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Adem Taşdemir
Ahi Evran Üniversitesi

Tezcan Kartal
Gazi University

Alper murat Özdemir
Nevşehir Hacı Bektaş Veli University

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REGULAR ARTICLE

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Abstract This study was aimed to determine pre-service teachers' views about science centers and museums, as out-of-the-school learning environments, through case study. For that purpose, the pre-service teachers were provided to participate in out-of-the-school learning environments which were designed in a structured way, and their attitudes and views were studied at the end of the process. The results showed that they held positive views with regard to the activities related to science centers and museums. Besides, pre-service teachers' attitude averages were positive both in overall evaluation and under the theme of attitudes toward science and technology course. As positive views they said that activities were visual, permanent knowledge formed in consequence of the activities, they would be able to use the knowledge they had obtained in daily life, they had the opportunity to apply one-to-one, and that they were able to acquire new knowledge. On the other hand, the fact that the activities were too much in number, some of them took much time, and participants were too many was reported as the disadvantage.

Keywords Out-of-the-school learning · Science centers and museums · Teacher training · Pre-service primary teacher

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A. Tasdemir (✉) · T. Kartal · A. M. Ozdemir
Faculty of Education, Ahi Evran University, Kirsehir, Turkey
e-mail: atasdemmir@gmail.com

Introduction

Current developments require that out-of-the-school learning environments should be actively used in addition to in-school applications during learning–teaching activities. Educational systems are not only dependent on school environments, but also they are structured explicitly or implicitly in a way as to facilitate students to learn lifelong. Lifelong learning is a significant process in this millennium to cope with revolutionary knowledge and skills (Subramaniam 2012). Although science studies the real world, many students study it only vicariously through books, lectures, and videos (Herr 2008). The fundamental aim here is to enable students to transfer what they have acquired in formal situations into daily life and to use that knowledge actively in problem solving because they spend a great portion of their time in out-of-the-school environments. The general view of school education is that pupils' knowledge of a school subject is acquired in the classroom within varying educational settings organized by the teachers. Very little importance is attached to children's out-of-school experiences. Out-of-school activities and experiences in varied learning environments may enhance children's interest in school subjects, too (Uitto et al. 2006). Moreover, out-of-school learning enhances idiosyncratic learning experiences, and encourages nonhierarchical relationship of facilitator and learner (Tal 2006).

Research with regard to field experiences are also described in many ways, such as out-of-school learning (Eshach 2007), informal and nonformal learning (Tal 2006), outdoor learning (Rickinson et al. 2004), and free-choice learning (Falk 2005; Falk et al. 2009). Out-of-the-school learning are defined as planned, programmed, and regular work which is performed in school or outside the school in line with the educational purposes, based on

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students' interests and desires so as to develop students' personality with the school administration's knowledge and under the teacher's guidance (Binbaşıoğlu 2000). Resnick (1987) differentiates sharply between the nature of ''school learning'' and ''other learning.'' To understand fully children's science learning, one should look not only at learning that takes place in the kindergarten and primary school but also at learning that takes place out-of-school. This is very important considering the fact that 85 % of the time children are awake is spent outside the classroom (Eshach 2007). A school visit to museums, industrial site, planetarium, or zoo, watching TV, interaction with friends, in various hobbies of such things as bird watching, walking, playing sport and junior organizations, extensive reading, reading magazines and newspapers, and science centers, for example, might be planned and led by the teacher as part of the science curriculum or as an extra-curricular activity (National Research Council 1996; Braund and Reiss 2006; Uitto et al. 2006). The process enables the learner to control what, why, how, and when he or she learns. Museums and science centers can contribute greatly to the understanding of science and encourage students to further their interests outside of school (National Research Council 1996). Science enrichment programs involve activities that are designed to supplement and/or reinforce formal classroom instruction. They offer learning experiences that are "above and beyond" the formal school curriculum and are non-evaluative and non-competitive (Caleon and Subramaniam 2007). In sum, the terms out-of-school learning and informal learning in the literature are usually interchangeable. A better distinction, which captures the characteristics of out-of-school learning, is between informal and nonformal learning. Another distinction which might provide insight as to the nature of out-of-school learning is based on the frequency to which we attend the place where the learning occurs (Eshach 2007).

According to Resnick (1987), the comparative contributions of in-school and out-of-the-school learning environments to students may be grouped in these categories: (i) individual cognition in school versus shared cognition outside, (ii) pure mentation in school versus tool manipulation outside, (iii) symbol manipulation in school versus contextualized reasoning outside school, and (iv) generalized learning in school versus situation-specific competencies. Dividing of out-of-school learning into informal and non-formal categories helps to achieve a better understanding of the characteristics of out-of-school learning. Yet, a variety of institutions are still hard to categorize as non-formal, because they are still different despite the fact that their activities might share some similarities (Eshach 2007). Table 1 summarizes some of the differences among three types of learning.

