European Institute of Knowledge & Innovation

Journal of Effective Teaching Methods (JETM)
ISSN: 2755-399X

Research article

Examining Academicians' and Teachers' Opinions on Designing Science Activities in Informal Settings

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https://doi.org/eiki/10.59652/jetm.v1i4.82

Abstract: The main purpose of this study is to determine what teachers and academicians think about the process of designing and implementing science activities in informal settings and make suggestions as to how to teach more effectively in them. This study is a cross-sectional survey study and divided the teachers constituting the sample group into subgroups (sections), namely, those who had received training in teaching science in informal settings and those who had not. The current opinions of the academicians were also included in the research. A total of 338 people – 304 science teachers and 34 academicians – participated in this study. A questionnaire was used to collect the data for the research. When the research findings were examined, it was seen that neither teachers nor academicians have the desired levels of knowledge about planning and implementing science-teaching activities in informal settings. The fact that teachers do not have sufficient information on this subject can be interpreted as a reflection of the inadequacy of academicians and government instructors who train and support teachers.

Keywords: science education, informal learning environment, informal science education, views of teachers, views of academicians

1. Introduction

The world is a difficult enough place to understand for anyone, particularly children. This is why people tend to bring order to the environment in which they live in their minds (Kaptan & Korkmaz, 1997). This effort to make sense of one's surroundings is done through learning (Güleç et al.,2013). When considering the individual's process of learning science, one should not focus only on the process that starts before school and ends in higher education. Medrich et al. (1982) reported that 85% of students spend their time outside the classroom (cited in Eshach, 2007). Considering the definition that science is everyday life itself, it is clear that for science to be taught effectively, the relationship between the classroom and the out of school life should be established correctly. It is widely held that the teaching done in the classroom has formal characteristics while that done outside the classroom has informal characteristics. That being said, it is not possible to make a clear distinction between formal and informal education (Eshach, 2007). This can be better demonstrated with an example. As the students who are taken to the science center to be taught science will approach the exhibitions there freely without being forced, and also because the learning environment is outside of the classroom, their learning here is informal. However, these students can participate in pre-planned experiments there, accompanied by a guide, and may be exposed to the guide's direct instruction. This learning is more akin to formal learning because it is planned. To fully define science teaching in informal settings, one must first internalize physical details, such as being in the classroom or outside, and social details, such as the communication between the learner and the teacher, and not the clear difference between formal and informal learning (Dierking, 1991; McGivney, 1999). Science teaching in informal settings is the bridge between formal education and informal education. Thus, the context of the science learning environment is expanded. These settings create a bridge between the school and the natural environment and help maximize the students' potential (Hannu, 1993; Karademir, 2018).

Received: November 14, 2023
Accepted: November 27, 2023
Published: December 7, 2023

Informal learning environments are defined as learning environments based on communication and interaction, where students obtain first-hand experience, both individually and in groups, and share this experience with teachers, experts, families, and peers (Diamond, 1986). Examples of informal learning environments are institutional such as aquariums, museums, wildlife parks, zoos, botanical gardens, planetariums and observatories, factories and industrial complexes, national parks, non-governmental organizations, artistic environments, health institutions, universities, non-institutional environments such as national parks, nature itself, lakes, seas, bus stops; in short, all social areas outside the classroom walls (Bozdoğan, 2016; Hannu, 1993; Karademir, 2018; Kisiel, 2013; Türkmen, 2010).

Activities carried out as part of science teaching in informal settings should take place outside the classroom walls, have a purpose, support the learning outcomes in the syllabus, and improve the science (Karademir, 2018). When carrying out these activities, students should be given as much freedom as possible and not be limited (Han & Bilican, 2018). These environments also provide students with many beneficial opportunities such as gaining experience, learning by scientific process skills. This makes the process as interesting and fun as possible for students (Ünsal & Karademir, 2017; Türkmen, 2010). Some studies have reported that teaching activities outside the school are considered to be more fun-oriented and thus fail to serve a purpose (Rennie & McClafferty, 1996, Shortland, 1987, Wymer, 1991, Ansbacher, 1998; Eshach, 2007). The most important step to be taken here is for teachers to prevent this process from straying from the goal (Bozdogan, 2008). According to Dewey, if the learner has fun and joins in the learning process by experiencing and doing, this indicates that he is learning better (Eshach, 2007). Piaget states that "children as groups are active explorers; they structure their understanding by exploring their environment" (Köseoğlu & Tümay, 2015, p. 10) and that learning is associated with individual experiences, whereas for Vygotsky it is more a social phenomenon. Information is never found in the environment independently of the learner. The learner must learn how to obtain that information (Sherman, 1995, as cited in Çakıcı, 2012).

All this shows that when learners, driven by curiosity, join in the process by doing and experiencing, and having fun, this helps them learn in a meaningful and lasting way. Studies have shown that trips carried out for a purpose in informal settings help students to learn meaningfully and establish a relationship between the school curriculum and their experiences in those environments. They also help students improve their social skills (Bozdoğan, 2008). This is why is it best to define science teaching in informal environments as an interesting and fun process that serves an outcome and distinguishes it from fun-oriented implicit program activities such as picnics, camping, and trips (Karademir, 2013; Olson, Cox-Petersen & McComas, 2001). To this end, a serious, three-stage process of design is mentioned. Figure 1 shows designing science activities in informal setting.

