ORIGINAL ARTICLE

The Effect of Activities Performed in the Science Center on Students' Perceptions of Out-of-School Learning Environments¶

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***Abstract**: This study aimed to investigate the effects of the applications conducted in the science center within the scope of the science lesson "Solar System and Beyond" unit of the 7th-grade students in the secondary school, on the perceptions of the students about the out-of-school learning environments (OSLEs). In the quantitative part of the research, in which nested design, one of the mixed research designs, was used, the study group consisted of 42 students. Also, in the quantitative part of the study, a quasi-experimental design with the pre-test-post-test control group, which is one of the experimental research methods, was used. The Science course was conducted in the classroom with the students in the control group as the program predicted. In addition to the science lessons conducted in the classroom with the experimental group students, activities within the scope of the unit were carried out in the science center and the planetarium. Quantitative data were collected with the "Out-of-School Learning Environments Perception Scale (OSLEPS)". The follow-up test was applied to the experimental group of students three months later. In the qualitative part of the study, semi-structured interviews were conducted with eight students from the experimental and control groups. When the results obtained from the qualitative data are evaluated together with the quantitative data, it is seen that the practices in the science center and the perceptions of the experimental group students towards out-of-school learning environments differ positively compared to the control group students.*

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Introduction

WHEN it comes to learning environments, the first ones that come to mind are school and classroom environments. If evaluated separately, classroom environments can often be scanty in adapting to the changing world conditions and solving the problems encountered in daily life. There is a need for informal learning environments outside the school where students can be directly intertwined with daily life. These informal learning environments are of great importance in reinforcing the information learned at school and in learning new information. However, visits to these environments without focusing on the achievements in the curriculum and without planning will be no different from a trip (Sarıoğlan & Küçüközer, 2017). Salmi (1993) defined the approach of using informal learning environments for formal learning within the framework of a certain curriculum as out-of-school learning (OSL). In the context of OSL, it would be more meaningful to express informal learning environments as OSLEs. OSLEs are crucial in enabling students to be influenced by materials in real-life situations, learning by doing, and providing learning opportunities in various ways. OSLEs are becoming the most used option among learning activities that complement and support many gaps that formal education cannot fill in the realization of the objectives based on the curriculum (Balçın & Yavuz Topaloğlu, 2019).

Intended goals can be achieved efficiently when out-of-school activities are supported by complementary activities in the classroom. The activities carried out in OSLEs increase the way students understand the subject and help them to make connections in their daily lives (Ertas et al., 2011). Since the activities carried out are enjoyable and interesting, it can be stated that students have a longer recall period (Lakin, 2006). Sontay et al. (2016) stated that with the lessons held in OSLEs, the information became more permanent, and the lessons were more fun and effective. For individuals, school is a preparation for life, and it aims to transfer the learned information to life beyond the classroom walls. In this sense, activities to be carried out in OSLEs, where individuals can take an active part in learning information meaningfully and permanently, play a crucial role. Many OSLEs can be mentioned, however, science centers and planetariums are among the prominent OSLEs for the Science course. The instinct of learning and curiosity of people, and the desire to study form the basis of scientific development. People always want to learn new things, do research, and share their knowledge with other people verbally or written. Exhibitions in science centers appear as a way of conveying knowledge. These exhibition areas and interactive experiment sets stimulate people's desire to wonder and question. Science centers contribute to teachers' professional development and allow society to deal with science. In addition, students gain a positive attitude to-

ward science by obtaining permanent and meaningful knowledge (Öztürk & Başbay, 2017). Science centers ensure students with opportunities to provide permanent information, develop research and inquiry skills, and gain critical thinking skills (Bozdoğan, 2007; Ertas Kilic & Sen, 2014; Erten et al., 2016; Yılmaz, 1996).