Table 1 Differences between formal, non-formal, and informal learning (Eshach 2007)

Formal	Non-formal	Informal
Usually at school	At institution out of school	Everywhere
May be repressive	Usually supportive	Supportive
Structured	Structured	Unstructured
Usually prearranged	Usually prearranged	Spontaneous
Motivation is typically more extrinsic	Motivation may be extrinsic but it is typically more intrinsic	Motivation is mainly intrinsic
Compulsory	Usually voluntary	Voluntary
Teacher-led	May be guide or teacher-led	Usually learner-led
Learning is evaluated	Learning is usually not evaluated	Learning is not evaluated
Sequential	Typically non-sequential	Non-sequential

Researchers and teachers have long suggested that extracurricular activity participation and constructive organized activities may be an important asset in the positive development of youth across childhood and adolescence (Holland and Andre 1987; Eder and Parker 1987; Mahoney 2000; Marsh and Kleitman 2002; Eccles and Templeton 2002; Zarrett and Mahoney 2011). Interest in the developmental consequences of extracurricular and after-school programs have been stimulated also by the growing interest in positive psychology and positive youth development (Eccles et al. 2003). In particular, researchers have proposed that organized activities support continued cognitive and socio emotional development because such activities provide opportunities to (Zarrett and Mahoney 2011):

1. acquire and practice specific social, physical, and intellectual skills that are useful in a wide variety of settings;
2. learn more general competencies, and develop instrumental values, initiative, planfulness, and self-efficacy;
3. contribute to the well-being of one's community and develop a sense of agency as a member of one's community;
4. belong to a socially recognized and valued group;
5. establish supportive social networks of both prosocial peers and adults that can help in both current and future goals; and
6. experience and deal with challenges.

Out-of-the-school learning environments may be said to be as important as formal education in raising children in line with the expectations of the society and in achieving educational goals. Therefore, students should be provided with the opportunities for such activities. While providing the opportunities, students should not be left alone. Their out-of-the-class activities must be controlled by the school (Köse 2004). The review of the literature indicates that informal learning environments such as science museums, science centers, botanical gardens, zoos, etc. offer significant opportunities to strengthen learning and fit well with a constructivist approach (Luehmann and Markowitz 2007). It is also emphasized that learning in informal settings can be enhanced with planning of students experiences before, after, and during the museum visit. Linking museum learning with the school learning by making clear connections between the museum experiences and school curriculum is also desirable for enhancing the possibility of better learning in informal settings (Metz 2005; Griffin 2004; Anderson and Zhang 2003; Kısa 2005). Organized constructive activities engage youth in a distinct set of socializing experiences, including a distinguished set of behaviors, rules, scripts, and goals. In addition, these activities are focused on developing a particular set of skills and take place in distinct settings, with regularly scheduled meetings and the supervision and guidance from adults, to aid youth in achieving the goals of the activity (Zarrett and Mahoney 2011). There is overwhelming evidence of the benefits of out-of-school learning. It is likely to be particularly important for disadvantaged students who have fewer material and cultural resources in the home to supplement their classroom work. However, despite the research evidence and political moves to promote out-of-school learning, it would appear that the provision of such activities is increasingly threatened by resource constraints, regulation, and risk aversion (Power et al. 2009).

The Current Situation in Turkey: Teacher Training Programs and Out-of-School Learning

There are 92 Faculty of Education as teacher training institutions in 68 different cities in Turkey. Although each cities approximately have at least a museum, contents of these museums i.e., small city museums without science materials are generally ethnography and archeology. Science centers only are situated in large cities such as in Ankara, Istanbul, and Izmir. Pre-service teachers in 20 faculty of education can directly profit from these science centers. Although it showed that 20 % of the pre-service teachers can benefit from science centers, this ratio is actually lower because of the intensity of pre-service teachers in education of faculty in small cities. Second, some of these science centers have not provided opportunities with the fully equipped. Each case shows that science centers are limited in Turkey, and students who graduate from each level are trained without being aware about them. Again, literature supported that teachers still are not efficient on planning, conducting, and integrating out-of-school learning environments (Kisiel 2003; Phillips et al. 2007).

Out-of-school learning environments have very advantageous aspects for educational implications which were emphasized above. However, researches with out-of-school learning generally have been studied at primary and secondary education in Turkey (Köse 2004; Kısa 2005; Sahan 2005; Yüksel 2009; Dogan 2010; Türkmen 2010; Ertaş et al. 2011; Guler 2011). Although many researches emphasized the importance of the relation between teachers and out-of-school learning, studies with informal learning environments as places of learning adults in both national and international literature have increased day by day (Tran 2007; Granier 2010; Dudzinska-Pzesmitzski and Grenier 2008; Tal 2006; Taylor and Neill 2008). Moreover, there is a growing use of science museums as setting for intensive teacher preserve and in-service development (Semper 1990). Although science centers are the primary institutions where out-of-school learning environments are performed, their importance is newly recognized in Turkey. The fact that they are not widespread across the country is one of the primary causes for the small number of research studies in this field and for not benefiting sufficiently from science centers in science education (Ertaş et al. 2011). In addition, teacher educators study pre-service and in-service teachers' professional development in university settings, after-school centers, or summer community literacy programs. Other researchers have shifted their research focus from classrooms to university lab schools, child development centers, and reading clinics (Leung et al. 2010). In this context, the results obtained by this research are thought to be important in terms of demonstrating the current situation with out-of-school learning in teacher training programs in Turkey and comparison of these results with international literature results.

