foundation?

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Development of Science Laboratory Entrepreneurship Scale

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ABSTRACT

The concept of entrepreneurship is a relatively recent concept introduced into educational programs and educational literature and the current study was conducted to determine the entrepreneurship characteristics possessed by pre-service teachers who are expected to educate future generations. The study employed the descriptive survey model. The sampling of the study is comprised of 239 pre-service science teachers from the universities of Kırıkkale and Amasya. The collected data were subjected to exploratory factor analysis (EFA) through SPSS program package and KMO value was found to be .910 and α reliability value of each factor was calculated to be ranging from .76 to .92. The exploratory factor analysis revealed that the scale is made up of four factors and then confirmatory factor analysis was carried out to confirm the factor structures of the scale. The results of the confirmatory factor analysis conducted by using maximum likelihood technique without putting any restrictions, the values of goodness of fit indices were found as follows; $\chi2sd=344= 650.1$, $p<.001$, $\chi2/d = 1.89$, RMSEA= 0.061, GFI= 0.89, AGFI= 0.91, CFI= 0.9 and IFI= 0.89. As a conclusion, 28-item Science Laboratory Entrepreneurship Scale explaining 52.136% of the total variance was developed.

Keywords: Science Laboratory; Entrepreneurship; Pre-service Teachers.

INTRODUCTION

When the literature on entrepreneurship is examined, it is seen that there are many definitions made for it and the research and definitions mostly focus on entrepreneurship in the field of administration and economics (İşcan & Kaygın, 2011; Keleş, Özkan & et al., 2012; Bilge & Bal, 2012; Yılmaz & Sünbül, 2009; Ercan & Gökdeniz, 2009; Korkmaz, 2012; Kılıç, Keklik & Çalış, 2012). In addition to this research, there are some studies conducted in the field of education (Argon & Selvi, 2013; Bacanak, 2013). If the definitions of entrepreneurship given in this research are subsumed under a single roof; then, it is seen that the person who is aware of the current situation, making effort to turn negative states into positive, adapting to changing conditions, having courage to take risk, open to novelties and having creative thinking skill and activating past experiences to find solutions to new situations is called entrepreneur and his/her actual activities are called entrepreneurship.

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When the literature is examined, it is seen that there are some common characteristic of entrepreneurs: a) They are tolerant to ambiguity, b) They have a need for independence, c) They can take risk, d)They are open to novelties, e) They have self-confidence, f)They are open to cooperation, g) They have inner control, h) They have creative thinking skill, i) They are in need of achievement, j) They are proactive, k) They can take initiatives, l) They are open to solutions and opportunities, m) They are courageous, n) They are ambitious (Hisrich & Peters, 1998; Cansız, 2007; Avşar, 2007; Curth, 2011; Bozkurt & Alparslan, 2013). Considering these characteristics, it is clear that social and cultural milieu, personal experiences and education are basic determinants of entrepreneurship (Lee, Chang & Lim, 2005).

The general purpose of entrepreneurship education is to impart attitudes, information and skills to students so that they can behave like an entrepreneur. This process can be incorporated into general education in different ways (European Commission, 2012). According to Heinonen (2006), the main goal of entrepreneurship education should be to uncover some hidden traits in the personality of an individual that would remain latent otherwise and to make the individual aware of these traits. An entrepreneur can prevent wrong actions and make more effective use of resources (cited, Bozkurt & Alparslan, 2013). Thus, characteristics of entrepreneurship can affect economic and social developments of a society and educational programs should be adjusted to nurture these characteristics.

In today's educational programs, students are defined as individuals who can think analytically, learn by means of inquiry and research, find effective solutions to existing problems and work in cooperation. While skills aimed to be imparted to students in science program are being explained, life skills as well as scientific process skills are emphasized. These life skills are divided into sub-groups that are analytical thinking, decision making, creative thinking, entrepreneurship and team work (MEB, 2013). In Elementary Education Science Programs put into effect in 2013 by The Board of Education and Discipline of The Ministry of National Education, it is stated that the characteristics of entrepreneurship should be possessed by teachers and pre-service teachers to educate enterprising individuals in the classroom environment, strengthen and reinforce students' characteristics of entrepreneurship and create environments suitable for students to come up with innovative ideas.

The lack of the above-mentioned skills and competencies in pre-service teachers to teach science courses including science, technology and society is a subject of greater interest because science programs offered to students at high school and university cover key concepts needed by students to understand the world around them (Deveci & Çepni, 2014).

Entrepreneurship is a relatively new concept dealt with in educational programs; thus, there is not much research to make its applications widespread and this has increased the research interest in the concept.

The current state requires teachers to assume some responsibilities to create opportunities for students to develop their reasoning, discovery and application skills so that they can be more advantageous and successful in settings whose borders are quite uncertain (Neck & Greene, 2011). In the visions of teacher training programs, the necessity of promoting scientific process skills and life skills of pre-service teachers through active learning methods is clearly stated. For effective teaching of the concept of entrepreneurship in the classroom environment, pre-service teachers should be provided with adequate theoretical and applied information. It can be argued that teachers not gaining enough information and experience on entrepreneurship during their undergraduate education or through in-service trainings may experience some problems in giving entrepreneurship instruction to their students (Deveci & Çepni, 2014).