Students and teachers' perspectives towards OSLEs guide the realization of activities in OSLEs. It can be said that teachers stay away from visits to OSLEs for reasons such as time and student control, content training concerns, and security. Students, on the other hand, can see OSLEs only as areas where they have a good time (Bozdoğan, 2018; Duruk et al., 2018; Orion et al., 1997; Rennie & McClafferty, 1995). When the literature is examined, it is seen that the perspectives of students and teachers on OSL are mostly tried to be determined through qualitative research (Duruk et al., 2018; Ok & Aslan, 2020). Moreover, in the literature, there are mostly studies in which undergraduate-level students, preservice teachers, and teachers' views are investigated on OSL and OSLEs. In this context, studies with elementary school students and secondary school students are needed. In this study, it was aimed to investigate the perceptions and changes in the perceptions of 7th-grade secondary school students towards OSLEs within the framework of the science center and planetarium, which we consider as OSLEs.

Perception, which consists of signals in the nervous system that occur with the physical stimulation of the sense organs, is shaped together with memory, learning, and expectation. Accordingly, perception; is the process of transforming the stimuli received with the five sense organs (eye, ear, skin, nose, tongue) into meaningful stimuli that activate the organism by interacting in the dimensions of objective reality and subjective experience (Aydın, 2001). The perception of students who have never experienced OSLEs can only summarize their expectations. For this reason, it is thought that the activities in these environments are crucial in terms of shaping and permanence of the perception towards OSLEs. In the study, OSL activities were conducted in the science center and planetarium, based on the scope and achievements of the "Solar System and Beyond" unit in the program. It was aimed to determine the effect of OSL activities on students' perceptions of OSLEs. In addition, the permanence of the effect determined in perception was investigated by performing follow-up tests. In the research, it was studied with secondary school students studying in a village school, which can be described as a disadvantaged region for its farawayness from the city center. Quantitative data provide a more general understanding of the research problem, while qualitative data provide a more detailed comprehension of the problem. Bringing together and discussing the quantitative and qualitative findings allows the research results to be more comprehensive (Creswell & Plano Clark, 2015). For this reason, the mixed method was preferred in determining the perceptions of students toward OSLEs.

Method

Research Model

In this study, a mixed method was used. The reason for choosing the mixed method is to eliminate the deficiencies that arise when qualitative and quantitative research are applied on their own and to address the research conducted in multiple stages and data sources. The study was based on the "nested pattern" in the classification of Creswell and Plano Clark (2015), one of the mixed-method studies. The nested mixed design occurs when the data are collected in qualitative and quantitative research designs and are tried to give meaning. The main purpose here is to find a better solution to the study problem by integrating qualitative and quantitative data. In this study, quantitative and qualitative data collection tools were obtained simultaneously.

In the quantitative phase of mixed methods research; "pre-test-post-test control group design" and follow-up test, which are quasi-experimental designs used in experimental research. In the quantitative part of the study, it was aimed to determine the perceptions of students towards out-of-school environments with OSLEPS. During the implementation process, the lessons were carried out in the experimental group (EG), following the current curriculum in the classroom, as well as the practices were carried out in the science center and planetarium. Three months after the completion of the applications in the EG, the permanence of the change in the perceptions of the students was tried to be determined by the follow-up test. In the control group (CG), the lessons were carried out in the classroom following the current curriculum. In **Table 1**, the quantitative part of the research is indicated.

In the qualitative phase of the research, it was desired to investigate the pre-perceptions and post-perceptions of the EG students before and after experiencing the science center and planetarium with practices, towards OSLEs. Here, it was tried to shape the perceptions of the EG students with learning, memory, experience, and expectation. Although the CG students did not experience the science center and planetarium, interviews were conducted with them and their perceptions at the level of expectation were tried to be determined. In addition, considering the possibility of the CG students visiting different informal environments such as science centers with their families and listening to the experiences of their peers, it was decided that it would be appropriate to conduct pre-interview and post-interview with them as well.

Participants

The study group consists of 7th-grade students (42 students) studying secondary school. Of these students, 24 (14 boys, 10 girls) are in the EG, and 18

Table 1. Quantitative Pattern of the Research.

Groups	Pre-Tests	Application	Post-Tests	Follow-up Test
CG	OSLEPS	Courses conducted in the classroom according to the current curriculum	OSLEPS	-
EG	OSLEPS	Practices carried out in the science center together with the lessons carried out according to the current curriculum in the classroom	OSLEPS	Determining the permanence of the effects of the implemented practices on student perceptions

(10 boys, 8 girls) are in the CG. It was determined that none of the students in the CG visited the science center before the study, and only two students from the EG experienced the science center. In the research, convenience sampling method, which is easy to access and practical, was preferred (Neuman, 2008). It is a method that accelerates the research with appropriate sampling. In this sampling, while choosing a sample from the immediate environment and accessible to the researcher; it is mostly used when other sampling methods cannot be selected (Dawson & Trapp, 2001).