This research was aimed to determine the effects of out-of-the-school learning environments such as science center and museum on pre-service teachers. Thus, answers were sought to the following questions:

1. what are the pre-service teachers' views of FG Science Centre and RMK museum?
2. what are the effects of activities performed in the science centre and in the museum on pre-service teachers' attitudes toward science and technology course?
3. What are the pre-service teachers' views of the science centre and the museum in terms of science–technology–society–environment interaction?
4. what are the pre-service teachers' views of the contributions of the science centre and the museum to their teaching career?

Method

This research used case study, a qualitative research design. An individual, an institution, a group, or a situation may set an example for the situations to be studied in a case study. The primary characteristic of a case study is that it researches one or more situations in depth (Ritchie and Lewis 2003; Cohen et al. 2007). In this study, science centers and museums, two of the out-of-the-school learning environments, were considered to be a case; and students' attitudes and views in that process were analyzed.

Participants

The study group was constituted using homogenous sampling, one of the purposive sampling methods. This sampling method represents selecting a homogenous sub-group or a case from the population and conducting the research accordingly (Cohen et al. 2007). Thus, the study group included 41 pre-service teachers attending the Department of Elementary Teaching, Ahi Evran University Faculty of Education in Turkey. The absence of science center for pre-service teachers in city and going to other cities for out-of-learning activities were considered as a homogenous sub-group by researchers. Most of the faculties of education approximately 72 of 92 have similar conditions in Turkey. In addition, pre-service teachers in study group did not take part in these activities before, and they were selected according to willingness.

Instrument

A descriptive-interpretative approach was adopted, with data sources comprising semi-structured survey with pre-service teachers. The "opinion form" was developed by the researcher and was designed in an open-ended format. The collect data with the use of this method has provided some advantages for this study. The respondents had to think and write the answers, and the items of opinion form tested the ability to recall and find the knowledge. The tool was also advantageous in that it required varying knowledge, the answers were short and thus many concepts could be tested and scoring became easier, and that it provided independence in responding to the questions. Along with those advantages, it enabled the researchers to determine the students' attitudes and views (Turgut 2000; Tekin 2000; Özçelik 2010). Questions of four distinct themes (namely, overall evaluation, attitudes toward science and technology course, science–technology–society–environment, and teaching profession) which were structured beforehand were included in the form. The questions listed below were structured in a manner so as to give students an opportunity to reflect their thoughts:

i) In what ways do you think FG Science Centre and RMK Museum in Ankara in Turkey contributed to you?
ii) What are the effects of your visits to the science centre and the museum on your attitudes toward science and technology course?
iii) What gains did the science centre and the museum offer to you in terms of science, technology, society, and environment?
iv) What contributions do you think the activities performed will make to your teaching life?

In the next stage, the questions in which the themes were included were asked to two science experts in the form of three-pointed Likert as "it can be used," "it cannot be used," and "it can be used after modification"; and Cohen kappa was checked for the data obtained, and conformity between experts was examined. Thus, the reliability of the scale was also determined. A kappa of .70 or above indicates adequate interrater agreement (Brennan and Prediger 1981). In this study, percent of overall agreement with raters was calculated as 0.75. This result showed acceptable level of agreement between the raters.

The Procedure

Researchers prepared for and implemented three stages of planing out-of-school activities—before, during, and after. Out-of-school activities may be very valuable experiences for learners, when they are well planned and thoughtfully conducted (Herr 2008; Esler and Esler 1993). Trips to out of school require greater planning and management than do on-school trips (Esler and Esler 1993). The following procedure was carried out to improve the efficiency of each stage.

Before the Out-of-School Activities

When the out-of-school activities came into being, this idea was shared with the research team and the department chair before mentioning the idea to pre-service teachers. In this process, the advantages and the disadvantages of out-of-school activities for pre-service teachers were discussed. Researchers set predetermined goals and made them known to pre-service teachers. In this context, out-of-school activities were contributed to the ongoing school courses such as environmental education, science education, science and technology laboratory, physics, chemistry, biology, etc. Then, research team planned all details for monitoring student safety from departure to return such as travel directions, arrival and departure times, parking, fees, and lunches. The expenses during the out-of-school activities were covered by the researchers' project.

A schedule was designed by the researchers prior to the application with regard to the places to visit and their properties, and including science centers and museums in the scope of the research was considered appropriate. Thus, FG Science Centre and RMK Museum were included in the research as out-of-the-school learning environments. While FG science center is the first science center in Turkey, RMK Museum is first and only industry's museum in Ankara which is capital city of Turkey.

After getting the permission of the administration of school, the pre-service teachers in the study group were first exposed to an orientation program. In this process, they were informed of the places to visit, what they should wear and bring, academic expectations of them, and about the rules to obey such as late for the departure or return, loses a personel items, injured, becomes sick. Along with the rules, important points were also emphasized in this process. In addition, pre-service teachers did not take part in these activities before, and they were selected according to willingness.

Before the trip, some questions such as "what do we know about …………? (kinesthetic energy, gases, etc.)," "what do we want to find out about ……?" were asked to pre-service teachers to check their preliminary knowledge and to create an interest about the subjects.