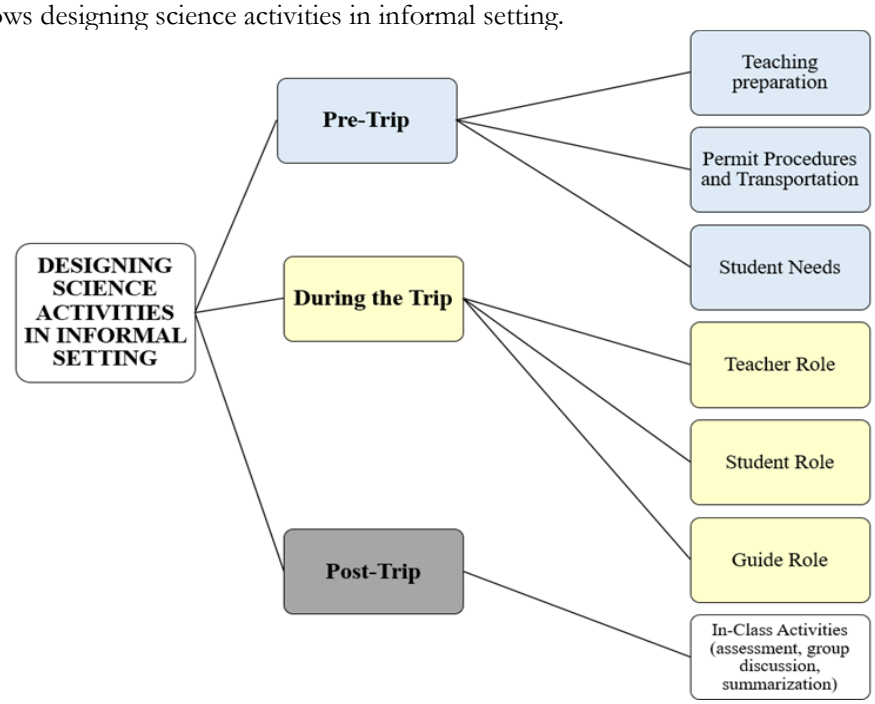

Figure 1. Designing science activities in informal setting.

This process is summarized as follows.

Pre-Trip: The work to be carried out before the trip includes making teaching preparations, obtaining permissions and transportation, and considering the physiological needs of the students (such as eating, drinking, shelter, and bathroom). Teaching preparation involves visiting the location where the activity will take place, determining the learning outcome, and preparing a lesson plan by establishing a relationship between the environment and the learning outcome. It also involves preparing the worksheets. Worksheets are crucial in that they let the process become student-centered. Worksheets should include questions that prompt students to investigate and question their learning environment and thus find the answers that way. Teachers are required to ask permission from parents, the school administration, and the District/Provincial National Education Directorates, depending on the location of the place to be visited. Regardless of whether the location to be visited is outside the city or not, it must be able to accommodate the students' physiological needs (food and drink, bathroom, etc.), either at the location or nearby.

During the Trip: During the trip, individual or group students should be able to search freely for answers to the questions on the worksheet, investigate, question, act out of curiosity; they should not be limited at all, but should be able to obtain the result with the right steering. At this time, the teacher should be a guide and strengthen the communication between the expert and the student, and should not leave all responsibility to the expert. The expert should avoid direct instruction and should help to establish the relationship between the topic being covered and the displays and objects that students encounter in the informal learning environment.

Post-Trip: This is an assessment process that takes place after the trip and can be carried out in the classroom. This assessment should focus on the students' experiences on the trip and on sharing the information that they collected using their worksheets. Steps should be taken to reveal and eliminate incorrect knowledge and misconceptions held by the students (Bozdoğan, 2014; Laçin-Şimşek, 2011; Orion & Hofstein, 1994; Türkmen, 2010).

In light of all this perspective, the main purpose of this study is to determine what teachers and academicians think about the process of designing and implementing science activities in informal settings and make suggestions as to how to teach more effectively in them.

2. Materials and Methods

2.1 Research Design

This study, which aims to determine what teachers and academicians think about the process of designing and implementing science activities in informal settings, is a cross-sectional survey study. According to Cohen et al. (2007), cross-sectional surveys are research conducted to determine the current views and attitudes about a given situation, reveal the distribution of characteristics of two or more subgroups of the sample group, and make comparisons between these subgroups (sections). This study divided the teachers constituting the sample group into subgroups (sections), namely, those who had received training in teaching science in informal settings and those who had not. It investigated their current opinions on the subject and then compared the subgroups' opinions among themselves. The current opinions of the academicians were also included in the research.