While creating the study group in the qualitative data collection process, criterion sampling, which the purposeful sampling method is used in qualitative research, was used. Criterion sampling is used when a situation is examined in detail by the researcher and wants to determine certain types of case studies (Neuman, 2008). Patton (1997) clarifies purposive sampling as a sampling method that allows a detailed study of events known to have rich information. None of the students selected for the interview had been to the science center before. Moreover, interviews were conducted with students in EG and CG with low, medium, and high achievement in science courses. For this purpose, interviews were conducted with four volunteer students from the EG before and after the trip and four volunteer students from the CG.

Data Collection Tools

Quantitative and qualitative data collection tools were used together in the research. OSLEPS was used as a quantitative data collection tool and a semi-structured interview form was prepared by the researcher as a qualitative data collection tool.

Out-of-School Learning Environments Perception Scale (OSLEPS)

OSLEPS which consists of 16 items, was applied to measure students' perceptions of out-of-school environments. Developed by Sen et al. (2021) the

scale has four sub-dimensions: "Incentive for learning, learning benefits, integration (association with in-school learning), and involvement". The Cronbach Alpha coefficient reported by the researchers for the developed scale is 0.80. In this study, the Cronbach Alpha coefficient of the scale applied to the students for the pretests was calculated as 0.80, and the coefficient for the posttests was calculated as 0.79.

Semi-Structured Interview Form

With the interview form created by the researcher, students' perceptions and perspectives on OSL were tried to be determined. The form includes seven open-ended questions prepared by considering the OSLEPS sub-dimensions (incentive for learning, learning benefits, integration, and involvement) used in the quantitative research part. Distinctly from the questions about the dimensions in the scale, two questions asking students to define their OSLEs were also included in the interview form. To assess the relevance of the questions on the interview form, the opinions of three academicians who worked on OSL in the field of science, were sought. Afterward, a pilot study was conducted with three students. As a result of the feedback from the experts and the pilot application, necessary arrangements were made and the form was finalized. The questions were as follows:

- *What do science lessons outside of school mean to you?*
- *If science was to be taught outside of school, where would you like it to be done?*
- *What kind of benefits do you think being taught science outside of school will provide for you?*
- *Do you think that the science lesson taught outside of school will contribute to the science lesson you take at school?*
  - *Sub-question: If you think so, how can it contribute?*
- *Do you know what a science center is?*
- *What would you say if I asked you to relate the science lesson outside of school with the science lesson you took at school?*
- *How do you think you feel about learning science outside of school?*
  - *Sub-question: For example, how would you feel at the Science center?*
- *How do you feel about expressing your thoughts and participating in learning environments outside of school?"*

Implementation Process

The research was started after obtaining the approval of the ethics committee and permission to practice. The science course, which has 4-course hours per

Table 2. Applications Carried Out in the Science Center and Planetarium with the EG

Before the science center visit	Introductory presentation about the science center
At the science center	Reminder events
	Events held in the exhibition area
	Workshops
	Planetarium
	Free time activity
After the science center visit	In-class complementary activities

week, was carried out for a total of 16-course hours for 4 weeks in line with the "Science Education Program" that came into effect in 2018. In the Science Curriculum, the 7th-grade first unit "Solar System and Beyond" was taught in line with the plan. In the CG, the unit was carried out in the classroom environment in line with the lesson plan.

In addition to the lesson, which was carried out according to the current program in the classroom with the EG, practices were carried out in Konya Science Center. The applications related to the science center and planetarium carried out with the EG were arranged in accordance with the program outcomes. These practices can be grouped under three main headings: before the science center, at the science center and after the science center. The applications related to the science center and planetarium carried out with the EG are given in **Table 2**.

Before the science center visit, a presentation containing introductory information about the science center was shown to the students. In the prepared presentation, students were given information about the activities to be carried out.