During the Out-of-School Activities

Out-of-school activities were made according to the directions of planning. Moreover, the observation/question worksheet was used to motivate and to create interest of pre-service teachers during activities. Out-of-school activities were recorded by camera and this record provided some of benefits such as evaluation of data and giving them feedback.

After the Out-of-School Activities

Pre-service teachers wrote about their experiences in paper. Morover, they filled in "opinion form" to determine the overall evaluation, the attitudes toward science and technology course, the science–technology–society–environment, and the teaching profession. Finally, small groups gave oral reports sharing what they did and learned.

The Data Analyses

The data obtained were studied through categorical analysis and evaluative analysis. In categorical analysis the following processes were employed (Bilgin 2006; Creswell 2007): (1) Encoding and selection stage. At this stage, students' views were first listed in writing, and the empty paper sheets were excluded. (2) Concept compilation stage. The documents containing students' views were initially encoded. Criteria such as gender (F/M), grade level (fourth grade), and ordering (first) were considered. Then the concepts outstanding in the texts were listed and their frequencies were determined. (3) Category-determining stage. After encoding the concepts, the codes were brought together, the common properties were found, and thus the themes (categories) forming the outline of the research findings were reached. The codes under the themes were explained in relation to each other, interpreted, and the findings were demonstrated in line with the purpose of the research. Students' views were divided into four themes (overall evaluation, attitudes toward science and technology course, science–technology–society–environment, and teaching profession). The concepts under the theme of overall evaluation were benefits and restrictions, those under the theme of attitudes toward science and technology course were cause and effect, those under the theme of science–technology–society–environment were process and result, those under the theme of teaching profession were teachers and students. (4) Validity and reliability achievement stage. A detailed reporting of the data collected and description of how the researcher has arrived at the conclusions are among the important criteria of validity in qualitative research studies (Creswell 2007). In this research, the process of data analysis is described in details. Thus, the validity of the research result was achieved. Reliability was achieved by re-grouping the researcher-determined concepts-categories by an independent researcher and by comparing them. In this process, the number of agreements and disagreements suggested by Miles and Huberman (1994) was calculated and was put into practice. Having determined the number of agreements and disagreements, the research reliability was found using Miles and Hubert's (1994) formula (reliability = agreements/agreements + disagreements). Thus, 99 concepts under the theme of overall evaluation, 99 concepts under the theme of attitudes toward science and technology course, 78 concepts under the theme of science–technology–society–environment, and 96 concepts under the theme of teaching profession were assigned; and those concepts were assigned under the categories with .89 reliability correctly. This result showed that the findings obtained were adequately represented, and that the research would yield reliable results.

At the second stage, evaluative analysis was used to evaluate qualitative data (Bilgin 2006). Evaluative analysis is primarily used to measure against attitudes in a message. These steps were followed in the research: (1) The severity of each attitude sentence in students' written texts was measured on a seven-pointed scale placed between the extremes of for and against and with a mid point meaning neutral (+9, +6, +3, 0, −3, −6, −9)/(very- quite- a little- neutral- a little- quite- very). (2) In order to determine the strength of the attitudes, words functioning as adverbs and stating amount/manner were searched in the messages. This procedure was repeated for each statement, and evaluative judgments were written one under another, and the attitude of the source of the message was displayed as a profile. For instance, in the sentences "the activities conducted certainly attained their goals. Seeing the experiments by applying them on to one in class became more permanent…" "certainly" in the first sentence and "more permanent" are judgment terms whereas "attained" and "became" are linking terms. (3) Having encoded the attitudes and evaluating them in numbers, the total was divided into the number of statements, and thus the average attitude was found. The sample analysis for the route taken was summarized in Table 2.

In Table 2, five sentences were analyzed for the analysis of a pre-service teacher's answers to open-ended questions, and the judgment terms and linking terms for each sentence were found and the average attitudes were calculated by dividing the total scores by the number of sentences. Thus, the average attitude ($M = 3.6$) could be interpreted as positive at the level of a little.

Table 2 The sample analysis concerning prospective teachers' attitudes in the process of evaluative analysis

Y		*B*		*Y* × *B*
Judgement term	Severity	Linking term	Severity	
1. Very	+3	I had fun	+3	+9
2. Too many activities	−2	Okay	+3	−6
3. Certainly	+3	Achieved	+3	+9
4. More detailed	+3	It might have been	+1	+3
5. Partly achieved	+1	Achieved	+3	+3
			Total	+18
			M	+3.6

Results

The data were analyzed in the findings part under four themes (overall evaluation, attitudes toward science and technology course, science–technology–society–environment, and teaching profession) separately (Table 3).

The pre-service teachers' average attitudes ($M = 5.90$) concerning the activities conducted in FG Science Centre and RMK Museum after the application was positive at the level of a little. This result showed that pre-service teachers thought positively of the applications.

