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Preservice Teachers' Thoughts about Designing Science Activities in Informal Environments

Pelin KÖSEOĞLU
Hacettepe University, Ankara -Türkiye

Hakan TÜRKMEN
Ege University, İzmir -Türkiye

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Abstract

Purpose: The main purpose of this research is to determine the perspectives of preservice science teachers who have taken and have not taken course on science teaching in informal environments, on the process of designing activities within the scope of science teaching in informal environments.

Design & Methodology: This study used explanatory design, one of the mixed-method design types. The sample of the study consisted of 76 senior preservice science teachers at Science Teaching Department from two different universities in Turkey. While choosing the study group, stratified purposive sampling, one of the purposive sampling methods, was used. Outdoor Science Activities Performing Scale was used as a quantitative data collection tool and interviews were used as qualitative data collection tools.

Findings: According to quantitative findings, when the dimensions of the Outdoor Learning Performing Scale were compared between the groups, no statistically significant difference was found in all dimensions. However, when the qualitative findings were examined preservice science teachers who have taken the course had enough knowledge about designing and performing science activities in informal learning environments.

Implications & Suggestions: To sum up, preservice science teachers who have taken the course had enough knowledge about designing and performing science activities in informal learning environments. This directly emphasizes the importance of receiving instruction in this subject. In this study, the instruction received by the preservice teachers who have taken courses was one of the main reasons for them wanting to have their students experience this process by overcoming all the difficulties they might encounter. However, preservice science teachers who have not taken the course about informal science education did not have enough knowledge about designing and performing science activities in informal learning environments.

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Öğretmen Adaylarının İnformal Ortamlarda Fen Etkinlikleri Tasarımına İlişkin Görüşleri

Pelin KÖSEOĞLU
Hacettepe Üniversitesi, Ankara -Türkiye

Hakan TÜRKMEN
Ege Üniversitesi, İzmir -Türkiye

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Anahtar Sözcükler

İnformal Öğrenme Ortamları
İnformal Fen Eğitimi
Fen Eğitimi
Öğretmen Adayları

Öz

Amaç: Bu araştırmanın temel amacı, informal ortamlarda fen öğretimi dersi alan ve almayan fen bilgisi öğretmen adaylarının bu ortamlarda fen öğretimi kapsamında etkinlik tasarlama sürecine bakış açılarını belirlemektir.

Yöntem: Bu araştırmada karma desenlerden açıklayıcı (explanatory) desen kullanılmıştır. Araştırmanın çalışma grubunu, iki farklı üniversitenin Eğitim Fakültesi Matematik ve Fen Eğitimi Bölümü Fen Bilgisi Öğretmenliği Anabilim Dalı son sınıf öğrencileri olmak üzere toplam 76 öğretmen adayı oluşturmaktadır. Çalışma grubu seçilirken amaçlı örnekleme yöntemlerinden tabakalı amaçlı örnekleme kullanılmıştır. Nicel veri toplama aracı olarak Okul Dışı Öğrenme Etkinlikleri Gerçekleştirme Ölçeği, nitel veri toplama aracı olarak görüşmeler kullanılmıştır.

Bulgular: Nicel bulgulara göre Okul Dışı Öğrenme Etkinlikleri Gerçekleştirme Ölçeği'nin boyutları gruplar arasında karşılaştırıldığında tüm boyutlar için istatistiksel olarak anlamlı bir fark bulunmamıştır. Ancak nitel bulgular incelendiğinde, dersi alan öğretmen adaylarının informal öğrenme ortamlarında fen etkinlikleri tasarlama ve gerçekleştirme konusunda yeterli bilgiye sahip oldukları görülmektedir.

Sonuçlar ve Öneriler: Özetle, dersi alan fen bilgisi öğretmen adayları informal öğrenme ortamlarında fen etkinlikleri tasarlama ve gerçekleştirme konusunda yeterli bilgiye sahiptir. Bu bulgu, bu konuda eğitim almanın önemini doğrudan vurgulamaktadır. Bu çalışmada, ders almış olan öğretmen adaylarının karşılaşabilecekleri tüm zorlukları aşarak öğrencilerine bu süreci yaşatmak istemelerinin temel nedenlerinden biri ders almış öğretmen adaylarının aldıkları öğretimdir. Ancak yaygın fen eğitimi dersini almayan fen bilgisi öğretmen adayları, informal öğrenme ortamlarında fen etkinlikleri tasarlama ve gerçekleştirme konusunda yeterli bilgiye sahip değildir.

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INTRODUCTION

Science is life itself. For this reason, the learning processes that take place in the plan and program in schools, interaction and communication in daily life, and informal learning that takes place randomly have a great effect on the science learning process (Öner & Güneş, 2017). Learning is a process and a product including cognitive and sociocultural outcomes, motivation, and cooperation. It is not possible to distinguish between this process and the multidimensional product (Anderson, Piscitelli, Weier, Everett, & Tayler, 2002). Learning should include a process, meaning, it requires gaining the ability to find solutions to problems encountered in daily life. In addition, cognitive learning theory explains learning not as a simple and linear process, but as a complex series of interaction and feedback loops (Falk & Dierking, 1997). This theory states that the student's learning environment and the events that take place within it greatly impact their learning processes. The stimuli received from the environment can facilitate or limit the process that enables cognitive learning (Senemoğlu, 2013). In support of this, environmental psychology states that the environment affects a person's behavior. The environment has a direct bearing on shaped behaviors (Yıldırım & Şimşek, 2016).

All this information reveals how much the environment affects learning. Classroom, laboratory, and informal (out-of-class, out-of-school) environments are three learning environments in which science teaching takes place (Orion & Hofstein, 1994). In learning environments such as classrooms and laboratories, factors such as where, when, how, how often, and from whom students learn are usually beyond their control (McMannus, 1988). Informal learning environments are interactive environments where students can learn by experience and share their experiences with their family and friends. This sharing is a fundamental part of the informal learning process (Diamond, 1986). The science education that takes place in these environments consists of the learning that the student acquires as a result of the experiences that occur in his daily life (Kaplan & Türkmen, 2022 & Türkmen, 2010). Examples of informal learning environments are science centers, museums, botanical gardens, zoos, libraries, open-air laboratories, aquariums, planetariums, and houses; in short, all social spaces that can be found outside the classroom (Hannu, 1993; Howe and Disinger, 1988, cited in Bozdoğan, 2012). Other studies have reported that students get bored when they cannot actively participate in the science learning process in the classroom; furthermore, informal environments provide students with opportunities to learn more easily (Colley, Hodkinson, & Malcolm, 2002; Stocklmayer & Gilbert, 2003; Türkmen, 2010; cited in Türkmen, 2015). Informal learning environments enable students to build on their learning experience by leaving them from the classroom learning environment. They introduce students to lifelong learning institutions and increase their interest in these environments (Storksdieck, 2001).