Science center activities are grouped under five main headings. Reminder events: It is an event called "I Know the Planets" and was held in the "Our Universe Exhibition" gallery of the Science Center. This activity deals with the Planets topic in the 6th-grade "Solar System and Eclipses" unit. The primary purpose of the 20-minute event which is based on the principle of "learning from the known to the unknown", is to give reminders about the planets that the students learned in the 6th grade. In this way, it is thought to be a prelude to the main activities to be held in the science center. Below are the outcomes of the event:

- *"Compares the planets in the solar system with each other."*
- *"Ranks the planets in the solar system according to their distance from the sun."*

- *"Knows the general characteristics of the planets in the solar system."*

A reminder of the information they learned in the 6th-grade was presented to the students with the exhibition setup of our solar system in our universe exhibition gallery. Afterward, the following questions were asked to the students through the Solar System model in the exhibition setup:

- *Which star is closest to our earth?*
- *What are the planets in the Solar System?*
- *How are the planets in the Solar System arranged according to their distance from the sun?*
- *What is the name of the largest planet in the Solar System?*
- *What is the name of the smallest planet in the Solar System?*
- *Why don't Mercury and Venus have moons?*

During the activities held in the exhibition area, 9 exhibition setups were selected from the 21 exhibition setups in our Universe Exhibition Gallery in accordance with the subject acquisitions. These exhibition setups consist of black holes, stars' habitats, constellations, telescope models, observation satellites, light pollution, space rocket preparation, space station, and space shuttle setups. The black hole experiment setup is interactive, and the students have experienced it themselves. The other experimental setups are in the form of presentations, and the students were studied by applying the question-and-answer method to the experimental setups. The activities held in the exhibition area lasted an average of 60 minutes.

Within the scope of the workshops, three workshops were held: "I am designing a space shuttle", "I am discovering the telescope" and "I am observing the sun with a telescope". These studies lasted approximately 60 minutes. In the I am designing a space shuttle study, the EG consisting of 24 students was divided into six groups of four. Activity papers and necessary materials were distributed to each group, and they were asked to design a space shuttle. In the I am discovering the telescope workshop; the parts of the telescope were introduced to the students in detail by the expert in the science center. The students were divided into two groups and each group was asked to assemble the telescopes in pieces. Sun observation was made by going out to an open area with the students who prepared their telescopes.

In the last stage, the planetarium was shown. There are 7 screenings in the planetarium; Mystery of the Unseen World, Dynamic Earth, Astronaut, Life of Trees, Return to the Moon, Space and Its Rotation, and Flight of Butterflies. An expert working at the science center was interviewed about the screening. The "Space and Its Rotation" notation was adapted to the objectives of "Comparison of the solar system with other stars, constellations, sky representation, finding the pole star and its properties" in the curriculum. By

making a start-stop where necessary, the question-and-answer technique was applied to the students within the demonstration. This activity lasted approximately 40 minutes. After the planetarium event, students were given free time to examine all the exhibition areas in the science center themselves. Free time lasted about 30 minutes. After the science center, complementary activities were carried out in the classroom for two lesson hours. In the complementary activities, the students worked in groups of four, concept maps, the fishbone method, and puzzles were used, and they were asked to write diary-style writings conveying their feelings and thoughts.

Analysis of Data

The SPSS-22.00 program was used in the analysis of the data collected in the quantitative part of the research. By using descriptive statistics, the characteristics of the student groups were determined and frequency values: mean, standard deviation, percentage, and frequency reached by the quantitative analysis, were examined. Normal distribution conditions were examined to decide whether to use parametric or non-parametric tests. While controlling the normality distribution for the groups, the Shapiro-Wilks test was used because the group size was less than 50 (Büyüköztürk et al., 2017). It was determined that the OSLEPS pretests, posttests of the CG and EG, and follow-up test scores of the EG showed normal distribution but were not homogeneously distributed. Although the test scores were normally distributed, the Mann-Whitney U test and Wilcoxon signed-rank test were used, which are non-parametric statistical analysis techniques because the groups were smaller than 30. (Büyüköztürk, 2017). Content analysis was used in the analysis of the data collected through interviews. The audio recordings taken during the interview were converted into written form and coded. These codes were gathered under categories and presented in tables. To ensure the credibility of the qualitative research, the data were coded and categorized by meeting with the researcher and a field trainer at regular intervals. The consistency between the codes was determined as 85%. In the excerpts, the names of the students belonging to the CG are in the form of CGPre for the preliminary interviews and CGPost for the post-interviews; EG student names are described as EGPre for the preliminary interviews and as EGPost for the post-interviews.