On examining the pre-service teachers' answers about the activities in terms of put-of-the-school learning environments, 99 concepts formed under two categories. On the other hand, almost all the students participating in the out-of-the-school learning activities ($f = 38$; 92.6 %) stated

Table 3 Pre-service primary teachers' attitudes toward overall evaluation

Theme	*N*	*M*	SD
Overall evaluation	41	5.90	2.682

Table 4 Pre-service primary teachers' attitudes toward science and technology course

Theme	*N*	*M*	SD
Attitude toward science and technology course	41	7.29	1.611

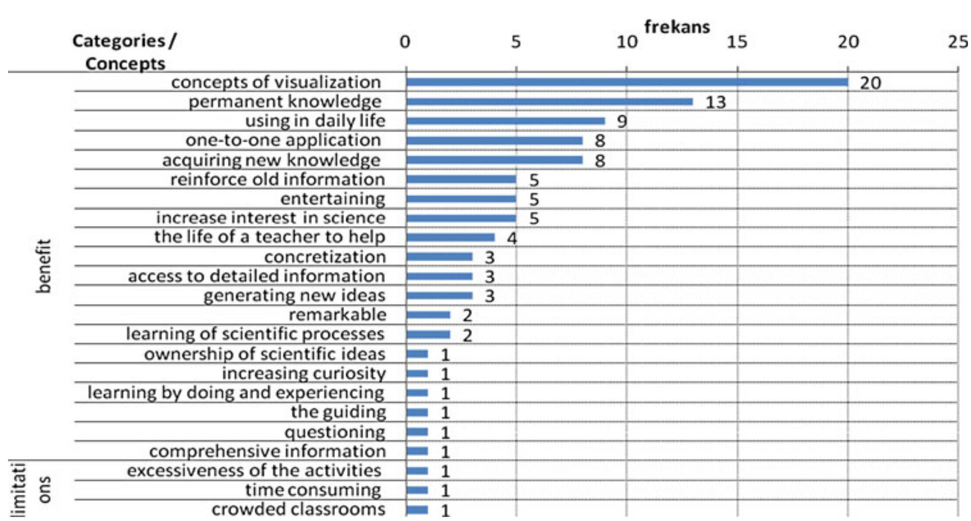


Chart 1 Findings concerning the categories and concepts formed under the theme of overall evaluation

positive views concerning the activities. Pre-service teachers were found to emphasize most the concepts of visualization (20), permanent knowledge (13), using in daily life (9), one-to-one application (8), and acquiring new knowledge (8) under the category of benefit; whereas excessiveness of the activities (1), time consuming (1), and crowded classrooms (1) were given as the limitations (Table 4).

Pre-service teachers' attitude average concerning the activities in the science centre and in the museum ($M = 7.29$) was positive at the level of quite. This result could be interpreted that the activities conducted in the science centre and in the museum affected pre-service teachers' attitudes toward science in a positive way (Chart 1).

In Chart 2, pre-service teachers' answers given after the activities were divided into 99 concepts and two categories (cause and effect) under the theme of attitudes toward science and technology course. It was found that an interest in science aroused (16), they began to think positively (10), knowledge was permanent in mind (8), their curiosity increased (7), and they began to find the course enjoyable (7). Besides, concepts concerning students' affective skills formed. According to students' answers, the causes for this were: the availability of learning by doing and experiencing (7), didactic activities (4), professional equipment for experiments (4), and doing observations (3).

Chart 2 Findings concerning the categories and concepts formed under the theme of attitudes toward science and technology course

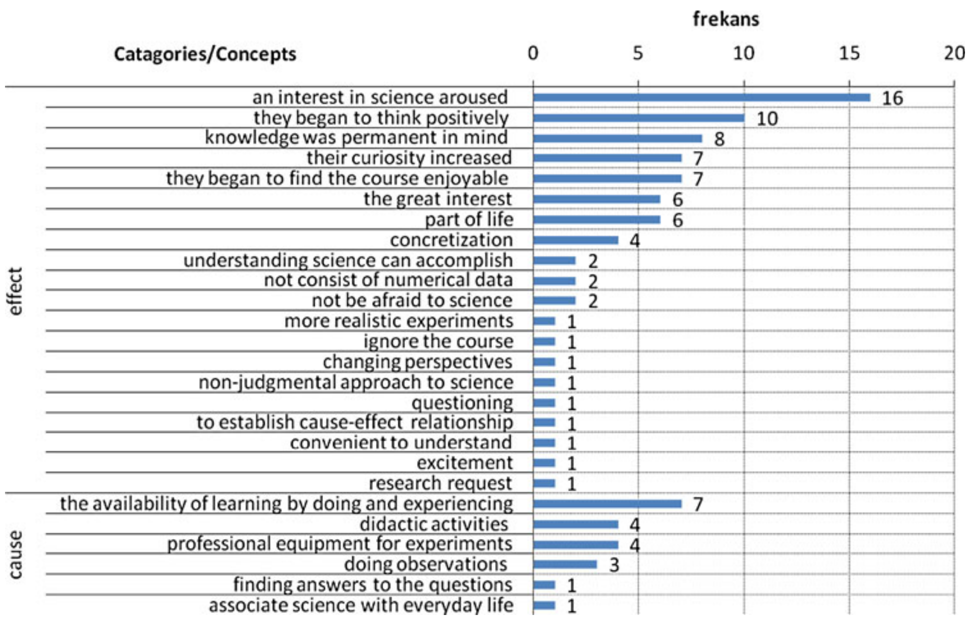


Chart 3 Findings concerning the categories and concepts formed under the theme of science–technology–society–environment