2.2 Sample

A total of 338 people -- 304 science teachers and 34 academicians -- participated in this study. The criterion sampling method, one of the purposive sampling methods, was used to select the study group. In criterion sampling, the units to be collected should meet a determined criterion and possess this quality (Büyüköztürk et al., 2016; Canbazoğlu-Bilici, 2019). This criterion was determined as science teachers who actively worked in schools affiliated with the Ministry of National Education. For academicians, this criterion was academicians who provide science courses in the undergraduate science teaching programs in the education faculties of the universities affiliated with the Council of Higher Education. Information about the training status of the teachers and academicians that made up the sample is given in the table below.

Table 1 analyzes the frequency and percentage distributions of teachers and academicians by training status.

Table 1. Frequency and percentage distributions of teachers and academicians by training status

	Teachers		Academicians	
	f	%	f	%
Trained	189	62,2	12	35,3
Untrained	115	31,8	22	64,7

2.3 Data Collection Tools and Data Collection

A questionnaire was used to collect the data for the research. A two-part questionnaire to be administered to the teachers and academicians was prepared. The questionnaires were moved online to collect detailed and in-depth data and sent to 892 teachers. A total of 312 teachers answered the questionnaires. Eight questionnaires were discarded due to reasons such as not meeting the criteria for sample selection and inconsistency between answers. In addition, the science teaching department syllabuses in the education faculties of the universities affiliated with the Council of Higher Education were examined, the academicians participating in science courses were identified, and the questionnaire was sent to 504 academicians. The study group consisted of 304 academicians who answered the questionnaire. The process of collecting the data took around five months and ended when enough data had been collected.

2.4 Analyzing of Data

The data collected from the teachers were first classified according to the predetermined subgroups. The answers given by each subgroup of the teacher sample group and the instructor sample group were combined based on each open-ended question in the data collection tool and then written down. The data obtained from the teachers and academicians were analyzed again to determine the frequency of the codes. The findings obtained as a result of this analysis were analyzed using frequency (f) and percentage (%) from the descriptive statistics, and tables were formed based on each open-ended question in the questionnaire and each subgroup in the teachers' sample and the academicians' sample.

3. Results

Here, the research findings are presented so as to show the answers given to each question by the teachers and academicians. Teachers' opinions were coded as T.1.-...-T.334, and academicians' opinions were coded as A.1.-...-A.34. Direct quotes were included to explain the findings.

3.1 Findings for the First Question of the Questionnaire

The first question of the relevant questionnaire was "For what purposes do you take your students to informal environments?" Nine (4.8%) of the 189 teachers who had received training and 10 (9.0%) of the 115 teachers who had not received training found it sufficient to answer, "I don't take them." Four (12.2%) of the academicians also said they do not take their students. The purposes for which teachers and academicians use informal environments are given in Table 2 and Table 3.

Table 2. Purposes for which trained and untrained teachers use informal environments

	Trained		Untrained	
	f	%	f	%
I take them.				
Learning				
• Hands-on	110	58,2	32	27,8
• Lasting	43	22,7	15	13,0
• Purposeful	37	19,6	17	14,8
• Associate the subject with daily life	28	14,8	7	6,1

The trip itself				
• Social activity based	7	3,7	15	13,0
Improve the skills				
• Social skills	21	11,1	1	0,9
• Scientific process skills				
✓ Observation	42	22,2	9	7,8
I don't take them.	**9**	**4,8**	**10**	**9,0**

Of the teachers who had received training, 110 (58.2%) said they like to use informal environments so their students can learn by doing and experiencing. Similar to those teachers who had received training, 32 (27.8%) of the 115 teachers who had not received training mostly intended for their students to learn by doing and experiencing (hands-on), but this proportion was lower than for trained teachers. The second highest proportion (22.7%) among the trained teachers was the belief that learning by doing and experiencing would make their students' knowledge more lasting. The second-highest scoring (14.8%) purpose cited by untrained teachers was for this process to be focused on a learning outcome or goal. Seven (3.7%) of the trained teachers who used informal environments for trips said that the process should be social activity based. This proportion is higher (13.0%) among trained teachers than untrained teachers. Teachers who stated they use informal environments to improve their students' scientific process and social skills said they believe that the ability to make observations will improve the most. When all these findings are compared, it is seen that teachers who had received training use these environments for learning more than untrained teachers do.

Sample opinions of teachers on this subject are given below.

T.25 (Trained): For the student to learn by doing and experiencing in the natural environment instead of learning in the classroom, to ensure that the student actively looks for and finds the information himself/herself instead of having it served to him/her all ready, to ensure permanent learning, and provide a learning environment that is more fun...

T. 56. (Untrained): …We can go on high school trips for social activities (seeing places such as the movie theater, the zoo, and nature centers)...

Table 3. Purposes for which academicians use informal environments

	f	%
I take them.		
Learning		
• Hands-on	12	36,4
• Associate the subject with daily life	12	36,4
Improve the skills		
• Social skills		
✓ Raising awareness	7	21,2
• Scientific process skills		
✓ Observation	5	15,2
I don't take them.	**4**	**12,2**

Twelve (34.6%) of the 34 academicians who contributed to the study said their purpose was learning by experiencing and doing and through association with daily life. When it comes to science teaching in informal environments, unlike the teachers, seven (21.2%) academicians said their purpose was to improve students' awareness within the limits of their social skills, and five (15.2%) academicians said their purpose was to improve the science process skill of making observations.