Findings

Findings Obtained as a Result of Quantitative Research

Table 3. Mann-Whitney U Test Results for Pre-test Scores of Groups.

Groups	n	Mean Rank	Sum of Ranks	U	p
CG	18	26.89	484.00	119.000	0.014
EG	24	17.46	419.00		

Table 4. Mann-Whitney U Test Results for Post-test Scores of Groups.

Groups	n	Mean Rank	Sum of Ranks	U	p
CG	18	22.33	402.00	201.000	0.73
EG	24	20.88	501.00		

Table 5. Wilcoxon Signed-Rank Test Results of EG OSLEPS Scores Before and After Experiment.

Post-test - Pre-test	n	Mean Rank	Sum of Ranks	z	p
Negative row	5	4.80	24.00		
Positive row	19	14.53	276.00	-3.603*	0.000
Equal	0	-	-		
**: Based on negative ranks.*					

Table 6. Wilcoxon Signed-Row Test Results of EG Follow-Up Test and Post-Test OSLEPS Scores.

Follow-up test - Post-test	n	Mean Rank	Sum of Ranks	z	p
Negative row	5	10	120.00		
Positive row	19	14.18	156.00	-0.550*	0.583
Equal	0	-	-		
**: Based on negative ranks.*					

The findings obtained from the Mann-Whitney U test statistical analysis of the pre-test scores of the control and EG students for unrelated samples are presented in **Table 3**.

When **Table 3** is interpreted, it is seen that the mean OSLEPS pre-test rank of the CG is 26.89, and the mean OSLEPS pre-test rank of the EG is 17.46. When the rank totals are examined, it is seen that the rank total of

the CG is 484.00, and 419.00 for the EG. It is seen that there is a difference between the rank totals of the groups and this difference is statistically significant ($U = 119.000$; $p = 0.014$; $p < 0.05$). According to these data, there was a statistically significant difference in favor of the CG between the EG and the CG's OSLEPS pretests at the beginning of the study. It can be said that the study groups are not equivalent to each other according to their perception scores.

The findings obtained from the Mann-Whitney U test statistical analysis of the post-test scores of the control and EG students for unrelated samples are presented in **Table 4**.

When the results of the analysis given in **Table 4** are examined, it was determined that the OSLEPS post-test rank average of the CG was 22.33, and the OSLEPS post-test rank average of the EG was 20.88. When looking at the row totals, it is seen that while the CG is 402.00, the EG's row total is 501.00. This difference between the mean rank and total rank of the groups was not statistically significant ($U = 201.00$; $p = 0.703$; $p > 0.05$).

This result shows that at the end of the research, there is no statistically significant difference between the EG in which the applications were made in the science center and the CG, in which the teaching envisaged by the program was applied, in the OSLEPS post-tests.

Wilcoxon signed-rank test was used to determine the significance of the change in the OSLEPS post-test scores of the EG according to the OSLEPS pretest scores. These statistical analysis findings are presented in **Table 5**.

When the results of the analysis given in **Table 5** are examined, it can be said that the difference within the EG is significant in favor of the posttest according to the Wilcoxon signed ranks test result [$Z = -3.603$, $p < 0.05$]. In **Table 6** below, the results of the follow-up test applied to the EG after 3 months were evaluated with the post-test.

When the results of the analysis given in **Table 6** are examined, it can be said that the difference within the EG did not show a statistically significant difference according to the Wilcoxon signed rank test result [$Z = -0.550$, $p > 0.05$].

Findings obtained from the data collected by the OSLEPS post-test and OSLEPS follow-up test, in the follow-up test performed after 3 months, no significant difference was found in the scores of the students compared to the post-test data. When the follow-up test scores of the group were evaluated according to the OSLEPS post-test scores; It can be said that the perceptions of students towards OSLEs have been permanent in the intervening time.

Findings Obtained as a Result of Qualitative Research

Table 7. The Codes of the "Definition" Category.