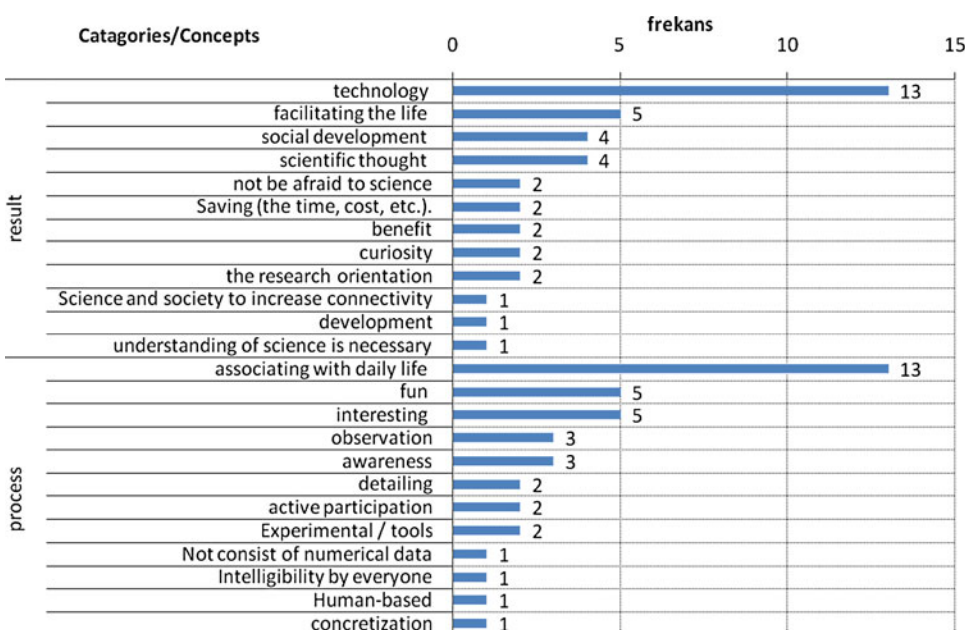
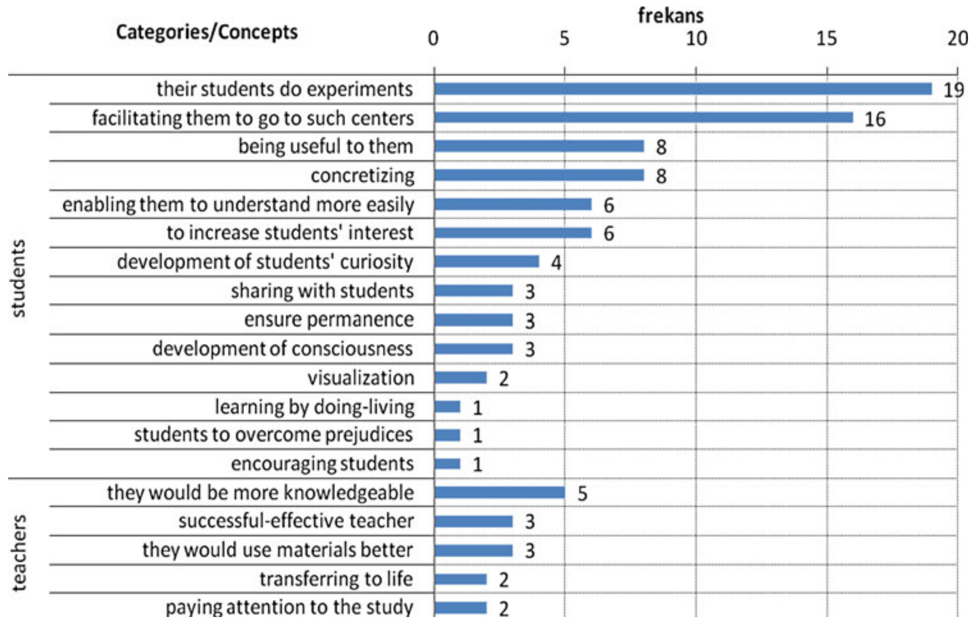


Chart 4 Findings concerning the categories and concepts formed under the theme of teaching profession



In Chart 3, pre-service teachers' answers under the theme of science–technology–society–environment contained 78 concepts in the categories of result and process. Under the category of result, these concepts formed: technology (13), facilitating the life (5), social development (4), scientific thought (4); on the other hand, under the category of process these concepts formed: associating with daily life (13), fun (5), interesting (5).

In Chart 4, the categories of students and teachers formed under the theme of the contributions that the activities would make to their teaching life in the future, and a total of 96 concepts were determined under this theme. The pre-service teachers emphasized that activities such as making their students do experiments, facilitating them to go to such centers, being useful to them, concretizing, and enabling them to understand more easily would be beneficial to their students. In addition, they also said that as teachers they would be more knowledgeable and that they would use materials better.