Teachers should be able to use various materials and equipments to make students active for the acquisition of the skill of entrepreneurship and this should be taken into consideration in the training of pre-service teachers. In this regard, activities promoting the development of cooperative skills at schools, encouraging students to make independent decisions, supporting alternative inquiries and solutions and enabling students to struggle with difficulties and disappointments they are confronted with should be incorporated into teaching programs (Entrepreneurship Education, 2012).

Seikkula-Leino (2011) state that there is a need for activities promoting students' interactive learning and reflective thinking and involving problem-based learning, cooperative learning, group and peer works, team works, drama and learning diaries for entrepreneurship education. In this connection, it seems to be important to determine the extent to which life skills are involved in science instruction through laboratory activities. Thus, the main focus of the current study is to develop a scale to determine the effect of science laboratories on pre-service teachers' entrepreneurship skills.

METHODOLOGY

a) Study Group

The study group of the current research consists of 102 fourth-year pre-service science teachers from the Education Faculty of Kırıkkale University in 2014-2015 academic year and 137 fourth-year pre-service science teachers from the Education Faculty of Amasya University; thus, totally 239 pre-service teachers participated in the study. In the determination of this sampling, one of the probabilistic sampling methods, purposive sampling selection method was employed in the current study (Çepni, 2014). The results of the literature review showed that the sampling size should be 5-10 times bigger than the number of items. Moreover, sampling size smaller than 100 is considered to be inadequate and unreliable (Şencan, 2005). Comrey and Lee (1992) categorized the sampling size as follows: 50 "very small", 100 "small", 200 "suitable", 300 "good", 500 "very good" and 1000 and more "perfect" (cited from Yiğit, Bütüner & Dertlioğlu, 2008; Şencan, 2005).

b) Data Collection Instrument

The study was conducted by using descriptive survey model. Descriptive survey method is a method used to collect numerical data related to a given variable and to describe the characteristics of the trial (study) group in the variable. (Büyüköztürk, 2012).

The current study was conducted to develop a scale and during the process of scale development, the following stages were pursued (Tezbaşaran, 2008; Azaltun, 2008; Karasar, 2014; Balcı, 2009);

1. *Literature review stage:* When a literature review in relation to "Science Laboratory Entrepreneurship Scale" was conducted, it was found that there is no study dealing with such a scale in the field of education. Thus, the literature review focused on the research conducted and the scales developed in the field of administration and economics in relation to the concept of entrepreneurship (Avşar, 2007; Cansız, 2007; Karabulut, 2009; Çarıkçı & Koyuncu, 2010; Yılmaz & Sünbül, 2009; Florian, Karri & Rossiter, 2007).
2. *Stage of determination of the characteristics to be measured:* Inquiries were carried out to determine the characteristics on which entrepreneurship was built, which characteristics should be observed in pre-service teachers to call them entrepreneurs; the characteristics reported in the literature of administration and economics to be possessed by entrepreneurs were determined and these characteristics were adapted to the field of science and thus, the characteristics to be measured were collected under 8 headings. These headings are; a) Tolerance to ambiguity, b.) Need for independence, c.) Risk taking, d.) Innovativeness, e.)

Self-confidence, f.) Cooperation, g.) Inner control, h.) Creativity (Avşar, 2007; Cansız, 2007; Karabulut, 2009; MEB, 2009).

3. *Stage of item pool construction:* Following the completion of the literature review related to entrepreneurship, the scales found in the literature were examined, the items of the scales found in the filed of administration and economics were adapted to the field of science and then by considering the laboratory setting and student behaviors in this setting, the items were written (Avşar, 2007; Cansız, 2007; Florian, Karri & Rossiter, 2007). In this way, an item pool comprised of 47 items was constructed. The distribution of these items across the above-mentioned characteristics to be measured is as follows: Six items for tolerance to ambiguity; 6 items for need for independence, six items for risk taking, six items for innovativeness, six items for self-confidence, six items for cooperation, five items for inner control and six items for creativity.

4. *The stage of seeking expert opinions:* While developing the draft of the scale, opinions of three experts were sought. Feedbacks were taken from the experts about the suitability of the items, the extent to which the items measure the target characteristics, comprehensibility of the items by the reader and possible corrections to be made (Tezbaşaran, 2008).

5. *Revision and editing of the scale:* In light of the feedbacks taken from the experts, 2 items were changed and 4 items were rearranged. Following these corrections, final form of the 47-item five-point Likert scale (1: Strongly Disagree, 2: A Little Bit Agree, 3: Agree, 4: Strongly Agree, 5: Completely Agree) was given.