Pre-Interview (CG)	Post-Interview (CG)	Pre-Interview (EG)	Post-Interview (EG)
Noiseless environments	Laboratories	Laboratories	Science centers
Home	Home	Classrooms	Science exhibition
Library	Library	Study room	Library
Green spaces	Forests	Forests	Forests
Courses	Schoolyard	Schoolyard	Planetariums
Mosque	Mosque	Cafes	Science gallery
Parks	Parks	Seaside	Museum of Mevlana
Gardens	Cafes	Open spaces	Zoo
	Neighbors		Museums
	Relatives		

The questions in the interview form were prepared by considering the OSLEPS sub-dimensions. The findings regarding the answers given by the students to the interview form were presented by quoting directly and creating categories and codes. As a result of the analysis of the pre-interview and post-interview data of the CG and the EG students, the categories of defining OSLEs, learning benefits, integration with science, and affective influence were obtained. The codes concerning the "definition" category of the CG and the EG students' perceptions of OSLEs are presented together in **Table 7**.

When the codes in **Table 7** are examined; it is seen that CG students generally give examples from their immediate environment while describing their OSLEs. We can state that the EG students approximately determined the OSLEs in the pre-interview application. They expressed out-of-school environments as classrooms, forests, study rooms, cafes, open spaces, seaside, and schoolyards. After completing the unit, it was determined that the answers they gave varied in the last interview held after the practices in the science center and in-class complementary activities. It is seen that science center activities are effective in defining OSLEs in students. Below are examples of statements from participants that were assessed under the definition category.

> *"Quiet environments, places where there is not much noise. It could be home; it could be mm libraries. I mean, other than at school, at home or elsewhere, in our neighbors, relatives or otherwise, I don't know." (CGPre1)*

"So, it can be open areas, a large environment, a place with greenery. So, it would be better to have soundless environments. I wish it was done where there is more science information. For example, when talking about oxygen, it can be in a wooded place." (CGPre2)

"It could be in places like a mosque, well it could be in an open place, it could be in a park, it could be in other wooded shady places. I mean, I don't know, I don't think about it. It's also nice to teach in the classroom." (CGPost3)

"It could be in the woods, so it depends. Then it could be in the green, it could be in the laboratory, outside of school. Well, it can be my room, my study desk, cafes, and courses." (CGPost4)

"For example, I would like it to be done in the laboratory; the teacher would show us and explain. I would like it to be done on the ground, depending on the subject, for example, in laboratories if we are processing pure substances and mixtures." (EGPre2)

"It refers to the places where we learn the lesson in places outside the school or classroom. It can be a library, a science center, a science gallery, a planetarium, or a garden. A place like a greenery, forest, or zoo would also be nice. We went to the science center, sir, it was very nice. It was as if we had everything about our lesson. We learned a lot there. I think it would be better if we had our science lesson there all the time." (EGPost1)

"Not here (in the village), but for example, in Konya, in places such as the science center. It can be in greenery places, so I would like to study in the forest, in the zoo. These are better places." (EGPost3)

"So they are more fun, more informative places. I learn in places such as zoos when it comes to learning outside of school. Places like Mevlana, eh Seksen Binde Devri Alem Park, science center, I can't think of anything else but the planetarium. Like a lot of parks, it could be Valley of Butterflies after that." (EGPost4)

The codes concerning the "learning benefits" category of the CG and the EG students' perceptions of OSLEs are presented in **Table 8**.

Table 8. The Codes of the "Learning Benefits" Category.

Pre-Interview (CG)	Post-Interview (CG)	Pre-Interview (EG)	Post-Interview (EG)
Repetition	Reinforcement	Reinforcement	Reinforcement
Acquiring new information	Acquiring new information	More information	Willingness to learn
Success (exam success)	Success (exam success)	Success (exam success)	Success (exam success)
Obtaining pre- information	Permanent learning	Obtaining pre-information	Permanent learning
Ease in learning	Ease in learning	Lesson preparation	Ease in learning
		Course success	Getting detailed information
		Visual representation	Research desire
			Acquiring new knowledge
			Competition
			Reality
			Curiosity
			Information sharing
			Class attendance
			Loving science
			Career choice