Conclusions and Discussion

The results of research showed that pre-service teachers held positive views of the activities performed in the science center and in the museum. Besides, their attitude averages under the themes of both overall evaluation and attitudes toward science and technology were also positive. From this case it could be interpreted that pre-service teachers' perspectives of science changed largely and that they began to think in a positive way. They stated that the activities were visual, permanent knowledge formed in consequence, they would be able to use the knowledge in real life, and they had the opportunity to apply one-to-one as positive views. These results showed that the out-of-school learning supports the development of scientific process skills such as making observations, classification, hypothesis-building, identifying variables and models, gathering data, taking photographs, and writing reports. However, pre-service teachers stated that the number of activities was too many, some of them were time consuming, and that activities were too crowded as the disadvantages. Supportive of the research findings, according to literature out-of-school learning environments such as science centers, museums, and zoos could help students to gain science experiences (Ramey-Gassert 1997). Moreover, these experiences in museums motivate children and adults to become more inquisitive (Semper 1990).

The pre-service teachers said that science centers in particular made them more interested in science, and thus they began to think more positively of science. In this sense, the activities of FG Science Centre and RMK Museum were influential in increasing their interest in science subjects, and in sustaining this. Science centers, especially in out-of-school learning environments, have importance for the development of science literacy. Findings are also available in literature showing that science centers, museums, and nature experiences were effective in increasing students' interest and academic achievement in science and improving it significantly (Gerber 1996; Dierking and Falk 1997; Youniss et al. 1999; Nundy 1999; Eshach 2007; Uitto et al. 2006; Luehmann and Markowitz 2007). Luehmann and Markowitz (2007) found that teachers showed a shift over time with respect to their perceptions of the value of the out-of-school experience, moving from an initial focus on increasing test scores toward a greater appreciation for its impact on students' motivation and identity development. Another major benefit of regular museum visits is that museums give students the chance to learn in different ways (Hooper-Greenhill 1997). Demirbaş (2005) pointed out that affective learning, which constitutes a dimension of learning, was as important as cognitive learning; and stated that visits to the places where the apparatus for experiments are displayed would be interesting to students; therefore, it was emphasized that parts for such activities should be added to the curriculum. In addition to that, research indicates that organized out-of-school activities (e.g., school government, sports, and volunteering) have the potential to enhance youth's ability to master the major developmental tasks of adolescence and young adulthood. For instance, participation in constructive out-of-school activities during high school has been linked to multiple indicators of academic achievement including school engagement, high grades/test scores, low school absenteeism, and high rates of college attendance (Zarrett and Mahoney 2011). On the other hand, research conducted by Kısa (2005) demonstrated that there were no significant differences between students' pre-test and post-test applications in terms of conceptual meanings.

The main purpose of science education is to improve the science literacy of all people. This purpose is usually carried out through formal and informal science education (Chang 2012). Rickinson et al. (2004) found strong evidence of the benefits of outdoor education by two meta-analyses of previous research. Outdoor adventure programs can impact positively on young people's: (i) attitudes, beliefs, and self-perceptions—examples of outcomes include independence, confidence, self-esteem, locus of control, self-efficacy, personal effectiveness, and coping strategies; (ii) interpersonal and social skills—such as social effectiveness, communication skills, group cohesion, and teamwork. Museums provide a favorable environment in which children can do and experience things to improve themselves cognitively, physically, affectively, and socially (Rickinson et al. 2004; Dogan 2010). One of the results of this study, pre-service teachers also stated that knowledge became permanent in mind, their curiosity increased, and that they began to find science course more enjoyable. This case showed that their attitudes toward science course increased in a positive way. This stemmed from learning by doing and by experiencing, from didactic activities, professional experiment apparatus, and from doing observations. Kısa (2005) also concluded that students found the activities in science centers very remarkable and meaningful. Mittelstaedt et al. (1999) found that the children arrived with a positive attitude toward the environment after a week-long experiential program. Chang (2012) developed science museum instructional module and evaluated its impact on students' expected and actual perceptions. One of the results of his study showed positive changes in the students' expected perception and actual perception of experience after going through the module. Also, Manzanal et al. (1999) founded that fieldwork aided the conceptual understanding and the development of attitudes of students. Luehmann (2009) directed by research has documented a number of important benefits of these out-of-school programs, such as (i) improving science content knowledge of students, (ii) positive impact on students' understanding of the nature of science and scientific inquiry as well as scientific reasoning, (iii) encouraging students' interest and motivation in science, and (iv) providing the opportunity to access scientific tools and practices. As a result, out-of-school learnings are environments in which teaching occurs, although not always in direct ways.

Under the theme of science–technology–society–environment, in the category of results, concepts such as technology, making life easier, social development, and scientific thought formed whereas in the category of process such categories formed: associating with daily life, enjoyable, and interesting. Empirical research has shown out-of-school programs to have a positive effect on improving science content knowledge of students. Out-of-school programs have been shown to have a positive impact on students' understanding of the nature of science and scientific inquiry as well as scientific reasoning (Luehmann and Markowitz 2007). Out-of-school learning environments provide multiple opportunities and deepen its knowledge and understanding of science, technology, and nature (Semper 1990).