Activities in informal environments and recreational activities such as excursions and picnics should not be considered as having the same terminology. These activities should be "purposeful," serve a certain purpose or correspond to a learning outcome in the science curriculum (Karademir, 2013). Science teaching outside the classroom is student-centered and provides students with fun and meaningful learning by doing and experiencing. Students act like a scientist and use their scientific process skills. It is known that a trip that takes place in an informal environment will not be forgotten over the years (Turkmen, 2010). For this reason, one key duty of teachers should be to design learning activities in informal environments. The role of teachers as guides and their abilities are crucial when designing this teaching and putting it into practice (Thomas, 2010; Association for Experiential Education, 2008; cited in Sontay, Tutar, & Karamustafaoğlu, 2016; Yigit, Sivrikaya & Guvan, 2021). This process entails many tasks that teachers are expected to perform *before, during,* and *after these trips*. Before even *making*

the trip, teachers should start by selecting an educational outcome from the Science Education Program of the Board of Education and Discipline. Having selected the desired outcome, the next step is to choose an appropriate informal environment. Teachers should create a lesson plan, taking into account the environmental conditions and the learning outcome. The next task is to obtain the necessary legal permissions from the school administration, parents, and, depending on the situation, the provincial or district National Education Directorates. In the process of doing the pre-trip planning, teachers are also required to go to the informal locations where they will take the students, examine them, and inform the staff and experts there what they plan to achieve and how. In addition, students' food, rest, security, and washroom needs should be taken into consideration. Planning should also take into account the families' economic situations and calculate transportation and expenses accordingly. A well-considered pre-trip plan will directly affect how the trip is remembered (Türkmen, 2010). The features of the exhibitions that students encounter in informal environments, the limited discovery offered to them, and experts or employees who tend to lecture them will cause them to get bored (Piscitelli & Anderson, 2001). In other words, it will not be enough simply to take students to an informal learning environment. It should be ensured that the tour order is a student-centered process. The teacher should act as a guide and the students should be steered by the research questions prepared before the trip (Türkmen, 2010). There are some features that an ideal informal learning process should have. Students should participate in the learning process voluntarily without getting bored, decide for themselves what to learn, and when to use which skill while learning without being exposed to any intervention; they should be able to obtain information by using more than one sensory organ, experiencing it for themselves; they should not be subjected to any time constraints, and they should experience the entire process as serving a purpose (MoNE, 2018; Orion & Hofstein, 1994; Türkmen, 2010). In the post-trip process, it is necessary to conclude by using discussion methods in order to reach an accurate and common theoretical knowledge by transferring the information collected by the students during the trip to the classroom environment and to eliminate the misconstrued information in the students (Türkmen, 2010).

Many studies have been made on this subject. Siegel (2007) conducted a study with a theory-building pattern, aiming to explain and describe experiences in informal environments, and he defended activities in informal environments should use for formal education, like Storksdieck's 2001 study (cited in Karademir, 2013.) Storksdieck also suggested that teachers should be given training on how to properly transfer museum experiences to the classroom. Türkmen (2015) revealed that teachers conduct these activities to provide learning by doing, adding that they are not well enough equipped in this subject and suggesting that teachers be supported during their undergraduate education or with in-service seminars. Bozdoğan (2012) conducted an action study of six field trips carried out by senior students of the Science Education Undergraduate Program and concluded that preservice teachers' knowledge of the activity planning process increased along with their confidence. In Güler's (2011) experimental study, She carried out inquiry-oriented activities for the experiment group and applied traditional teaching to the control group in an informal environment. The study reported a significant difference between the experimental and control group students' attitudes toward science in favor of the experimental group. In his doctoral thesis, Karademir (2013) revealed the goals of in-service teachers and preservice teachers when organizing science activities in informal environments and said that these goals are shaped by the regions where the teachers work and preservice teachers study and the expectations and intentions of the institutions with which they are affiliated. Moreover Öner and Güneş (2017), taking the opinions of science teachers about informal learning environments, stated that teachers declared their students' cognitive and affective behaviors changes in positive way students as a result of informal activities.

Purpose and Importance of the Research

Considering the studies mentioned above, the benefits of activities in informal environments speak for themselves. This study aims to determine how preservice teachers who took and did not take a course on teaching science in informal environments design and plan the activities to make recommendations on how to make teaching more effective in informal environments. To this end, the study sought answers to the research question "What do preservice science teachers who have taken and not taken a course on teaching science in informal environments make of the science teaching activity design process?" The sub-problems that will enable us to attain this problem are as follows.

1. To what extent do preservice science teachers who have taken and not taken course on teaching science in informal environments intend to conduct science teaching activities in informal environments?
2. What do preservice science teachers who have taken or not taken courses on teaching science in informal environments think about the process of designing science teaching activities in informal environments?

METHODOLOGY

Research Design

This study used explanatory design, one of the mixed-method design types. This is a two-stage design, the first of which is the collection of data using quantitative methods. In the second stage, data are collected using qualitative methods to support, explain, or confirm the quantitative data. In this design, quantitative and qualitative data have the same weight, and the ability to collect data at various times is advantageous for the researcher (Yıldırım & Şimşek, 2016). The quantitative data collection stage used a seven-point Likert-type scale, then the qualitative stage used interviews. The quantitative part of this research is descriptive research that includes two groups of pre-service teachers who have taken and who have not. No application was made during the research process that included activity design in informal environments. Therefore, it is not experimental research. The purpose of doing this was to make a more in-depth analysis of the subject.

Study Group

The study's working group consists of a total of 76 preservice teachers, senior students in the Faculty of Education, Department of Mathematics and Science Education/Science Education at two universities in two big provinces of Turkey. One of the preservice teachers' groups who have taken a course that includes both theory and practice called "Science Teaching in Informal (out-of-class) Environments" in the fall semester of their final year. During the course, the preservice teachers learned the theoretical framework of teaching science in informal (out-of-class) environments; acting as students, they participated in science teaching activities in informal environments under the guidance of the lecturer, and as the final task of the course, this time as teachers, they prepared a lesson plan that includes science teaching activities in out-of-school environments. A total of 40 preservice teachers who took this course contributed to this study. The other preservice teachers' group, consisting of 36 people, did not take a separate course on this subject. Quantitative data were collected from all 76 preservice teachers, taking into consideration the purpose of the study and whether or not they had taken courses. Stratified purposive sampling, which is one of the purposive sampling methods, was used when selecting the study groups. Researchers using this method aim to define and describe the characteristics of study groups with different characteristics and to uncover the difference between them (Büyüköztürk, Kılıç, Akgün,

Karadeniz, & Demirel, 2016). Qualitative data were collected through interviews with 13 preservice teachers, seven of whom had taken courses and six who had not, selected randomly from this sample.

Data Collection Tools

The "Outdoor Learning Performing Scale" was used as a quantitative data collection tool and six interview questions related to the subject were used as a qualitative data collection tool.The aforementioned scale was prepared by Karademir for the doctoral thesis published in 2013. The part of this scale related to out-of-school activities consists of three dimensions, six subscales, and 39 items. The original part of the scale about out-of-school activities consists of 41 items, but some items were removed due to item difficulties. The scale is in a seven-point Likert type ranging from Not possible/Not at all Important (1) to Quite Possible/Very Important.