6. *Administration stage:* The developed scale consisting of 8 dimensions and 47 items was administered.

c) Data Collection

The participants of the study are fourth-year pre-service science teachers and they took the course of “Science Laboratory Applications” for two terms in their third-year. As they already completed the course of Laboratory Applications, fourth-year students were selected to administer the scale.

d) Data Analysis

Both exploratory and confirmatory factor analyses were conducted to establish the construct validity of the “Science Laboratory Entrepreneurship Scale”. Factor analysis is used to establish the construct validity. It is a statistical method aiming to bring related variables together and thus, to reduce the number of factors (Seçer, Halmatov & Gençdoğan, 2013). Exploratory Factor Analysis (EFA) examines the connected basic constructs contained by a data set and aims to elicit the factor by looking at the correlation between variables (Büyüköztürk, 2012). Confirmatory factor analysis is grounded on the principle of taking the relationships between observed variables and latent variables (items and factors) as hypotheses and testing them. In other words, confirmatory factor analysis is a structural equation model addressing the relationships between observed variables and latent variables (Korkmaz, 2012). In the confirmatory factor analysis, maximum likelihood technique was employed.

The suitability of the data for factor analysis can be investigated with Kaiser-Meyer-Olkin (KMO) coefficient and Barlett test (Büyüköztürk, 2012). Kaiser-Meyer-Olkin (KMO) coefficient offers information about whether the data are suitable for factor analysis and suitability of the data for deriving factor. It is expected to be higher than .60. Barlett test investigates the correlation between variables and it is expected to be lower than .005. If the results of KMO and Barlett tests satisfy these criteria, then it means that the study is suitable for conducting factor analysis.

The following three criteria need to be taken into consideration for sorting out the items that do not measure the same construct;

1- Factor loading value should be >.45. When the number of items is low, then this value can be taken as >.30 (Şencan, 2005).

2- High factor value in a single factor: the difference between two high loading values should be at least .10. According to Büyüköztürk, in a multi-factor construct, an item giving a high loading value in more than one factor is overlapped and should be discarded from the scale. Following the operation of exclusion, EFA needs to be repeated (Durmuş, Yurtkoru & Çinko, 2013; Tavşancıl, 2002)

3- Common factor variance should be converging to 1.00 or higher than 0.66.

Following the completion of factor analyses, reliability analysis for each factor should be conducted. The reliability coefficient (α) calculated should be .70 or higher (Durmuş, Yurtkoru & Çinko, 2013; Şencan, 2005; Tavşancıl, 2002).

FINDINGS

In the study, exploratory factor analysis (EFA) was employed to test the construct validity of the scale to be developed (AFA). In order to test the suitability of the data for factor analysis, Kaiser-Meyer-Olkin (KMO) coefficient and Barlett test were used. The findings obtained are presented below;

Table 1. *KMO and Barlett Test Results for the Scale*

KMO and Barlet Test Values		
Kaiser-Meyer-Olkin Sampling Adequacy		0,91
Barlett Sphericity test	χ^2	2896,236
	Sig.	.000

As the result of KMO test was found to be higher than .60 and also be suitable for Barlett test results, factor analysis was started.

First, the factor analysis was administered to 47 items. In the first administration, KMO value was found to be .920, Barlett test data 5504.911 were found to be explaining 45.364% of the total variance and α reliability coefficient is .951. According to the data, 9 items having a factor loading value lower than .30 (E5.2; E5.1; D4.4; D4.3; A1.5; G7.3; D4.2; A1.6; C3.2) and five items having a loading value in a single factor lower than .10 and giving loading values to more than one item (B2.6; H8.1; E5.3; A1.1; C3.1) were excluded; thus, a total of 14 items were excluded from the scale in the first stage. Then, the remaining 33 items were subjected to factor analysis once more.

The results of the second EFA revealed that KMO value is .914, Barlett test data 3630.475 were found to be explaining 50.587% of the total variance and α reliability coefficient is .937. According to the data, 3 items having a loading value in a single factor lower than .10 and giving loading values to more than one item (G7.1; F6.5; B2.1) and 1 item having a factor loading value lower than .30 (C3.5); thus, totally 4 items were discarded from the scale. Then, the remaining 29 items were subjected to factor analysis once more.

The results of the third EFA revealed that KMO value is .912, Barlet test data 3024.466 were found to be explaining 51.654% of the total variance and α reliability coefficient is .927.

According to the data, 1 item having a loading value in a single factor lower than .10 and giving loading values to more than one item (G7.5) was excluded from the scale and final factor analysis was conducted on the remaining 28 items.

According to the results of the fourth EFA, KMO value was found to be .910, Barlett test data 2896.236 were found to be explaining 52.136% of the total variance and α reliability coefficient is .924. In the structure constructed in this way, the contribution of the first factor to the explained variance is 17.241% and its eigenvalue is 4.827; the contribution of the second factor to the explained variance is 14.525% and its eigenvalue is 4.067; the contribution of the third factor to the explained variance is 10.353% and its eigenvalue is 2.899 and the contribution of the fourth factor to the explained variance is 10.018% and its eigenvalue is 2.805. Although some other factors having an eigenvalue higher than 1 are observed, eigenvalue curve reaches a plateau after the fourth factor. Therefore, it was thought that four-factor structure would be more suitable.