Sample opinions of academicians on this subject are given below.

A.3: To ensure that they learn where the outcomes that they need to achieve in the Science course are by doing and experiencing...

3.2 Findings for the Second Question of the Questionnaire

The questionnaire asked, "What do you consider when designing and implementing science activities in informal environments?" Rather than expressing what they know about the planning process, two academicians (6.1%) preferred to answer, "I don't take them." Four (12.2%) academicians answered, "I don't know how to design." Twelve teachers (10.4%) said they do not take their students to informal learning environments and four teachers (3.5%) said they do not know how to design such lessons. It was seen that none of the teachers who gave these answers had received training. Details on this are given in Table 4 and Table 5.

Table 4. Factors that trained and untrained teachers consider before, during, and after the trip

	Trained		Untrained	
	f	%	f	%
Pre-Trip				
• Preparing a trip plan				
✓ Preparing a lesson plan	38	20,1	15	13,0
✓ Preparing a worksheet	8	4,2	0	0,0
• Selecting the location to be visited				
✓ Safe	63	33,3	44	33,6
During the Trip				
• Create the process				
✓ Suitable for the learning outcome	124	65,5	30	26,1
✓ Safe	63	33,3	44	38,3
Post-Trip				
• Evaluating the Process	4	2,1	1	0,9
I don't take them.	**0**	**0,0**	**12**	**10,4**
I don't know how to design.	**0**	**0,0**	**4**	**3,5**

According to the answers given by the teachers, a plan for the trip should be prepared beforehand. This plan also includes preparing a lesson plan and worksheet. Thirty-eight (20.1%) of the teachers who had received training said that they prepare a lesson plan and eight (4.2%) of them said that they prepare worksheets. While 15 (13.0%) of the teachers who had not received training said that they prepare lesson plans, none of them said that they prepare worksheets. This shows that teachers who do not receive training have a more traditional approach to teaching science in informal settings. Another topic that teachers consider as part of the pre-trip process is selecting the location to be visited. When choosing the location, 33.3% of the trained teachers and 33.6% of the untrained teachers said they pay attention to safety. It was seen that the vast majority of the teachers in the study group did not give sufficient importance to the subject of permission. Overall, when the answers given by the trained and untrained teachers were compared, the frequency distributions of the answers given by the teachers who had not received training were lower than those who had. As for during the trip, 124 (65.5%) of the trained teachers said they plan to create a process suitable for the learning outcome. The untrained teachers mostly (38.3%) tend to create a safe process. Sixty-three of the teachers who had received training said a safe process (33.3%) should be created. Thirty (26.1%) of the untrained teachers said they want to create an achievement-oriented process. It was seen that the rates of the answers concerning safety given by the teachers who had and had not received training were close to each other and that the trained teachers focused more on learning outcomes than the untrained teachers. Again, overall, it was seen that the rates of answers concerning the during-the-trip part of the process given by the teachers who had not received training were lower. As for the post-trip process, only 4 of the 189 trained teachers (2.1%) and 1 of the 122 untrained teachers (0.9%) stated that they would make use of the process. These rates are quite low, which shows that teachers cannot transfer the during-the-trip part of the process to the classroom and do not complete the teaching process regardless of their training status.

Sample opinions of teachers on this subject are given below.

T. 52. (Trained): First, I make a plan for the trip in line with the learning outcome and the level of the students, then I get the necessary permissions. I inform the parents in writing or verbally. After asking them for permission, I inform my students ahead of the trip...

T. 99. (Untrained): … I don't do post-trip assessments.

Table 5. Factors that academicians pay attention to before, during, and after the trip

	f	%
Pre-Trip		
• Preparing a Trip Plan		
✓ Preparing a lesson plan	2	6,1
• Selecting the location to be visited		
✓ Safe	7	21,2
✓ Low cost	7	21,2
During the Trip		
• Create the process		
✓ Be in line with the students' level	14	42,4
✓ Be in line with the learning outcome	13	39,4
Post-Trip	**0**	**0,0**
I don't take them.	**2**	**6,1**
I don't know how to design.	**4**	**12,2**

Seven of the academicians said that they consider safety and low cost (21.2%) when choosing the location during the pre-trip process. They said that trip itself should be in line with the students' level (42.4%) and the learning outcome (39.4%). The number of academicians who said they aimed to keep costs low when planning was seven (21.2%). The academicians made no comments about the post-trip process.

Some of the answers given by the academicians under this heading are given below.

A.5: To acquire different learning outcomes by getting as much out of the location as possible.

3.3.Findings for the Third Question of the Questionnaire

The question "What methods, techniques, and strategies do you use for teaching science in informal settings?" was asked. Some of the teachers said they did not use strategies, methods, or techniques for teaching science in informal settings. Only one (0.5%) of the teachers who had received training thought this way. This rate is higher among teachers who had not received training. Eleven (9.6%) of those teachers said that they did not use any strategies, methods, or techniques. Five (15.2%) academicians said that they did not use strategies, methods, or techniques. Details on this are given in Table 6 and Table 7.