The first dimension of the scale is "Action Beliefs." This dimension consists of two subscales: "Action Expectations" and "Action Assessments" and has 16 items in total. When developing the scale, the researcher set the type of action referred to in the scale's dimensions and subscales as "out-of-school science activities," and the purpose of the action as "out-of-school activities in science lessons." "The students learn through experience" and "I consider it important that students socialize" can be given as examples of items under this domain. The alpha value was found to be [0.89] and [0.90] for the perceived action expectations and assessment parts, respectively.

The scale's second dimension is "Control Beliefs." This dimension consists of two subscales: "Difficult Aspects of the Action" and "Easy Aspects of the Action." The action here is the action of "conducting science activities out of school" as before. This also consists of 16 items. "It will be difficult because of the trouble with parents giving permission" and "Being able to check the students regularly will make it easier." The Cronbach Alpha values of the two subscales in this domain were found to be [0.91] and [0.95], respectively.

The scale's third dimension is "Normative Beliefs." This domain consists of two subscales called "Subjective Person, Institution or Organizations" and "Motivation" and consists of 24 seven items in total. The Cronbach Alpha value for this domain of the scale was found to be [0.85].

A semi-structured interview form prepared by the researcher was used to collect data. The prepared interview form was sent to two field experts. Experts are faculty members of the Faculty of Education, Department of Science Education. Experts have publications on informal learning environments. Experts have said that questions should be short and concise. As a result of the feedback received, the interview questions were simplified. The necessary adjustments were made in light of their feedback and the form was finalized. Thus, the content validity of the form was ensured. The six interview questions used to collect data are as follows:

Table 1
Interview Questions

Interview Questions
1. Have you ever attended an activity in an informal environment? What did you experience from this?
2. What do you think the goals should be when organizing science activities in informal environments?
3. What do you pay attention to when planning a science activity in an informal environment?
4. What advantages do these activities provide?
5. How confident are you in your ability to plan activities? How did you come to this conclusion?
6. What difficulties might you encounter in planning and implementing such activities? How do you plan to overcome these difficulties?

Data Collection and Analysis

During the research process, quantitative data were collected from the preservice teachers on science teaching in informal environments using the "Outdoor Learning Performing Scale." It took them approximately 20 minutes to fill in this scale. The data were analyzed with SPSS version 25.0 and descriptive statistics were used for analysis. Then, it was examined whether there was a significant difference between the dimensions of the scale for the preservice teachers who took and did not take a course. For this purpose, it was first investigated whether the data showed a normal distribution. As a result of the analysis, it was concluded that the data were normally distributed. For this reason, the Independent Sample T-Test, one of the parametric tests, was used for the analysis of the data. To be able to comment on the data collected for the study, the range width of the scale was determined first. This range width is calculated using the formula a= (array width/number of groups) and is also called the range coefficient (Tekin, 2001). The range values are shown in Table 2. Also, preservice teachers who take a course were coded group of *Taken a Course,* and preservice teachers who did not take a course were coded group of *Not Taken a Course.*

Table 2
Limits and Options of the Scale

Point	Options	Limits
7	Quite possible	6.22 – 7.00
6	Possible	5.35 – 6.21
5	Somewhat possible	4.48 – 5.34
4	Neither possible nor impossible	3.61 – 4.47
3	A little possible	2.74 – 3.60
2	Not possible	1.87 – 2.73

Then, interviews were held with the teacher candidates taking a total of 1 hour. The interviews were recorded on tape and transcribed. The researcher tried to prevent data loss as much as possible by taking notes about the participants' non-verbal behaviors during the interviews. In addition, the transcribed interview recordings were given to the preservice teachers to check and confirm them. This was done in an attempt to ensure internal validity. Qualitative data in the interview records were analyzed using descriptive analysis. The descriptive analysis involves creating codes then explaining and describing them

by taking into account the interview questions. There is a theoretical framework in the analysis. It involves analyzing the data according to a previously determined list of codes/categories/themes. It is the process of summarizing and interpreting (Yıldırım & Şimşek, 2016). The codes in this study were created from the answers given to the interview questions, then paired with the interview questions and explained as percentages and frequencies.

FINDINGS

This section covers the findings reached as a result of the analysis of the collected data. The findings are examined under the headings "Quantitative Findings of the Outdoor Learning Performing Scale" and "Qualitative Findings from the Interview Questions".

Quantitative Findings of the Outdoor Learning Performing Scale

In this heading, there is the normal distribution of the Outdoor Learning Performing Scale data respectively. The Kolmogorov-Smirnov test and Shapiro-Wilk test were performed to understand whether it showed a normal distribution to the Outdoor Learning Performing Scale data. According to the values given in table 3, it was found that the scores of the preservice teachers from the related scale showed a normal distribution (p>.05, p=.200, and p=.506).

Table 3
Kolmogorov-Smirnov Test Results of Outdoor Learning Performing Scale Data

Kolmogorov-Smirnov Test Results of Outdoor Learning Performing Scale Data						
	Kolmogorov-Smirnov			Shapiro-Wilk		
	Statistic	Df	p	Statistic	df	p
Group of Taken & Not Taken a Course	.068	76	.200*	.985	76	.506

* p< .05

Therefore, between-group difference analyzes were performed with an Independent Sample T-Test. Findings related to these analyzes are given in table 4. One of the assumptions of the Independent Sample t-test is that the variances in the two groups are similar. When this assumption was calculated with Levene's test, the variances were homogeneous (p>.05, p=.126). Independent t-test results showed that there was no statistically significant difference between the two groups (p=.153).

Table 4
T-Test Results of Outdoor Learning Performing Scale Scores

T-Test Results of Outdoor Learning Performing Scale Scores						
	N	Mean	sd	df	t	p
Group of Taken a Course	40	5.56	0.53	74	1.13	.153
Group of Not Taken a Course	36	5. 72	0.42			

When the dimensions of the Outdoor Learning Performing Scale were compared between the groups, no statistically significant difference was found in all dimensions. One of the assumptions of the

Independent Sample t-test is that the variances in the two groups are similar. When this assumption of the Action Beliefs dimension was calculated with Levene's test, the variances were homogeneous (p>.05, p=.907). Independent Sample t-test results showed that there was no statistically significant difference between the two groups (p=.262) in the “Action Beliefs” dimension (Table 5).

Table 5
T-Test Results of Action Beliefs Dimension Scores

T-Test Results of Action Beliefs Dimension Scores						
	N	**Mean**	**sd**	**df**	**t**	**p**
Group of Taken a Course	40	5.56	0.53	74	1.13	.153
Group of Not Taken a Course	36	5. 72	0.42			

When the assumption of Control Beliefs dimension was calculated with Levene's test, the variances were homogeneous (p>.05, p=.070). Independent Sample t-test results showed that there was no statistically significant difference between the two groups (p=.401) in the “Control Beliefs” dimension (Table 6).