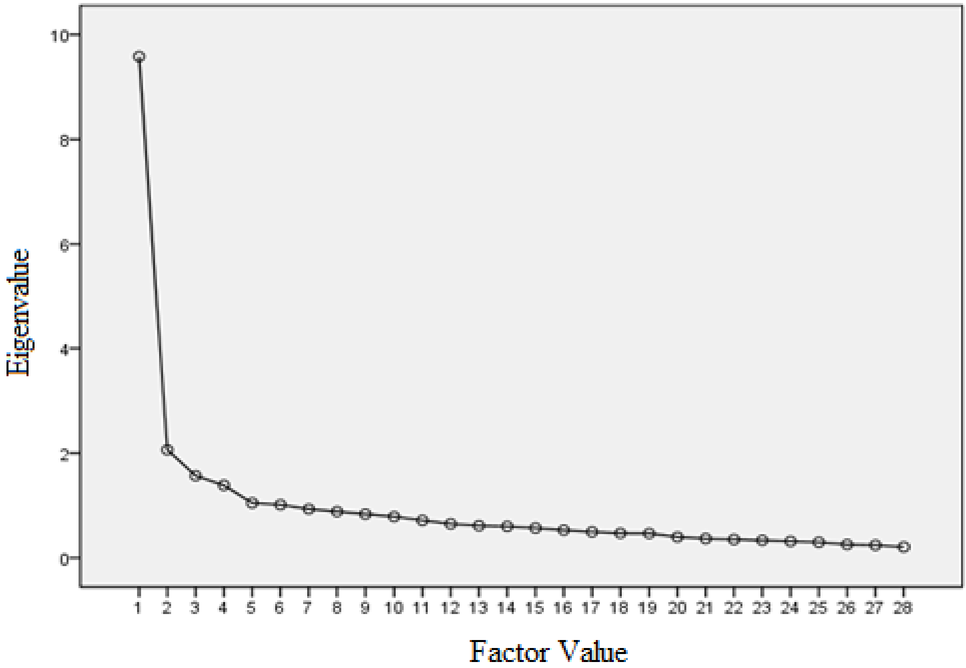

Figure 1. *Scree Graph*

When the line graph belonging to the factors is examined, it is seen that breakages occurred in 4 points. As it was observed that values at the fourth breakages and at the following ones are close to each other and low, from the results of EFA, it was concluded that the scale consists of four factors. Bu using Varimax vertical rotation technique, the factors were more clearly separated and the obtained EFA results are presented in Table 2.

As can be seen in Table 2, item D4.6 gives factor values to items 2 and 4 and item C3.4 gives factor values to items 1 and 3. As the factor values given to both factors are not lower than .10, they were not excluded from the study (Büyüköztürk, 2012).

The data presented in Table 2 in relation to EFA results and item contents were examined and then expert opinions were sought. In light of the feedbacks given by the expert, factor names representing the items were determined as follows; the name of the first factor is "Communication-Self-efficacy", the name of the second factor is "Creativity", the name of the third factor is "Risk Taking" and the name of the fourth factor is "Need for Achievement".

Table 2. *EFA Results*

Item	Factor			
	Factor -1	Factor -2	Factor -3	Factor -4
F6.2	.750			
F6.1	.687			
F6.4	.671			
E5.5	.669			
F6.3	.661			
E5.4	.661			
E5.6	.645			
G7.2	.481			
D4.5	.463			
H8.4		.787		
H8.3		.758		
H8.5		.662		
H8.6		.628		
H8.2		.600		
D4.1		.544		
D4.6		.519		.407
C3.6		.461		
G7.4		.421		
A1.2			.641	
A1.4			.617	
C3.3			.602	
C3.4	.420		.599	
A1.3			.563	
F6.6			.471	
B2.3				.743
B2.4				.722
B2.5				.630
B2.2				.579

Confirmatory factor analysis was conducted to confirm the factor structures of the scale determined to be consisting of four factors as a result of exploratory factor analysis. The goodness of fit values obtained as a result of confirmatory factor analysis conducted by using maximum likelihood technique without imposing any restrictions are as follows; $\chi 2sd=344= 650.1$, $p<.001$, $\chi 2/d = 1,89$, RMSEA= 0.061, GFI= 0.89, AGFI= 0.91, CFI= 0.9 and IFI= 0.89. These values show that $\chi 2/d$ value exhibits a perfect fit and the values of the other goodness of fit indices are acceptable. That is, the model obtained proves that the factors are confirmed by the data. Factorial model of the scale and values related to factor-item correlation are given in Figure 2.