When the codes concerning the "learning benefits" category of OSLEs were examined from **Table 8**, the CG students estimated the benefits of being in an out-of-school environment. The benefits of the pre-interview meeting; while expressing repetition, high grade, and subject repetition; similarly in the post-interview, they expressed success, reinforcement, high grades, and easy learning. When the codes concerning the learning benefits category are examined, it is seen that the codes of the EG students differ after the science center applications. In the pre-interview, EG students expressed the benefits of OSLEs as course success, prior knowledge, visual expression, and information. In the post-interview, it can be stated that the answers given by the EG students vary as they experience OSLEs. When the codes and student answers were examined in the post-interview; It is seen that science center activities made with EG students change the dimension of benefit from their perceptions of OSLEs. The following are examples of expressions from participants that were assessed concerning this category:

> *"I would learn new information, then I would learn new topics, I would have pre-information. There would be many things that caught my attention, I would learn things that I did not know." (CGPre1)*

"I repeat the lesson better, I listen well, I remember the topics better, I will do better in the exam" (CGPost2)

"I think I will be more successful in my studies. Well, my grades would be better. My lessons can improve." (CGPost3)

"I don't know what use it would be." (EGPre4)

"My teacher, I did not understand the science lesson here (in the classroom), I was a little bored, but I understood more there, I understood better, and I gave the answers well. My interest in science lessons increased a little more. It contributed a little more to my exams; I did it by thinking about it, in the exams. What I saw there remained better in my mind." (EGPost4)

"When we went to the science center, we learned the subjects that we did not know in the lesson better visually. We reinforced it more. We learned what we did not learn in the lesson. We learned what happened in the sky, we learned what we were wondering. We see it in books, this is pollution, but when we went there, we saw space pollution as if we were in space. I learned better about space rockets and astronauts." (EGPost1)

"I learned a lot at the science center, learned some of the subjects I hadn't learned, and then I started to attend the class more. It felt real there as if I was in outer space. We saw the satellites, and my curiosity increased. I learned things I did not know, I learned new information there. My curiosity about science increased, and it increased my desire to research. We just thought that the sun was big, but thanks to the planetarium, we saw that there are bigger stars in the Milky Way galaxy. It can enable us to better answer the questions asked in knowledge competitions. We can participate more in the lesson with what we remember from the show we watched there. I realized that things other than stars and clouds are in the sky. There were a lot of stars, I thought there were very few. We learn from the book or the smart board in the classroom, but we see it live there. It's more descriptive there and we don't get bored because it's fun. Everyone is listening, there is no sound, we understand better." (EGPost2)

"We can learn what we do not understand in the lesson, and we can understand more by seeing and hearing. We learn the

Table 9. The Codes Concerning the "Integration with Science (Specifically for the Science Center)" Category.

Pre-Interview (CG)	Post-Interview (CG)	Pre-Interview (EG)	Post-Interview (EG)
Planets	Planets	Planets	Planets
Dinosaurs	Dinosaurs	Dinosaurs	Planetarium
Space	Space	Space	Space shuttle
Electronic devices	Robots	Robots	Robots
Plants	Plants	Stars	Test sets
Microscopes	Microscopes	Mock-up	Telescopes
	Telescopes		Space telescope
	Satellites		Satellites
	Stars		Constellations
			Black hole
			Space station
			Light pollution
			Astronauts
			Exhibitions

lessons we will cover later. We learned it at school, and when we went there, we reinforced it even more". (EGPost3)

"My curiosity increased; more questions began to come to my mind. My desire to learn has increased. I explain what I learned there in class if my friends don't know, I explain them too." (EGPost4)

The codes concerning the "integration with science (specifically for the science center)" category of the EG students' perceptions of OSLEs are presented in **Table 9**.