Table 6
T-Test Results of Control Beliefs Dimension Scores

T-Test Results of Control Beliefs Dimension Scores						
	N	**Mean**	**sd**	**df**	**t**	**p**
Group of Taken a Course	40	5.02	.85	74	.84	.401
Group of Not Taken a Course	36	5.17	.68			

When the assumption of the Normative Beliefs dimension was calculated with Levene's test, the variances were homogeneous (p>.05, p=.080). Independent Sample t-test results showed that there was no statistically significant difference between the two groups (p=.408) in the Normative Beliefs dimension (Table 7).

Table 7
T-Test Results of Normative Beliefs Dimension Scores

T-Test Results of Normative Beliefs Dimension Scores						
	N	**Mean**	**sd**	**df**	**t**	**p**
Group of Taken a Course	40	5.05	1.18	74	.832	.408
Group of Not Taken a Course	36	5.27	1.16			

For each item in the Outdoor Learning Performing Scale, it was examined whether there was a difference between the group of Taken a Course and group of Not Taken a Course group. According to the Independent Sample t-test results, a significant difference was just found in the 3 items (3-6-32) of the scale. There were statistically significant differences between groups in item 3, (students learn through experience, p<.05, p=.04), item 6 (students' realizing the relationship between science and natüre, p<.05, p=.007), and item 32 (this process will be easier if the number of students in the classes is less, p<.05, p=.015) in favor of the group of Not Taken Course.

When the mean averages of each item in the Outdoor Learning Performing Scale are compared, the average of the group of Taken a Course was slightly higher in only 9 items. The first item, item 10, is

about *learning by experience* (X=6.52>6.50). Item 14 is about *the importance of students' observing the relationship between science and daily life* (X=6.60>6.52). Item 15 emphasizes that *students will learn science better* (X=6.40>6.36). The other 6 items are related to the difficulties of the outdoor learning process. Item 19 (X=5.10>4.84), 20 (X=4.82>4.69), and 22 (X=5.25>4.84) are related to *the school administration*. Item 21 is about *classroom management* (X=5.12>4.86). Item 28 indicates *the distance of informal environments from schools as a difficulty* (X=5.25>4.86). The other challenge is the *appropriate time* (X=5.20>5.00) in item 39.

Qualitative Findings from the Interview Questions

Each interview question was analyzed in order. The findings include the codes generated and verbatim quotes taken from the answers given by the preservice teachers. The interviewed preservice teachers were coded as *"T1, 2., …, 7. (group of Taken a Course), and NT1, 2, …, 6 (group of Not Taken a Course)."*

The preservice teachers were asked, "Have you ever participated in an activity in an informal environment? What did you experience from this?" as a first question the codes obtained from their answers are presented in Table 8.

Table 8
Preservice Teachers' Experiences in Informal Environments

Preservice Teachers' Experiences in Informal Environments					
Group of Not Taken a Course	**f**	**%**	**Group of Taken a Course**	**f**	**%**
Participated			Within the scope of the course		
• Gained lasting learning experiences	3	60.0	• Gained concrete experience	2	28.6
• Developing a positive attitude	2	40.0	• Learned through experience	2	28.6
• Definition of the next level	2	40.0	• High Cost	1	14.3
			• Transportation difficulty	1	14.3
			• Hard to available institutions, like museums	1	14.3
Not participated	1	16.7	School field trips in middle school		
			• For fun	3	42.9

The Group of Taken a Course stated that they participated in activities in informal environments (85.7%) during the Teaching Science in Informal Environments course at university. Some of these preservice teachers had participated in school trips (42.9%) in junior high. These preservice teachers said that they learned through experience (28.6%) on the course; gained concrete experience (28.6%); transportation may be difficult (14.3%); and difficulties in terms of cost (14.3%). In addition, they stated that it is difficult to find institutions, like museums, that are suitable for the educational outcomes in the science curriculum (14.3%).

> *T1: "…it is hard to find suitable learning outcomes. More precisely, there are no informal environments in Turkey that have been planned around learning outcomes. Student transportation, costs -- these are the things that I think are difficult. We were taught that we should take measures for this beforehand…"*
>
> *T3: "I participated in an activity. I was a child. It was a school trip; I don't know if it can be called an activity. You can't experience much from this; these trips are more for fun, not so much information or culture…"*

The Group of Not Taken a Course stated that they experienced teaching in informal environments (83.3%) when they were students. Preservice teachers did not give detailed information about this experience. These preservice teachers gained lasting learning experiences (60.0%), developed a positive attitude toward science (40.0%), and participated in trips to introduce the next level (40.0%). One preservice teacher had never participated in such a process (16.7%).

> *NT2: In our junior year at university, our teacher took us for training as part of the course of the special subject in physics to show us the electron microscope. I still remember what I learned there…*
>
> *NT1: I took part. There was a training seminar, we went to it after high school. It was a seminar where we got answers to questions such as which department should I go to at the university and which department is good.*

As a second question, the preservice teachers were asked, "What do you think the goals should be when organizing science activities in informal environments?" The codes obtained from their answers are presented in Table 9.

Table 9
Goals of Preservice Teachers When Organizing Activities in Informal Environments Preservice Teachers'

Goals of Preservice Teachers When Organizing Activities in Informal Environments Preservice Teachers'					
Group of Not Taken a Course	**f**	**%**	**Group of Taken a Course**	**f**	**%**
Learning			Learning		
• Lasting and effective	5	83.3	• Lasting and effective	4	57.1
• Associate the subject with daily life.	3	50.0	• Purposeful	3	42.9
• Concrete experiences	3	50.0	• Developing social skills	2	28.6
• Learning in nature	2	33.3	• Learning in nature	2	28.6
• Giving interest and curiosity	2	33.3	• Concrete experiences	2	28.6
			• Associate the subject with daily life	1	14.3
Appropriate Learning Environment			• Fostering a sense of curiosity	1	14.3
• Fun learning environment	2	33.3	Appropriate Learning Environment		
Initiative	2	33.3	• Active participation	5	71.4
			• Research and explore	4	57.1

The Group of Taken a Course said that their goal when organizing science activities in informal environments was to create a learning environment in which students could actively participate (71.4%), conduct research (57.1%), and explore (57.1%). Their goal was to provide students with lasting and effective learning and that learning outcomes were the basis of these goals. They also aim to develop students' social skills such as effective communication and cooperation (28.6%). In addition, their other goal was for students to learn (28.6%) in nature, where they can directly observe science subjects. One preservice teacher (14.3%) was seen in their answers as aiming to provide students with concrete experiences, foster a sense of curiosity, and help them associate the subject with daily life.