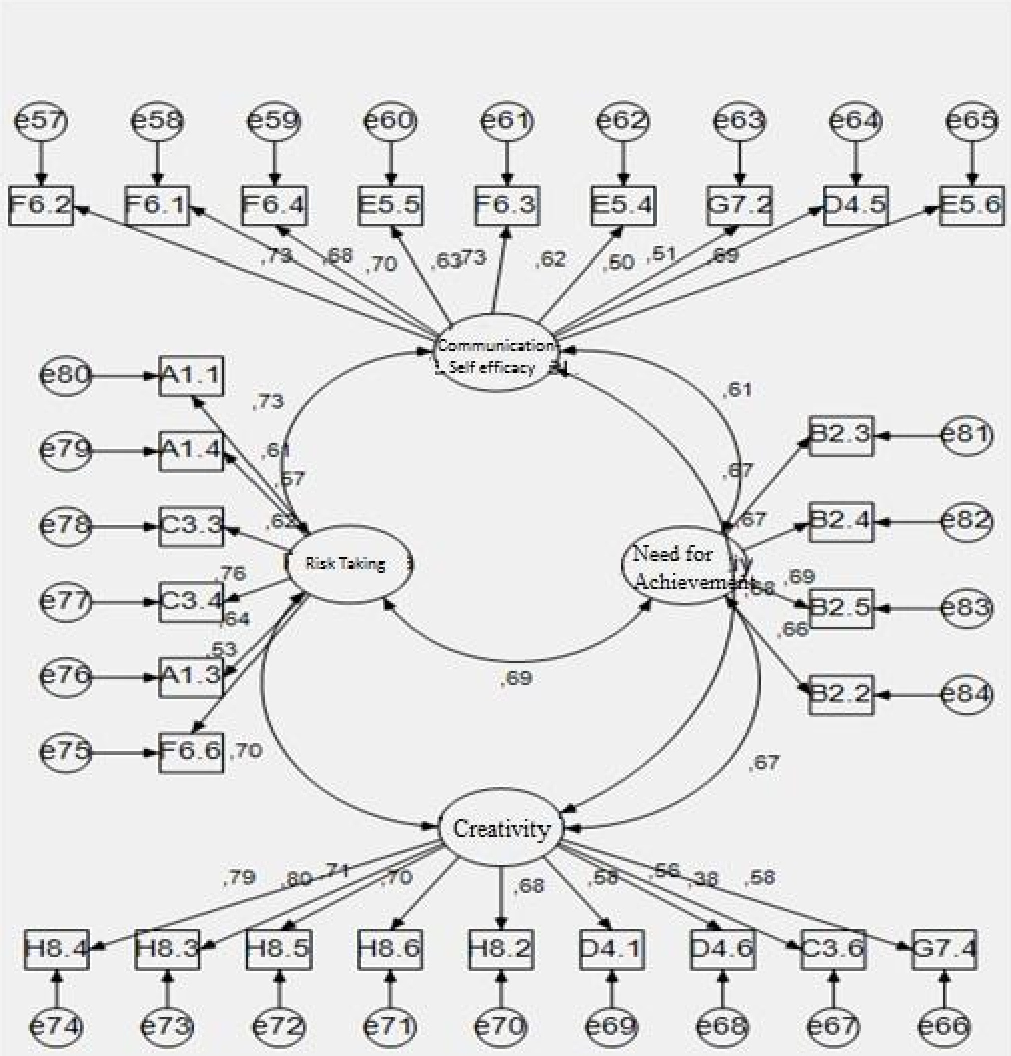

Figure 2. *Confirmatory Factor Analysis Correlation Diagram*

Following the factor analyses, correlations between scores obtained from each item and scores obtained from the factors were calculated via total correlation method and thus, the extent to which each item can contribute to the general purpose was tested. Item-factor correlation values found for each item are presented in Table 3.

Table 3: *Item – Factor Correlation Analysis Results*

F1		**F2**		**F3**		**F4**	
I.	**r**	**I.**	**r**	**I.**	**r**	**I.**	**r**
F6.2	,722(**)	H8.4	,805(**)	A1.2	,676(**)	B2.3	,783(**)
F6.1	,748(**)	H8.3	,807(**)	A1.4	,703(**)	B2.4	,780(**)
F6.4	,707(**)	H8.5	,734(**)	C3.3	,672(**)	B2.5	,760(**)
E5.5	,698(**)	H8.6	,710(**)	C3.4	,738(**)	B2.2	,742(**)
F6.3	,743(**)	H8.2	,705(**)	A1.3	,726(**)		
E5.4	,689(**)	D4.1	,649(**)	F6.6	,586(**)		
E5.6	,721(**)	D4.6	,619(**)				
G7.2	,595(**)	C3.6	,535(**)				
D4.5	,586(**)	G7.4	,631(**)				

N=239; **=p< .001

As can be seen in Table 3, item test correlation coefficients vary between 0.586 and 0.722 for the first factor; between 0.535 and 0.805 for the second factor; between 0.586 and 0.738 for the third factor and between 0.742 and 0.783 for the fourth factor. Each item is in a positive and significant correlation with the general factor ($p<0.001$). Thus, it can be argued that each item serves the function of its factor. General reliability coefficient of the scale is α=.924. Reliability values and item numbers of each factor are given in Table 4.