Table 6. The strategies, methods, and techniques used by trained and untrained teachers for teaching science in informal settings

	Trained		**Untrained**	
	f	%	f	%
Student-Centered				
• Observation	78	41,3	42	36,5
• Experimentation	46	24,3	22	19,1
• Strategy of research and analysis	42	22,2	19	16,5
• Trip	35	18,5	24	20,9
• Brainstorming	22	11,6	6	5,2
• Teaching through invention	22	11,6	17	14,8

Teacher-Centered				
• Question and answer	24	12,7	13	11,3
• Direct instruction	12	6,4	7	6,1
I don't use.	**1**	**0,5**	**11**	**9,6**

Of the teachers who had received training, 78 (41.3%) said they use observation and 46 (24.3%) said experimentation. Again, the student-centered strategy of research and analysis (22.2%) is one of the strategies they said they use the most. Thirty-five teachers (18.5%) said they use the trip technique. The question-answer method, one of the teacher-centered teaching methods, is used by 24 teachers (12.7%) and teaching through brainstorming and teaching through invention by 22 teachers (11.6%). Of the 115 teachers who had not received training, 42 stated that they use observation (36.5%). After observation, they mostly (20.9%) said that they use the trip technique. Twenty-two teachers (19.1%) said they use experimentation. On analyzing the data obtained from the trained and untrained teachers, it was seen that both groups of teachers mostly prefer to use student-centered strategies, methods, and techniques. However, the data obtained from both groups of teachers showed that the frequency of using other strategies, methods, and techniques other than observation, experimentation, research-analysis, and the trip was low. When the teachers who had and had not received training are compared, it can be said that the trained teachers are better at using teaching strategies, methods, and techniques than the untrained teachers.

Table 7. The strategies, methods, and techniques used by academicians for teaching science in informal settings

	f	%
Student-Centered		
• Strategy of research and analysis	8	24,4
• Observation	6	18,2
• Prediction-Observation-Explanation	4	12,2
• Discussion	4	12,2
Teacher-Centered		
• Question and answer	6	18,2
• Direct instruction	3	9,1
I don't know.	**5**	**15,2**

Eight of the 34 academicians who contributed to the study stated that they use the research-analysis strategy (24.4%). Six of them (18.2%) said that they use the student-centered technique of observation and the teacher-centered technique of question and answer. Four academicians (12.2%) said they use prediction-observation-explanation, and discussion. Direct instruction is used by three academicians (9.1%).

Some examples of the academicians' opinions on the strategies, methods, and techniques they use for teaching science in informal settings are given below.

A.5: I usually prepare worksheets for prediction-observation-explanation. I design short-term student-centered activities that will ensure that what is learned will be implemented and repeated after the trip.

A.32: We go to these places mostly in groups and make observations. We spend time with the subject matter expert using direct instruction, question-answer, and prediction.

3.4.Findings for the Fourth Question of the Questionnaire

Another question in the questionnaire was "What skills do you expect your students to improve following the science activity in informal settings?" Six of the academicians answered this question by saying, "I don't know." Details on this are given in Table 8 and Table 9.

The trained teachers mostly (16.9%) expected their students' creative thinking skills, which are high-level thinking skills, to improve. This was followed by 30 teachers (15.9%) who thought that their students' analytical thinking skills should improve. The trained teachers mostly said that they expect the scientific process skills of observation and analysis to improve. Forty-nine teachers (25.9%) said they intend to improve their students' ability to observe and analyze. The observation skill, one of the scientific process skills, is the skill that

the untrained teachers said they most expect to improve in their students. Of the 115 untrained teachers, 19 (15.6%) gave this answer. Of the trained teachers, 43 (22.7%), 38 (20.1%), and 31 (16.4%) said they expect to improve their students' skills in forming cause-and-effect relationships, interpretation, and data collection, respectively.

Table 8. Skills that trained and untrained teachers expect their students to improve following science teaching in informal settings

	Trained		Untrained	
	f	%	f	%
Advanced Thinking Skills				
• Creative	32	16,9	11	9,1
• Analytical	30	15,9	14	11,5
Scientific Process Skills				
• Observation	49	25,9	19	15,6
• Analyze	49	25,9	6	4,9
• Forming cause-and-effect relationships	43	22,7	5	4,1
• Inference	41	21,7	7	5,7
• Interpretation	38	20,1	12	9,8
• Data collection	31	16,4	6	4,9
• Experimentation	29	15,3	8	6,6
Social Skills				
• Self-confidence	33	17,5	5	4,1
• Communication	29	15,3	4	3,3
• Cooperation	22	11,6	5	4,1
• Group work	20	10,6	6	4,9
Target Behaviour				
• Cognitive	54	28,6	16	13,1
• Affective				
✓ Positive attitude	27	14,3	7	5,7
• Psychomotor	21	11,1	3	2,6
Not a Skill				
• Being in line with the learning outcome	21	11,1	3	2,5
• Associating it with daily life is a skill	20	10,6	15	12,3