Under the theme of contributions to their teaching life in the future, pre-service teachers said that such activities as making their students do experiments, facilitating them to go to such centers, being useful to them, concretizing, and enabling them to understand more easily would be beneficial to their students. In addition, they also said that as teachers they would be more knowledgeable and that they would use materials better. In this content, according to Ramey-Gassert (1997), out-of-the-school learning environments are rich sources of teaching for teachers.

Limitations of the Study

This study has several limitations that may narrow the applicability of the results. First, results of the study are limited with 41 pre-service teachers. Moreover, this study contained only about practices of out-of-school learning with science such as science center and museum. Although there are some studies about out-of-school learning in literature in Turkey, they have associated with the elementary education. The generalizability of this research' results can be ensured by more and larger sample size researches. This also will highlight the importance of out-of-school learning in the teacher training.

A second limitation is that pre-service teachers mainly graduate from schools without visit to science centers and museums, because numbers of the extensive out-of-school learning environments are very limited in Turkey. This situation restricts the applicability of the research results.

Third, many schools have limited funds for expenses with out-of-school activities. Other limitations are transportation, communication with parents, time, and the completion of the permissions. In fact, out-of-school learning directly is influenced by external factors (Anderson et al. 2006; DeWitt and Storksdieck 2008). Pre-service teachers through their own efforts or small organizations can involve in field trips, but some of them who are in low-income abstain from participation in these activities. These limitations can be overcome with establishing of budgets for out-of-school learning in schools.

Implications for Educational

Metz (2005) claims that pre-service teachers have difficulty in associating their experiences in the science course and in daily life with science, and that field-based learning model could remove that problem and offer a more reliable perspective of science. In this sense, out-of-the-school learning makes significant contributions to students' in class education and to lifelong learning. Therefore, in shaping the teacher training curricula, the nature of out-of-the-school learning should be questioned. Because, teachers still fall down on planning, conducting, and integrating out-of-school learning environments (Kisiel 2003; Phillips et al. 2007). Science centers and museums can contribute to education via schools. The best way to do that is promoting cooperation between out-of-school learning and schools. In the process planning and developing of teacher training programs should be included in overtly and covertly in the curriculum in harmony with out-of-the-school learning (Semper 1990; Hooper-Greenhill 1997; Falk 2005; Lucas et al. 1986; Hein 2006). In this way, out-of-school learning can expand the range of opportunities for adults with practical applications to an individual's profession, personal interests, and community (Hein 2006). Thus, all the pre-service teachers might be given opportunities to gain experience, and in this way, their sensitivity to this issue could be increased. In the short term, this could have an impact in making them develop a positive attitude toward science, in increasing their interest, and in increasing their achievement. In the long terms, however, it would be important for pre-service teachers to provide their students with appropriate learning environments in their teaching life in the future. Furthermore, students benefit from a variety of teachers, both formal and informal. Variety provides new perspectives and ideas and opens minds to new goals and careers (Herr 2008).

One of the limitation emphasized for this study was that the extensive science centers and museums are only in the largest populated cities. However, out-of-school learning should not just limit with science centers. Many different out-of-school learning environments adequately can be used in different ways relative to conditions of schools and cities. Museums (aeronautics, automotive, invention, natural history, science, technology, and transportation), wild lands (beaches, county parks, forests, etc.), research (universities, weather stations, research vessels, mountain research stations, etc.), interpretive centers (animal parks, arboretums, nature centers, planetariums, etc.), and industry (airports, dams, factories, farms, hospitals, harbors, coal power plants, refineries, fire stations, etc.), for example, can be used as possible science field trip destinations (Eshach 2007; Herr 2008). In this context, flexible educational curriculums subject to the conditions of schools rather than solid curriculums can be developed. It can provide advantages for overcoming these and other problems.

Actually, a science center located on the site is important for individual usage without a time constraint and for students in other educational institutions. Doris (2010) suggests that one of the ways making out-of-school activities efficient and effective is "keep it local, short, and simple." However, removable applications with science activities can be made for limited opportunities schools in order to create awareness toward science centers. On the other hand, technology is another key factor behind the huge strides being made by the developing world—and indeed everywhere—in science (Quevedo 2012). Since the internet is a useful tool to provide scientific information to a large number of users, e-learning designs can be used to carry out science activities and they can provide opportunities and benefits for application users of all ages.

Suggestions for Future Research

Although there are some studies about out-of-school learning in literature in Turkey, they have limited in higher education. More and larger sample size studies need displaying the benefit of out-of-school learning. Especially, development of scale toward out-of-school learning will give feedback in order to increase the effectiveness of activities. In addition, studies on the effects of removable and mobile applications may be implemented to minimize the negative effects of external factors such as transportation and rising costs. This will provide invaluable contributions for schools with limited resources.

This study only covers about environments of out-of-school learning with science. Advantages and disadvantages of out-of-school learning environments can be detected for educational implications with pre-service teachers in different departments by further studies. In addition, taking the necessary precautions against the restricting factors which emerge as disadvantages in the research results such as crowded classrooms and excessiveness of time and activities could increase efficiency in students' learning. Attention should be paid to those points in out-of-the-school learning environments to be organized.

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