Table 4. *The Number Items in Sub-dimensions and Reliability Values of the Factors*

Dimension	Item Number	α-Reliability Value
Communication-Self-confidence	9	,859
Creativity	9	,853
Risk Taking	6	,766
Need for Achievement	4	,764
Total	28	,924

DISCUSSIONS and RESULTS

Within the current study, a scale consisting of 4 dimensions; communication-self-confidence, creativity, risk taking and need for achievement, and 28 items was developed to determine the pre-service teachers' entrepreneurship skills in a laboratory setting. There are 9 items in the communication-self-confidence dimension, 9 items in the creativity dimension, 6 items in the risk taking dimension and 4 items in the need for achievement dimension. Florian, Karri and Rossiter (2007) developed a scale to test the development of entrepreneurship orientation in business environment with the participation of 220 people and their scale is comprised of 42 items and 5 dimensions. They reported that the scale can explain 45.88% of the total variance. The dimensions in their scale are; proactive tendency, innovativeness, self-efficacy, achievement motivation and unconformity. The dimensions reported in their study and in the current study are in compliance with the literature; yet, the characteristics may be placed in different dimensions. According to Erkuş (2012) human traits are inherently in association with each other; thus, in some cases, it might not be suitable to reduce them into a single dimension. Accordingly, a specific feature should not be separated from the others. Instead, it should be seen as a component. What is more important is that the intersection areas in the structure of the component should not be ignored. In the current study, it was found that though they support the dimensions of entrepreneurship, the associated items were collected within four dimensions.

The statistically significant results of the current finding are as follows; KMO value .910, Barlett test values 2896.236, significance value .000, explains 52.136% of the total variance, α reliability coefficient .924. These results concur with the literature findings (Büyüköztürk, 2012; Şencan, 2005; Tavşancıl, 2002; Durmuş, Yurtkoru & Çinko, 2013).

When the literature on entrepreneurship is examined, it is seen that totally 7-8 characteristics of entrepreneurship are mentioned (Cansız, 2007; Avşar, 2007). These are; tolerance to ambiguity, need for independence, risk taking, openness to innovation, self-confidence, openness to cooperation, inner control and creative thinking skill. When EFA results and dimensions emerging in these results were compared to the factors in light of expert opinions, the items were decided to be collected under four factors. In this regard, the study concurs with the literature.

The study was conducted with the participation of university students. This sampling can be expanded by including elementary and secondary school students. The scale developed within the current study is assumed to evaluate the current state and development of the entrepreneurship skills of pre-service teachers by means of laboratory activities. This scale can be used as a data collection instrument in research dealing with the effects of various teaching models and laboratory approaches on individuals' learning outcomes. When the scale is used together with different demographic features of students, it may serve different purposes.

REFERENCES

Altun, A.S. & Büyüköztürk, Ş. (2011). Değişim Eğilimleri Ölçeğinin Geliştirilmesi. *Kalem Eğitim ve İnsan Bilimleri Dergisi,* 2011, 1 (1), 73 – 90.

Argon, T. & Selvi, Ç. (2013). İlköğretim Okulu Öğretmenlerinin Sahip Oldukları Girişimcilik Değerleri Ve Algıladıkları Sosyal Destek Düzeyleri Arasındaki İlişkisi. *International Journal of Social Science*, 6/1), 179-206,

Avşar, M. (2007). *Yüksek Öğretimde Öğrencilerin Girişimcilik Eğilimlerinin Araştırılması, Çukurova Üniversitesinde Bir Uygulama,* Yayınlanmış Yüksek Lisans Tezi, Çukurova Üniversitesi Sosyal Bilimler Enstitüsü İşletme Anabilim dalı.

Azaltun, M. (2008). VI. Araştırma Yöntemleri Semineri – Ölçme ve Ölçek Geliştirme. *Anatolia: Turizm Araştırmaları Dergisi*, 19(1), 104-111.

Bacanak, A. (2013). Fen ve Teknoloji Dersinin Öğrencilerde Girişimcilik Becerisinin Gelişimine Etkisi Üzerine Öğretmen Görüşleri. *Kuram ve Uygulamada Eğitim Bilimleri Dergisi*, 13(1), 609-629.

Balcı, A. (2009). *Sosyal Bilimlerde Araştırma; Yöntem, Teknik ve İlkeleri,* Pegem A Yayıncılık 7.baskı.

Bilge, H. & Bal V. (2012). Girişimcilik Eğilimi: Celal Bayar Üniversitesi Öğrencileri Üzerine Bir Araştırma, *Süleyman Demirel Üniversitesi Sosyal Bilimler Enstitüsü Dergisi.* Yıl: 2012/2, Sayı:16.

Büyüköztürk, Ş. (2012). *Sosyal Bilimler İçin Veri Analizi El Kitabı,* 16. Baskı. Ankara: Pegem Yayınları.