Another skill that the untrained teachers said they expect their students to improve the most is experimentation (6.6%). When these findings were examined, it was seen that the teachers who had received training mainly wanted their students to improve their scientific process skills. The trained teachers mostly aimed to improve their students' self-confidence (17.5%), communication (15.2%), cooperation (11.6%), and group work (10.6%). The untrained teachers mostly expected their students' group work skills to improve (4.9%). In terms of target behaviors, the trained teachers mostly expected a change at the cognitive level (28.6%). In the affective field, they wanted them to develop a positive attitude (14.3%). Some expected psychomotor skills to improve (11.1%). Just like teachers who had received training, the teachers who had not received training also thought there should be a change at the cognitive level (13.1%). From the answers given by the trained teachers, it is obvious that they tend to plan the entire process in line with the learning outcome. Although not a skill, 21 teachers gave the answer of being in line with the learning outcome (11.1%). Twenty teachers

(10.6%) gave this answer by thinking that learning a topic by associating it with daily life is a skill. It was observed that the frequency distribution of the answers given by the teachers who had received training was higher than those who had not.

Sample opinions of teachers on this subject are given below.

T.5. (Trained): 1) Social skills (accepting roles within the group, communication) 2) Science literacy 3) Critical, creative, reflective, and analytical thinking from among the high-level thinking skills.

T. 147. (Untrained): 1) The student gaining the learning outcome 2) Increasing the student's positive attitude toward the lesson 3) Seeing how the topics relate to daily life.

Table 9. Skills that academicians expect their students to improve

	f	%
Advanced Thinking Skills		
• Creative	3	9,1
• Analytical	3	9,1
Scientific Process Skills		
• Observation	14	42,4
• Forming cause-and-effect relationships	10	30,0
Social Skills		
• Cooperation	6	18,2
Target Behaviour		
• Affective	14	42,4
• Cognitive	5	15,2
• Psychomotor	2	6,1
Not a Skill		
• Science literacy	3	9,1
I don't know.	**6**	**18,2**

Three of the academicians (9.1%) said they expect their students to improve their high-level thinking skills in critical and analytical thinking. Unlike the teachers, the academicians did not comment on reflective thinking skills. They mostly (42.4%) wanted the scientific process skill of observation to improve. This was followed by 10 academicians (30.0%) who said they believe their students will form a cause-effect relationship during this process. The only social skill they said will improve is cooperation (18.2%). They mostly thought (42.4%) that this process contributes to the affective field, which is one of the target behaviors. Five (15.2%) academicians said they think their students' cognitive skills will improve and only two (6.1%) said they expect their psychomotor skills to improve. Although not a skill, three academicians answered by saying science literacy (9.1%). Below are some of the skills the academicians said they expect their students to improve.

Sample opinions of academicians on this subject are given below.

A.6: Observation-explanation, data collection, affective goals, science literacy, cooperation, critical thinking...

3.5.Findings for the Fifth Question of the Questionnaire

Another question in the questionnaire was "What criteria are you looking for to consider the science activity in an informal setting a success?" Again, five academicians answered "I don't know" to this question. None of the teachers gave this answer. This question and details are given in Table 10 and Table 11.

Just like the trained teachers (20.1%), the untrained teachers (13.9%) said that identifying a location in line with the learning outcome is the most important criterion in considering the process a success. However, the proportion of untrained teachers who gave this answer was lower than that of trained teachers. Teachers mostly accept students' learning by doing and experiencing and assessment results as criteria for calling the process a success. Of the 189 trained teachers, 32 wanted to see what their students learned by doing and experiencing (hands-on) (16.9%). Again, 32 trained teachers (16.9%) stated that their assessment results at the end of the trip would determine whether it was a success or not.

Table 10. Criteria sought by trained and untrained teachers to consider the science teaching activity in an informal setting a success

	Trained		Untrained	
	f	%	F	%
Environment				
• in line with the learning outcome	38	20,1	16	13,9
• Effective	12	6,3	6	5,2
Student				
• Cognitive				
✓ Learning				
➢ Hands-on	32	16,9	21	18,3
➢ Assessment results	32	16,9	27	23,5
➢ Purposeful	25	13,2	18	15,6
• Affective				
✓ Positive attitude	15	7,9	8	6,9

Twenty-seven untrained teachers (23.5%) said they would look at the assessment results to judge whether the science teaching activity in an informal setting was a success. The number of untrained teachers who thought that students should learn by doing and experiencing was 21 (18.3%). When the teachers who had and had not received training were compared, it was seen that the frequency distribution of the answers given by the trained teachers was higher than the untrained teachers. From the answers given by the trained teachers, it is obvious that they care more about the behavioral changes in their students than they do about the learning environments.

Sample opinions of teachers on this subject are given below.

T. 163. (Trained): I measure whether they can form a connection between the learning outcome and the topic, whether they can interpret by collecting data and reaching a conclusion, whether there is any change in their observation skills and their attitudes toward science, and of course, whether there is an increase in their academic achievement...

T.86. (Untrained): Did the students learn by experience? Was there any change in the students after the activity? Is the student willing to study in informal settings again for the next learning outcome?