> *T5: "The most important goal is for students to learn by touching and seeing things. This has to be the most important goal. The acquisition is a process that needs to be prepared as part of a key learning outcome. You have to create a setting that will enable the student to do something."*

T6: "My primary goal is to create concrete experiences for students. Maybe it will open a new window that will open a new page in the child's life to provide them with a lasting learning experience, make them wonder… Yes, the lesson plan and the lesson must achieve the goal of the lesson, but I would also do this for the children's social skills…"

The Group of Not Taken a Course defined lasting learning (83.3%) and learning by associating with daily life (50.0%) as their goal. In addition, they think that students should learn through concrete experiences (50.0%) and by obtaining information first-hand (33.3%) given their interest and curiosity. Another goal set by them was to create a fun learning environment (33.3%), and they said that in doing this, the students would be more initiative (33.3%). These preservice teachers did not offer any opinion on the aim of the process, unlike those who had taken courses.

NT6: My goal could be to provide a lasting learning experience. I try to choose topics that will attract the students' attention and interest more. Because if it does, it will be more lasting. And the students will be happy.

NT5: My goal may be to conduct an experiment. Experiments are also done to provide concrete experiences. Since science is a subject that is associated with daily life, it is better to study outside.

The next question was "What do you pay attention to when planning a science activity in an informal environment?" asked the preservice teachers. The preservice teachers said they break this process down into pre-trip, trip, and post-trip phases. For this reason, the codes obtained from their answers are explained in the following three separate tables. The elements they said they paid attention to when planning the pre-trip process are summarized in Table 10.

Table 10

How Preservice Teachers Plans Activities in Informal Environments

How Preservice Teachers Plans Activities in Informal Environments					
Group of Not Taken a Course	**f**	**%**	**Group of Taken a Course**	**f**	**%**
Prepare a plan			Prepare a plan		
• Appropriate to the student level	3	50.0	• Review the features of that environment	6	85.7
• Appropriate to the learning outcomes	1	16.7	• To determine the appropriate environment for the learning outcome	5	71.4
• Extracurricular (separate from the learning outcomes)	1	16.7	• To prepare a comprehensive trip	4	57.1
Choosing a topic from daily life	1	16.7	• Experts in their field	4	57.1
Cost	1	16,7	• to prepare research questions	4	57.1
Security	1	16,7	• prepare students for the trip	4	57.1
Obtaining the necessary permissions	1	16,7	• weather and transportation conditions	1	14.3
Determining a suitable time	1	16,7	Security	6	85.7
Providing the necessary materials	1	16,7	Obtaining the necessary permissions		
			• Parents	6	85.7
			• School administration	6	85.7
			• National Education Directorate	4	57.1

Accordingly, it can be seen that the Group of Taken a Course cares most about security, determining an environment suitable for the learning outcome, and obtaining the necessary permissions beforehand. They said that when determining the appropriate environment for the learning outcome, they should

visit the location if possible, and review the features of that location (85.7%) and that there should be experts in their field (57.1%). In addition, they said that they should obtain permission from parents (85.7%), the school administration (85.7%), and the relevant National Education Directorate (57.1%). Determining the learning outcome, which is the basis of the answer "to determine the appropriate environment for the learning outcome," is another issue they pay attention to when planning the process (71.4%). In addition, they said they have to prepare a comprehensive trip and post-trip plan (57.1%), to prepare research questions that will steer students during the trip (57.1%), and to prepare students for the trip (28.6%). Other factors affecting the plans are the weather conditions of that day, the season in which the trip will take place (14.3%), and transportation conditions (14.3%).

> *T5: "The necessary permissions must be obtained. Since obtaining these permissions will take some time, the plan must be prepared at the beginning of the year. We have to talk to parents, the school administration, and the district or provincial National Education Directorate. We need to talk to the people in the location we are going to, explain the purpose of this activity, what we want to do, what the students might ask, what answers should be given, that the students should go through a process of research and inquiry; also, we need to prepare the location and the experts there accordingly. Since the employees there are experts in their fields, they may be inclined to give the information directly to the students. This needs to be prevented. Security at the location is another important matter. It is permissible to eliminate flaws and design the things that are seen to be lacking…"*

On looking at the responses given by the Group of Not Taken a Course, it was seen that they wanted to prepare a plan appropriate to the student level (50.0%) and the learning outcomes (16.7%). Contrary to this view, one preservice teacher argued that the plan to be prepared should be extracurricular, separate from the learning outcomes (16.7%). Only one preservice teacher paid attention to making a pre-trip plan, choosing a topic from daily life, the cost of the trip, the safety of the students, obtaining the necessary permissions, determining a suitable time, and providing the necessary materials (16.7%). The frequency distribution of the answers given by the Group of Not Taken a Course is low when compared with the preservice teachers of taking courses.

> *NT3.: …Of course, there is the opinion that security is also important, family permission is important, and the trip should be in line with learning outcomes, but do not think it is necessary to adhere to that outcome. It's not just that the students will learn about that subject, they can learn other things they see around them. To be honest, I have no clear idea...*

> *NT4.: What matters most here is the students' level of development and the activity being appropriate to this level. That's the purpose of our planning anyway; I try to give them outcomes that are appropriate for their level of development...*

The elements they said they paid attention to when doing the pre-trip planning are summarized in Table 11.

Table 11
Preservice Teachers' Opinions about the Activity Plan during the Trip

Preservice Teachers' Opinions about the Activity Plan during the Trip					
Group of Not Taken a Course	**f**	**%**	**Group of Taken a Course**	**f**	**%**
Keeping students under control	3	50.0	Free learning environment	5	71.4
Create a plan that would not tire the students	1	16.7	Giving students research questions	4	57.1
			Expert in the role of guide	4	57.1
			Keeping students under control	3	42.9
			Efficient learning process	2	28.6
			Observation this process	2	28.6

The Group of Taken a Course said that the most important criterion for the trip planning phase is to create a learning environment in which the students are free with no interference (71.4%). They said that to achieve this, they would give their students research questions appropriate to the relevant learning outcome they had prepared in the pre-trip plan (57.1%). They think that for this process to be free with no interference, the experts at that location should act as guides (57.1%). The tasks they set for themselves when planning this stage are keeping students under control (42.9%), providing them with an efficient learning process (28.6%), and conducting observation to accomplish this (28.6%).

> *T4: "I don't interfere much. A person who is an expert in his field will already be at their head. I pay special attention to this. I can give students steering questions at this time. This is how I can control what happens. I think there shouldn't be too much interference…"*

> *T5: " … I give the student's research questions. Since I have already told the staff there that I want it to be a student-centered process, I don't interfere much. I just observe whether it is progressing according to the plan I designed. I note what I might need to change next time…"*

The Group of Not Taken a Course takes care to maintain control of the students (50.0%) and create a plan that would not tire the students (16.7%).

> *NT3.: I make sure that the class is not crowded; crowded classes are difficult to control…"*

> *NT6.: As I said before, I set the subject as something that can be done in daily life. It will be something everyone can do. I also take care not to tire the students.*

The elements that they said they paid attention to while doing the post-trip plan are summarized in Table 12.