Bozkurt Ç. Ö. & Alparslan, A. M. (2013). Girişimcilerde Bulunması Gereken Özellikler İle Girişimcilik Eğitimi: Girişimci ve Öğrenci Görüşleri, *Girişimcilik ve Kalkınma Dergisi*. 8(1): 7-27.

Cansız, E. (2007). *Üniversite Öğrencilerinin Girişimcilik Özelliklerinin Belirlenmesi: Süleyman Demirel Üniversitesi Öğrencileri Üzerine Bir Çalışma*, Yayınlanmış Yüksek Lisans Tezi, Süleyman Demirel Üniversitesi, Sosyal Bilimler Enstitüsü, Isparta, 2007.

Curth, A. (2011). *Mapping of Teachers' Preparation For Entrepreneurship Education* (Ed. Daniela Ulicna). Final Report, Framework Contract No EAC 19/06, Dg Educatıon and Culture, J 3025 8322.

Çepni, S. (2014). Araştırma ve Proje Çalışmalarına Giriş. (7. Baskı). Trabzon.

Deveci, İ. & Çepni, S. (2014). Fen Bilimleri Öğretmen Eğitiminde Girişimcilik. *Türk Fen Eğitimi Dergisi,* 11(2), 161-188.

Durmuş, B., Yurtkoru, E.S. ve Çinko, M. (2013). *Sosyal Bilimler'de SPSS'le Veri Analizi,* Beta Yayınları 5. Baskı s.73-113.

Entrepreneurship Education, (2012). Entrepreneurship Education Learner Driven Collaboration Url: http://www.opinkirjo.fi/en/activity/entrepreneurship_education_

European Commission, (2012). *Entrepreneurship Education at School in Europe; National Strategies, Curricula and Learning Outcomes*, EACEA P9 Eurydice and Policy Support, ISBN 978-92-9201-252-6, doi:10.2797/80384, Url: http://eacea.ec.europa.eu/education/eurydice.

Ercan, S. & Gökdeniz, İ. (2009). Girişimciliğin Gelişim Süreci ve Girişimcilik Açısından Kazakistan. Ahmet Yesevi Üniversitesi Mütevelli Heyet Başkanlığı. *Bilig, 49*, 59-82.

Erkuş, A. (2012). Varolan Ölçek Geliştirme Yöntemleri ve Ölçme Kuramları Psikolojik Ölçek Geliştirmede Ne Kadar İşlevsel: Yeni Bir Öneri. *Eğitimde ve Psikolojide Ölçme ve Değerlendirme Dergisi,* 3(2), 279-290.

Florian, J. Karri, R. & Rossiter N. (2007). Fostering entrepreneurial drive in business education: An attitudinal approach. *Journal of Management Education*, 31, 17-42.

Hisrich, R. D. & Peters, M. P. (1998). *Entrepreneurship*. New York: Irwin Mc Graw Hill.

İşcan, Ö.F. & Kaygın, E. (2011). Üniversite Öğrencilerinin Girişimcilik Eğilimlerini Belirlemeye Yönelik Bir Araştırma. *Atatürk Üniversitesi Sosyal Bilimler Enstitüsü Dergisi.* 15 (2), 443-462.

Karasar, N. (2014). *Bilimsel Araştırma Yöntemi Kavramlar, İlkeler, Teknikler.* Nobel Yayınları 26. Baskı.

Keleş, H.N., Özkan T.K., Doğaner, M. & Altınoğlu, A.E. (2012). Önlisans Öğrencilerinin Girişimcilik Düzeylerini Belirlemeye Yönelik Bir Araştırma. *Uluslararası İktisadi ve İdari İncelemeler Dergisi.* 5(9), 107-118.

Kılıç, R., Keklik, B. & Çalış, N. (2012). Üniversite Öğrencilerinin Girişimcilik Eğilimleri Üzerine Bir Araştırma: Bandırma İİBF İşletme Bölümü Örneği. *Süleyman Demirel Üniversitesi İktisadi ve İdari Bilimler Fakültesi Dergisi*, 17(2), 423-435.

Korkmaz, Ö. (2012). A validity and reliability study of the online cooperative learning attitude scale (Oclas). *Computers & Education, 59*(4), 1162-1169. Doi: 10.1016/j.compedu.2012.05.021

Korkmaz, O. (2012). Üniversite Öğrencilerinin Girişimcilik Eğilimlerini Belirlemeye Yönelik Bir Araştırma: Bülent Ecevit Üniversitesi Örneği. *Afyon Kocatepe Üniversitesi, İİBF Dergisi.* 14(2), 209-226.

Lee, S. M., Chang, D., & Lim, S. B. (2005). Impact of entrepreneurship education: a comparative study of the US and Korea. *The International Entrepreneurship and Management Journal*, 1(1), 27-43.

MEB, (2009). *Orta Öğretim Girişimcilik Dersi Öğretim Programı.* T.C. Millî Eğitim Bakanlığı Ortaöğretim Girişimcilik Dersi Öğretim Programı Ankara–2009 Ortaöğretim Genel Müdürlüğü-Ankara.