Table 11. Criteria sought by academicians for teaching to be successful

	f	%
Environment		
Active participation	13	39,4
Suitable for student level	7	21,2
Student		
• Cognitive		
✓ Learning		
➢ Scientific process skills	11	33,3
➢ Lasting	8	24,2
➢ Assessment results	7	21,2
➢ Purposeful	6	18,1
• Affective		
✓ Social skills	5	15,2
I don't know.	**5**	**15,2**

According to the academicians, the informal learning environment in which the teaching will be successful should be one in which students will actively participate (39.4%). Seven academicians (21.2%) said that for the teaching process to be successful, the learning environment should be designed around the student level. Six academicians (18.1%) said the

environment should be suitable for the learning outcome. Students acquiring scientific process skills was enough for 11 preservice teachers (33.3%) to consider the process a success. According to eight academicians (24.2%), the process should result in permanent learning. Seven academicians (21.2%) said they decide whether the process was a success only after making an assessment. This answer from academicians who did not comment about planning for the post-trip process is a contradiction (see Table 31). Six academicians (18.1%) said that students' learning should be purposeful. Five academicians (15.2%) said they consider the process a success if their students' social skills improve. The academicians' thoughts on the criteria they look for teaching to be successful are given below.

3.6.Findings for the Sixth Question of the Questionnaire

Another question in the questionnaire was "What difficulties do you encounter in designing and implementing the activity?" Unlike the teachers, the academicians replied by saying, "I don't experience any difficulties" and "I don't know." The details are given in Tables 12 and 13.

Table 12. Difficulties experienced by trained and untrained teachers when teaching science in informal settings

	Trained		Untrained	
	f	%	f	%
School management and Parents				
• Financial impossibilities	76	40,2	31	27,0
• Lack of support	25	13,2	8	6,9
Teacher				
• Concern				
✓ Not being able to manage the process	30	15,9	19	16,5
✓ Planning	14	7,4	4	3,5
Student				
• Negative attitudes	28	14,8	14	12,2
• Crowded classes	20	10,6	10	8,7
Environment and Process				
• Suitable time	38	20,1	17	14,8
• Permission	35	18,5	19	16,5
• Transportation	33	17,5	14	12,2
• Security	22	11,6	12	10,4

The most common problem faced by the trained teachers was the financial impossibilities they encounter arising from the school administration and parents (40.2%). The untrained teachers also said this was the problem they encounter the most but the frequency of this answer was still lower than for trained teachers (27.0%). Thirty of the teachers who had received training stated they were concerned about not being able to manage the process (15.9%). The frequency of this answer was higher among untrained teachers (16.5%). Another topic they said they worry about is planning. Some 7.4% of the trained teachers and 3.5% of the untrained teachers gave this answer. The teachers who had received training were more concerned about planning. Of the trained teachers, 38 (20.1%) said the most common difficulty they encounter is finding a suitable time; 35 (18.5%) said obtaining permissions from the necessary authorities, 33 (17.5%) said transportation, and 22 (11.6%) said security. Of the untrained teachers, 19 (16.5%) said obtaining permissions from the necessary authorities, 17

(14.8%) said finding a suitable time, 14 (12.2%) said transportation, and 12 (10.4%) said security.

Sample opinions of teachers on this subject are given below.

T.142. (Trained): Classroom management becomes difficult in crowded classrooms. It is hard to keep track of what each student is doing. You have to plan without straying from the relationship between activity and topic; I think this is very hard to do.

Table 13. Difficulties experienced by academicians when teaching science in informal settings

	F	%
Student		
• Negative attitudes	7	21,2
• Crowded classes	5	15,2
Environment and Process		
• Transportation	8	24,2
• Not finding environment suitable for the learning outcomes	3	9,1
• Straying from the learning outcomes	2	6,1
University Administration		
• Financial impossibilities	11	33,3
• Lack of support	4	12,1
I don't know.	**3**	**9,1**
I don't experience any difficulties.	**2**	**6,1**

Here, the academicians complained about students' negative attitudes (21.2%) and crowded classes (15.2%). Eight academicians (24.2%) saw transportation as a problem, three (9.1%) said not finding an informal learning environment suitable for the learning outcomes, and two (6.1%) cited the concern of straying from the learning outcomes as a problem. The biggest difficulty faced here by academicians was cost (33.3%). Four academicians (12.1%) cited lack of support from the university administration.

Some of the opinions expressed by the academicians under this heading are given below.

A.10: The universities have no unit for this and no allocated budget. Perhaps most importantly, the informal learning environments around us are few and far between.

4. Discussion and Conclusions

This study aims to determine what teachers and academicians think about the process of designing and implementing science activities in informal settings and make suggestions as to how to teach more effectively in them. When the research findings were examined, it was seen that neither teachers nor academicians have the desired levels of knowledge about planning and implementing science-teaching activities in informal settings. The fact that teachers do not have sufficient information on this subject can be interpreted as a reflection of the inadequacy of academicians and government instructors who train and support teachers. When the subgroups of the teachers were compared among themselves, it was found that the teachers who had received training were more knowledgeable than those who had not. Examination of the relevant literature reveals many studies that report that being trained in how to teach science in informal settings directly affects this process (Carrier et al, 2013; Dilli; 2017; Kisiel, 2005; Türkmen, 2015; Türkmen, 2018).