Table 12.
Preservice Teachers' Opinions on the Post-Trip Activity Plan

Preservice Teachers' Opinions on the Post-Trip Activity Plan					
Group of Not Taken a Course	**f**	**%**	**Group of Taken a Course**	**f**	**%**
-	-	-	Assessment		
-	-	-	• Assessing the students	4	57.1
-	-	-	• Assessing the process	4	57.1
-	-	-	Discuss the travel process	3	42.9
-	-	-	Come to a conclusion	3	42.9

According to the Group of Taken a Course, the post-trip process is generally an assessment process meaning assessing the students (57.1%) and the trip process (57.1%). In addition, they stated that it is necessary to transform the excursion process into a discussion based on the answers to the research questions by students either in the current environment or when returning to school (42.9%). End of the discussion, the post-trip process should be ended with obtaining a common theoretical framework and reaching a conclusion (42.9%). The Group of Not Taken a Course did not give any information about this process.

T1: "I would like them to report what they learned during the trip."

T3: "It would be like discussing the information they gathered on the trip, either in the classroom or at the location we are in. The students give me their comments and thoughts. Then I try to come to a common theoretical conclusion."

We asked, "What advantages do these activities provide?" The codes obtained from their answers are presented in the table below.

Table 13
The Advantages of Activities in Informal Environments According to Preservice Teachers

The Advantages of Activities in Informal Environments According to Preservice Teachers					
Group of Not Taken a Course	**f**	**%**	**Group of Taken a Course**	**f**	**%**
Learning			Learning		
• by living and doing	6	100.0	• by living and doing (hands-on)	5	71.4
• Lasting	4	66.7	• Lasting	4	57.1
• in one's own environment	1	16.7	• in one's own environment	2	28.6
Developing skills			• with fun	1	14.3
• Scientific process	2	33.3	Developing skills		
• Life	2	33.3	• Social skills	3	42.9
• Psychomotor	1	16.7	Students' interest in science	4	57.1
Students' interest in science	2	33.3	Show that learning can take place outside the classroom	1	14.3

Looking at the given answers, the Group of Taken a Course sees these activities as being advantageous in that they allow learning with hands-on (71.4%) and in their own environment (28.6%), students associate what they learn with daily life (57.1%), have a lasting (57.1%) and long-term effect. And also they encourage the students to develop their social skills (cooperation, effective communication, etc.)

(42.9%), to increase interest and motivation toward science (57.1%) and show that learning can take place outside the classroom, too (14.3%).

> *T4: "I am against learning by rote and I do not think it is correct. I think that children only obtain the correct knowledge and most importantly lasting knowledge through experience. I think that the use of informal environments for science teaching will contribute to this."*

> *T5: "The students will have fun, go out, be free of the classroom environment, and see that learning is not confined to those four walls. They will be more interested in doing something by seeing, touching, traveling, and taking a photo of it, rather than having to write it down in the classroom. This lets them enjoy learning. The students will not memorize, they will learn…"*

The Group of Not Taken a Course saw these activities as advantageous as they provide learning by living and doing (hands-on). Furthermore, it provides lasting (66.7%) and first-hand learning (16.7%). They think that the process of teaching science in informal environments improves the scientific process (33.3%), personal life (33.3%), and psychomotor skills (33.3%). And also it increases the students' interest in science (16.7%).

> *NT4: …Lasting learning can be achieved as it will let students learn by living and doing.*

> *NT5: Psychomotor skills improve. They learn by living and doing, they learn by gaining experience, it becomes more lasting...*

When interviewing the teachers to collect data, we asked them as a fifth question, "How confident are you in your ability to plan activities? How did you come to this conclusion?" The codes obtained from their answers are presented in Table 14.

Table 14
Goals of Preservice Teachers When Organizing Activities in Informal Environments

Goals of Preservice Teachers When Organizing Activities in Informal Environments					
Group of Not Taken a Course	**f**	**%**	**Group of Taken a Course**	**f**	**%**
Be confident			Be confident		
• Like going on trips	2	33.3	• Students' enthusiasm	4	57.1
• Good command of science subjects	1	16.7	• Providing a fun environment	4	57.1
• Creating a student-centered learning environment	1	16.7	• Willingness to tackle difficulties	3	42.9
• Gain experience	1	16.7	• The training they received	2	28.6
Be not confident			• Having creative ideas	2	28.6
• Not received training on this subject	3	50.0	• Effective communication	1	14.3
• Not prepared a plan	3	50.0	• Belief in getting the support of the school administration	1	14.3
• Implementation difficulty	2	33.3	• Belief in managing the process	1	14.3
• Not being creative	2	33.3	Be not confident		
			• Students' attitude	3	42.9
			• permission from parents	1	14.3
			• difficult process to plan	1	14.3

The Group of Taken a Course justified this by showing the students' eagerness to take part in student-centered activities, and their belief in being able to provide students with a fun learning environment. Other reasons they gave were their willingness to cope with any difficulties they may encounter (42.9%), their self-confidence due to the education they receive (28.6%), having creative ideas that can make this process effective (28.6%), and being able to communicate effectively with students (14.3%). They also said they can get the necessary support from the school administration (14.3%) and manage the process (14.3%). However, 42.9% of the preservice teachers were not confident in their abilities. The reasons they gave are that students are accustomed to teacher-centered activities (42.9%) and their attitude will not change easily (14.3%), and also it is difficult to get permission from parents (14.3%) and difficult process to make a whole plan (14.3%).

> *T3: "I am confident and not at the same time; there is the parent factor and the administration. We know the children of today. They are not used to such things because of our education system. Obviously, they don't know much about how to behave outside, how to do research, how to ask an expert a question. I may have some problems with this aspect. But I think I can overcome this with time…"*

> *T4: "I can do it. I'm confident. I see that the students I attended during my internship got used to the teacher dictating and being passive during the lesson. But I can see the excitement on their faces when they encounter a different activity. I am aware that students are eager to be active. They expect attention. I think I can provide students with this. And I believe that I can get the support of the school administration in organizing that environment…"*

The main reason for preservice teachers' self-confidence is that they like going on trips (33.3%). As justification for their self-confidence, they believe that they have high enough science knowledge (16.7%) and if they would gain experience through practice they could create a student-centered learning process (16.7%). The reasons they cited for their lack of confidence are they had not received training on this subject (50.0%) and never prepared to make a lesson plan for teaching science in informal environments before (50.0%), thus, they were not creative enough to make such a plan (33.3%) and it was difficult to do this type of teaching (33.3%).

> *NT1: I can't say that I have much confidence since I haven't planned anything like this before. If it is only about preparing a lesson plan, there is no problem. But implementing an activity can be difficult. Since I have never done this kind of thing before, I'm bound to make mistakes.*
> *NT6: I'm confident because I have a good command of science and I like going on trips. I know the subjects, but I don't think I can come up with a very creative plan.*

As the last question "What difficulties might you encounter when planning and implementing such activities?" How do you plan to overcome these difficulties? asked to study groups. The codes obtained from their answers are presented in Table 15.