MEB, (2013). *İlköğretim Kurumları (İlkokullar Ve Ortaokullar) Fen Bilimleri Dersi (3, 4, 5, 6, 7 Ve 8. Sınıflar) Öğretim Programı.* T.C. Millî Eğitim Bakanlığı Talim ve Terbiye Kurulu Başkanlığı.

Neck, H. M. and Greene, P. G. (2011). Entrepreneurship Education: Known Worlds and New Frontiers, *Journal of Small Business Management,* 10.1111/j.1540-627X.2010.00314.x

Seikkula-Leino, J. (2011). The implementation of entrepreneurship education through curriculum reform in Finnish comprehensive schools. *Journal of Curriculum Studies,* 43(1): 69-85.

Seçer, İ., Halmatov, S. & Gençdoğan, B. (2013). Duygusal Tepkisellik Ölçeğinin Türkçeye Uyarlanması: Güvenirlik ve Geçerlilik Çalışması. *Sakarya University Journal of Education.* 3(1), 77-89.

Şencan, H. (2005). *Sosyal ve Davranışsal Ölçümlerde Güvenirlik ve Geçerlilik.* Seçkin Yayıncılık. Ankara.

Tavşancıl, E. (2002). *Tutumların Ölçülmesi ve Spss İle Veri Analizi*, 1. Basım, Ankara: Nobel Yayıncılık.

Tezbaşaran, A.A. (2008). *Likert Tipi Ölçek Hazırlama Klavuzu*. Üçüncü Sürüm e-Kitap. Mersin-2008.

Url: http://www.academia.edu/1288035/Likert_Tipi_Ölçek_Hazırlama_Klavuzu

Yılmaz, E. & Sünbül M.A. (2009). Üniversite Öğrencilerine Yönelik Girişimcilik Ölçeğinin Geliştirilmesi. *Selçuk Üniversitesi Sosyal Bilimler Enstitüsü Dergisi*. 21, 195-203.

Yiğit, N., Bütüner, S.Ö. & Dertlioğlu, K. (2008). Öğretim Amaçlı Örütbağ Sitesi Değerlendirme Ölçeği Geliştirme. *Necatibey Eğitim Fakültesi Elektronik Fen ve Matematik Eğitimi Dergisi (EFMED)*. 2(2), 38-51.

APPENDIX

DIMENSION	CHARACTERISTIC	1	2	3	4	5
COMMUNICATION-SELF-EFFICACY	I can do my part in a group work	( )	( )	( )	( )	( )
	I show respect to different opinions expressed in discussions involved in an experimental process	( )	( )	( )	( )	( )
	I can make co-decisions in cooperation with my group members	( )	( )	( )	( )	( )
	I feel happy when experimental data comply with the hypothesis	( )	( )	( )	( )	( )
	I can motivate my group members in laboratory activities	( )	( )	( )	( )	( )
	I do an experiment to learn something rather than just for the sake of conducting it	( )	( )	( )	( )	( )
	I feel confident while defending my ideas	( )	( )	( )	( )	( )
	I want to be successful for myself not for others	( )	( )	( )	( )	( )
	I prefer to make use of technologies in experiments	( )	( )	( )	( )	( )
CREATIVITY	By evaluating existing solutions, I come up with new solutions	( )	( )	( )	( )	( )
	I can find original solutions to problems	( )	( )	( )	( )	( )
	I can reach a solution by seeing the positive sides of negative situations	( )	( )	( )	( )	( )
	I can make synthesis by combining my daily life experiences with the newly learned information	( )	( )	( )	( )	( )
	I capitalize on my prior experiences to find a solution to a problem	( )	( )	( )	( )	( )
	I can propose new ideas that can lead to the solution of a problem	( )	( )	( )	( )	( )
	I can adopt a point of view of a problem different from the viewpoints of others	( )	( )	( )	( )	( )
	I work spontaneously without making plans	( )	( )	( )	( )	( )
	I can motivate myself	( )	( )	( )	( )	( )
RISK TAKING	I do not feel hopeless in the face of failure	( )	( )	( )	( )	( )
	If there are external interventions while conducting an experiment, I can go on without feeling distracted	( )	( )	( )	( )	( )
	I immediately test the hypothesis I have constructed for the problem	( )	( )	( )	( )	( )
	I do not hesitate to test the variables involved in the hypothesis	( )	( )	( )	( )	( )
	I can produce alternative solutions to the problem involved in the experiment	( )	( )	( )	( )	( )
	I can complete the works left uncompleted by my team mates	( )	( )	( )	( )	( )
NEED FOR ACHIEVEMENT	I can myself provide the equipments and tools required for an experiment	( )	( )	( )	( )	( )
	I can test my opinions without the approval of others	( )	( )	( )	( )	( )
	When I encounter a problem, I can motivate myself to find a solution	( )	( )	( )	( )	( )
	I can make decisions on my own in the laboratory	( )	( )	( )	( )	( )