Learning, the trip itself, and improving students' skills were found to be common goals among the academicians and the trained and untrained teachers in the sample group for teaching in informal settings. In general, it is seen that teachers who receive training on this subject mostly adopt the goal of learning and improving skills in informal environments. The finding that untrained teachers see this process as more of a social activity supports this. The academicians, on the other hand, stated that they attach the most importance to learning and skill development when setting goals, as did the trained teachers. Considering that what the teachers know about this subject comes from the educational sciences courses in the

undergraduate programs run by education faculties, it is to be expected that their opinions echo those of their academicians.

To design and implement a science teaching lesson in an informal setting, teachers must carefully design all stages of the process: pre-trip, during the trip, and post-trip. In the pre-trip process, it was seen that the academicians and the teachers who made up the sample group attached more importance to choosing low-cost, safe, and easily accessible locations than they did to making educational preparations such as making lesson plans and worksheets. However, this lesson is going to take place in an informal setting and has to be suitable for the learning outcome, so the lesson plan matters a lot. One of the questions asked to teachers and academicians was about the strategies, methods, and techniques they used for this process. From the answers given to this question, both the teachers and the academicians want to create a student-centered process. One key element that makes this process student-centered is the use of worksheets to steer the students. These worksheets allow students to experience the process without any other influence by steering them to the knowledge that they are supposed to obtain directly as part of the process. The findings of this study show that not much importance was given to the worksheet. This means that both teachers and academicians actually manage this process without focusing on the student.

The permissions required in the pre-trip process are another important step. Teachers and academicians do not give the necessary importance to obtaining permissions. That both teachers and academicians want to create an outcome-oriented trip can be regarded as positive. When the findings are examined, it is seen that none of the teachers and academicians attach the necessary importance to the post-trip process. In the constructivist approach, learners build on their existing experiences to obtain new knowledge. The new experience is gained by combining learners' prior knowledge with real-life experiences. For this experience to become knowledge, students need to be guided by theoretical explanations and analyses (Şentürk, 2010). Since the trip itself is a part of daily life, it already has the necessary qualities for students to acquire this new experience. However, the post-trip process is the part where the explanations necessary for meaningful learning are made and the information is structured. The fact that the post-trip process is not given importance shows that meaningful learning has not actually taken place for the students. When the sample group was asked about the criteria they were looking for to judge this teaching process as a success, they said that the assessment results would give them a hint as to whether the process was a success or not. This contradiction clearly shows that teachers and academicians do not see the post-trip process as a part of the overall process of teaching in informal settings. On the over hand teachers and academicians have a more traditional perspective with regard to teaching science in informal settings, are unable to carry the actual trip part of the process to the classroom, and do not complete the teaching process. Hence the academicians perceive this process only as the activities carried out during the trip. The academicians want to make the actual trip part of the process student-centered, and their choice of methods, strategies, and techniques supports this finding. Many studies have concluded that teachers do not give enough importance to the post-trip process and cannot establish the relationship between the trip itself and the post-trip process (Griffin and Symington, 1997; Kisiel, 2007; Orion & Hofstein, 1994; Stroksdieck, 2001).

Teachers and academicians alike stated that they face many problems in designing and implementing this process. These problems can be classified as those originating from school administrations and parents, students, the location and the process, and colleagues. In addition, teachers mentioned other matters such as cost, security, and transportation as problems. The answers given by the instructors show parallelism with the answers given by the teachers. Inadequate support from the university administration, lack of experts, thinking that the process is for entertainment purposes and cost are the difficulties faced by the instructors. These results are in line with the studies made by Dilli (2017), Carrier et al. (2013), Sarışan-Tungaç & Ünaldı-Çoral (2017) and Türkmen (2018).

5. Recommendations

The results of this study show that not enough use is made of informal settings and that science teachers know very little about this topic regardless of whether or not they have received training. Teachers need to be given more frequent training on this topic and this training needs to be practical.

Considering the problems faced by teachers and academicians here, both teachers and academicians should be supported in finding appropriate informal settings, obtaining transportation, and getting access to the necessary resources.

A certain period of time is needed for students and teacher candidates to develop positive attitudes for this teaching process, which will take place in a different learning environment, and for teachers and faculty members to gain practical experience. Therefore, this teaching process should be repeated as long as possible.

Academicians who train future science teachers should use informal environments at universities more, so that prospective teachers can experience this process more.

For science teaching to be carried out more in informal settings at universities, the number of learning environments such as museums, botanical gardens, and science centers on university campuses should be increased. These informal learning environments will benefit both university students and the surrounding schools.

This study is limited only to the opinions of teachers and academicians. Other studies should be conducted to obtain the opinions of preservice teachers, school administrators, students, and parents.

This study found that the teachers who had received training were more knowledgeable than the other teacher groups when it came to designing and implementing science teaching processes in informal settings. However, these levels of knowledge are still inadequate. Therefore, teacher training courses on this subject should be developed and the qualities that these courses need to possess should be investigated.

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