Table 15

The Difficulties that Preservice Teachers will Encounter When Planning Activities in Informal Environments

The Difficulties that Preservice Teachers will Encounter When Planning Activities in Informal Environments					
Group of Not Taken a Course	**f**	**%**	**Group of Taken a Course**	**f**	**%**
Difficulty in obtaining permission			Difficulty in obtaining permission		
• from school administration	4	66.7	• from parents	5	71.4
• from parents	4	66.7	• from school administration	3	42.9
Keeping students under control	5	83.3	Find the appropriate time	3	42.9
Lack of material	1	16.7	Cost	3	42.9
Security	1	16.7	Socioeconomic status of families	2	28.6
Transportation	1	16.7	Students attitudes	2	28.6
			Transportation	2	28.6
			Volunteering	1	14.3
			Inexperienced teacher	1	14.3
			Large group of students	1	14.3
			Cultural features of the school's location	1	14.3

The Group of Not Taken a Course said that they would have the most difficulty in keeping students under control (83.3%) and obtaining permission from school administration (66.7%) and parents (66,7%). Lack of material, security, and transportation are the other things that they said (16.7%). The Group of Taken a Course said that they would have the most difficulty in obtaining permission. They said that obtaining permission from parents is the most difficult part because of their instinct to protect their children and their thought that such activities may be unnecessary (71.4%). They also stated that getting the administration to grant permission would be difficult and that this can be a lengthy process (42.9%). Not being able to find the right time for the school or the location where the activity will take place is another difficulty (42.9%). The socioeconomic status of the families (28.6%) and the fact that students are not accustomed to such activities are other factors that make this process difficult (28.6%). Transportation (28.6%), students not volunteering (14.3%), teachers not having enough experience to manage the process (14.3%), the group of students who will participate in the activity being too large (14.3%), the cultural features of the place where they have been assigned (14.3%), and the students' readiness levels (14.3%) can all be listed as other difficulties.

> *T1: "If the place we are going to puts a financial burden on the family, this can be a problem. This can be a problem as families have different levels of income. The culture of the place where I will be assigned matters. I may have problems with transportation."*

> *T4: "…The family may not want to send their child on the trip. The socioeconomic status of the families may be the reason for this. The school administration may feel that this is not necessary. The location I want to organize may not be available at that time…"*

Table 16
Solutions to Difficulties by Preservice Teachers

Solutions to Difficulties by Preservice Teachers					
Group of Not Taken a Course	**f**	**%**	**Group of Taken a Course**	**f**	**%**
Do not know	5	83.3	Desire for a solution	6	85.7
Contacting parents	1	16.7	One-on-one conversation		
			• with parents	3	42.9
			• with the school administration	3	42.9
			Easy to reach the place	1	14.3
			Using the school budget	1	14.3

The Group of Taken a Course said they wanted to tackle all the difficulties they would encounter and resolve them (85.7%). They stated that in cases where they could not get permission, they would try to resolve it by talking to the school administration (42.9%) and/or students' parents (42.9%); in case of financial matters, they could get help from the school budget (14.3%); in case of transport problems, they would facilitate this process by going to places that were easy to get to (14.3%).

> *T1: "…I have to solve all the problems I encounter as best I can…"*

> *T4: "…I talk to families about it and try to explain that it is better and more beneficial for their children. I will try to show them. I don't know how I can accomplish this, but I will tell them. I would ask them to see the difference in their children and listen to their feedback if they let their children go at least once. I think the administrators should definitely approve of such a thing because they are educators, too…"*

The Group of Not Taken a Course said that they did not know how they would cope with the difficulties they would encounter (83.3%). Only one preservice teacher said that they could find a solution by talking to the parents one-on-one (16.7%).

> *NT6: I think I can solve the problems I will have with the parents by talking to them.*

> *NT1: To be honest, I couldn't even guess right now...*

DISCUSSION AND CONCLUSION

This study was made to examine in-depth the views of preservice teachers who have and have not taken courses on the processes of designing science activities in informal environments, using both quantitative and qualitative methods. The analyses showed that the total scores received by the preservice teachers from the scale for intention to conduct science activities in informal environments were at the "possible" level. This result shows that the preservice teachers who make up the sample intend to perform science activities in informal environments. In terms of the subscales of the aforementioned scale, the mean values of the *Action Expectations* and *Action Assessment* subscales of Action Belief dimension for Conducting Science Activities in Informal Environments are at the "quite possible" level for preservice teachers. It can be said that they believe in the effectiveness of activities in informal environments given the actions and characteristics measured by this subscale. Similarly, the scores in the *Difficult Aspects* and *Easy Aspects* subscales of Control Belief dimension and the *Subjective Person, Institution or*

Organizations and *Motivation* subscales of Normative Belief dimension for Conducting Science Activities in Informal Environments are at the "somewhat possible" level for all preservice teachers. Although the mean values of these subscales are lower than the other subscales, it is seen that the preservice teachers think that the process of conducting an activity is possible. These results parallel Karademir's study in 2013.

Although the arithmetic mean values for the preservice teachers were at the same level both in total and for each subscale, it was observed that the arithmetic mean score of the group of Not Taken a Course was higher than the group of Taken Course. As a result of the analyses made, it can be seen that the data collected for the group of Taken a Course support each other. However, this does not apply in the case of teachers who have not taken courses. When the quantitative findings of the study are examined, it is seen that there is no significant difference for any dimension. The main reason is that the study did not have an intervention for designing science teaching activities in informal environments. This research is not experimental, it is descriptive research. Although preservice teachers did not have a special education on this subject, theoretical courses such as "Introduction to Educational Sciences", "Teaching Principles, and Methods", and "Special Teaching Methods" contain content for science teaching in informal environments.

Although the knowledge difference between preservice teachers does not emerge in the quantitative data, it is quite clear differences in the qualitative findings. Interestingly, the quantitative and qualitative data collected from the group of Not Taken a Course contradict each other. During the interviews with preservice teachers who had higher intentions of performing science activities in informal environments, it was revealed that they did not know the difficulties they would encounter when designing and implementing the activity since they had not received any practice on this subject. The group of Taken a Course on this subject was aware of these difficulties as they had experience in this process. This is why their levels of intention to conduct activities were numerically lower. Again, in quantitative findings, it is seen that the group of Not Taken a Course expected more support. The crucial noticed is that they have less idea about the difficulties they will experience. In addition, they care about everyone's expectations, from other teachers to school management and national education directorates. However, the qualitative data obtained as a result of the interviews show that the group of Taken a Course had sufficient knowledge in determining the aim, planning the pre-trip, trip, and post-trip processes, determining the advantages that these activities will provide, justifying their confidence, identifying the difficulties they will encounter and offering solutions to them. It was also revealed that the group of Not Taken a Course did not have sufficient knowledge, and they only presented their opinions by associating them with the teaching processes.

While describing their experiences, the group of Not Taken a Course said that they gained lasting learning, developed a positive attitude towards science, and made trips within the implicit curriculum. When talking about their experiences, the group of Taken a Course said that the activities they participated in when they were junior high students were mostly entertainment-oriented, but they experienced learning by experience, and gained concrete experiences in the course on teaching science in informal environments they took at university. When they assess the activities from the perspective of a teacher, the first thing that strikes them is the difficulties in finding a museum that is convenient in terms of transportation, cost, and learning outcome. Quantitative and qualitative findings support each other in this context. The fact that the preservice teachers had experienced activities in an informal environment and had their own trip experiences influenced their activity planning (Bozdoğan, 2012). Based on their own experiences and the knowledge they possess, the first goal of those preservice teachers who had taken courses when designing these activities is to create an appropriate environment

of research and inquiry that will ensure active participation. According to the group of Not Taken a Course, this learning environment should be entertaining. Other goals adopted by all preservice teachers, whether they have taken courses or not, included ensuring lasting and effective learning and letting students see plants in a garden and animals in a zoo, and learn about them in their natural settings. For Taken a Course, achieving the learning outcome in a student-centered environment was an important goal but the preservice teachers who had not taken courses did not aim for an outcome-based process. Furthermore, it was seen in the answers given by the group of Taken a Course that they aimed to prove students with concrete experiences, support their social skills development, and show where knowledge fits into daily life by instilling a sense of curiosity.

The responses given by the preservice teachers concerning the elements they paid attention to during the activity design process stated there should be criteria that need to be considered more when planning the field trip. A well-considered pre-trip plan will affect the trip itself and the post-trip process. A learning outcome and the selection of an informal environment appropriate to that outcome form the basis of preservice teachers' activity planning processes. For the group of Not Taken a Course, the process must be appropriate to the students' level. According to the group of Taken a Course, the location must have features suitable for this process and there must be experts present. Another factor that the group of Taken a Course said they would pay the most attention to in the planning process is obtaining the necessary permissions from parents, the school administration, and the district or provincial National Education Directorates. The preservice teachers said they would need to create a field trip and lesson plan, also prepare research questions to steer the students, pay attention to seasonal and climatic conditions, and plan transportation. The group of Not Taken a Course was not as knowledgeable as those who had taken it when planning this process. The other points mentioned by the preservice teachers are that they will pay attention to the freedom of the students during the trip, they will only steer the students with the research questions they give. They will ensure that the expert in the environment does not provide information directly during this process and that they will only act as a guide and try to be a good observer. On the other hand, the group of Not Taken a Course said that they would only keep the students under control. Moreover, the group of Taken a Course stated that the post-trip process is a measurement and assessment process and both the process and students should be assessed, and the shortcomings corrected in the next plan. In addition, the field trip should be carried over to the classroom and transformed into a discussion environment, thus creating a common theoretical framework. These results parallel Bozdoğan's study in 2012. The group of Not Taken a Course did not express any opinion about what they would do after the trip.

All the preservice teachers said they consider activities in informal environments to be advantageous because they provide learning through living and doing. Türkmen (2010) stated that one of the aims of teachers when doing these activities should be to provide learning by living and doing. Öner and Güneş (2017) reported that 11 teachers who observed the activities in the informal environment stated that the biggest difference with these activities is that they enable students to learn by living and doing. Looking at the other answers given by the preservice teachers, other advantages are lasting learning, associating with daily life, helping the development of social skills, changing motivation and attitude toward science, learning with fun, and making students realize learning can occur out of the classroom. The information frequently mentioned in the literature that activities in informal environments support students' cognitive, emotional, and psychomotor skills supports this conclusion (Bozdoğan, 2012; Öner & Güneş, 2017).

The group of Taken a Course stated that they were confident in their ability to plan and implement the activity. The most key factors affecting their confidence are the instruction they receive on this topic and

what they experience during their internships. It is known that the instruction preservice teachers receive concerning teaching in informal environments helps them structure what they know and that they develop a positive attitude as a direct result of this (Tal, 2001, 2004; Bozdoğan, 2012). They said that they noticed during their internships that students were eager to participate in student-centered activities. This is why the preservice teachers developed the belief that they could provide them with an environment in which they could learn and have fun. They consider themselves creative and at the same time believe that they can communicate effectively with students. The group of Not Taken a Course did not have confidence in themselves and said this was because they had not take any course on teaching science in informal environments. The group of Taken a Course is aware they may encounter difficulties in this process, but they intend to tackle these difficulties. This result directly supports the quantitative findings of the study. In addition, the group of Taken a Course is concerned that it is a difficult process to plan, that students are used to teacher-centered activities in schools, and that this attitude will not change easily. These are the areas in which they have little confidence. They worry about some difficulties, which are getting permission, the cost, the socioeconomic status of the families, student attitudes, large groups of students, their inadequate experience, the socio-cultural characteristics of the schools they will be assigned to when they do graduate, and the proper time of climate. Their answers showed that they will try to solve the problems they encounter through correct communication and that they have the will and motivation to solve every problem they encounter. The group of Not Taken a Course does not know and cannot predict the difficulties they will encounter or their solutions as much as the preservice teachers who took the course.

As a result, it was seen that the group of Taken a Course had sufficient knowledge about designing and implementing activities in informal environments. This result parallels the studies by Bozdoğan (2012), Karademir (2013), and Öner & Güneş (2017). The group of Not Taken a Course does not have sufficient knowledge about the process of designing and implementing activities in informal environments. This situation parallels the results of Türkmen's study in 2015 and Sarıoğlan and Küçüközer's study in 2017. The remarkable factor in the studies revealing these two situations is that teachers and preservice teacher candidates, who form these studies' sample groups, have not taken a course related to teaching in informal environments. As a result of many studies, it is known that teachers can plan and manage activities in informal environments correctly (Griffin, 1994; Griffin & Symington, 1997; Kisiel, 2005, 2007; Orion & Hofstein 1994; Storksdieck, 2001; Tal & Morag, 2009; Tanik-Onal & Ezberi-Cevik & 2022; Wellington, 1990); cited in Bozdogan, 2012). This directly emphasizes the importance of receiving instruction in this subject. In this study, the instruction received by the preservice teachers who had taken the course was one of the main reasons for them wanting to have their students experience this process by overcoming all the difficulties they might encounter. Türkmen (2015) believes that teachers and preservice teachers should be supported with courses and in-service seminars on this subject. Bozdoğan (2012) also stated that teacher training institutions should support teacher candidates in this area.

RECOMMENDATIONS

Given the effect of science activities in informal environments on learning, the practice of conducting science activities in informal environments should be increased in schools. Teachers should be supported by holding seminars to give them information.

Considering the legal period for obtaining the necessary permissions, science activities in informal environments can be designed at the beginning of the year in cooperation with the relevant group.

It is going to take time for students to change their attitudes and for teachers to gain this experience. Therefore, these activities should be continued as long as possible.

If the participants in the sample can try science teaching in informal environments during the applied lesson, as was the case in this study, an observation form could make an especially useful data collection tool for further studies.

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