When the CG students' codes are examined here, it can be said that the answers given by the students before the unit differ slightly compared to the answers given after the unit is completed. This differentiation is in the form of the diversification of the concepts related to the subject of the unit. Examining the student codes in the category of integration with science from the pre-interviews, it is seen that the EG students can integrate in a limited way. Looking at the post-interview codes after the science center activities, it can be said that the students also benefited from the experiment sets in the science center. The following are direct quotations from participants:

"In it, there may be something about physics and chemistry in those subjects. Well, it could be mixtures, plants, dinosaur bones, machines, pictures, or tools, I don't know." (CGPre1)

"In my opinion, there are robots in the science center, so we watch a video showing how robots are made, then maybe we can make small robots." (CGPre4)

"I think of things related to science, cell, dinosaurs, where we have more interesting things to learn more about. It can be introductory things, everything, it can be exhibitions. What remains of the past may be fossils of dinosaurs." (CGPost2)

"There are microscopes in the science center, I think we can study everything there. We saw it in the class, we learned about the planets, the stars, and then the moons in the science class, they can be there too." (CGPost3)

"For example, I did not know the parts of the telescope, I learned there, then we saw things and learned about artificial satellites there. It made me more interested; it made me examine more subjects. I realized there was a lot more to science. Well, I learned things we didn't know about planets. They were built so that they could learn new information for us. We built a telescope in the science center, then we did a lot of activities and went to the planetarium. We learned things we didn't know." (EGPost1)

"It was a place where planets could be seen with the display there where the planets were visible, and when we looked up it seemed like the stars were raining down on us. It was as if we were out in space in a space shuttle. After that, it felt like I could touch the planets, it was beautiful. It was a place like a cinema, we leaned on the seats, but there they put the curtain on the ceiling, it felt like the stars were falling on us, we passed through the sun or something, it was very beautiful, I saw that there are things bigger than the sun, the stars. It was spinning like this, then the music started, we swayed like it was spinning." (EGPost2)

"There is a space shuttle in the science center, there are constellations, there are planets, and after all, it's like a museum. There was a place related to our body, our lungs, it swelled when we got the air. Then there was a place like a corridor. A place where there is a universal waste. There was the drum thing about

Table 10. The Codes Concerning the "Affective Influence" Category.

Pre-Interview (CG)	Post-Interview (CG)	Pre-Interview (EG)	Post-Interview (EG)
Happiness	Happiness	Happiness	Happiness
Excitement	Excitement	Excitement	Excitement
Fun	Interest	Exploring	Interest
Like	Like		Exploring
			Curiosity
			Feeling comfortable

sound, there were robots. He even had hair like a woman's face. The arm of the robot was moving. There were robots; there was sound vibration ground, space, satellites, black holes, and so on. There were other planets than these." (EGPost4)

Table 10 shows the codes concerning the "affective influence" category of the CG and EG students' perceptions of OSLEs.

As a result of the analysis of the pre-interview and post-interview with the KG students, it is understood that there is no change in the codes related to the "affective effect" category, except for "interest". As a result of the pre-interview in the "affective influence" category for OSLEs codes of the EG students were determined as excitement, happiness, and exploring. In the post-interview, the codes are exploring, feeling comfortable, interest, curiosity, excitement, and happiness. The following are direct quotations from participants:

"It makes me like science more; I become a more knowledgeable person. Science can make me like a subject I already like even more." (CGPre1)

"My interest in science increases, anyway, I have a special place for the science lesson, and extraordinary things come to my mind in this lesson. Science increases the motivation of people; I like science more than social sciences courses." (CGPost2)

"I like to learn new information, it interests me." (CGPost4)

"I was very impressed; it seemed to me that science class was better than it was in school. It increased my desire to learn a

little more. I liked making more such discoveries, I focused on it. Interest in science increased the things I wanted to learn. My interest in science increased." (EGPost2)

"It increased my interest in science even more. I began to wonder more about objects in the sky. It increased my desire to learn, and I started to study harder." (EGPost3)

"It made me feel a sense of curiosity, it's nice to see new places and I would like to go again." (EGPost4)

When we look at the qualitative findings of the pre-interview data, it is realized that the "involvement" dimension among the four dimensions in the OSLEPS could not be determined as a category for both the CG and the EG. The "integration with the school" sub-dimension in the scale was determined as the "integration with science (especially science center)" category in the context of the course. While the learning benefits dimension in the scale was determined as a category, the "incentive for learning" sub-dimension in the scale was determined as codes under the "learning benefits" and "affective influence" categories. The "definition" category, which is not in OSLEPS, was obtained with the question, which was added to the interview form by the researchers, what the science lesson outside of school means and if science was to be taught outside of school, where they would like the lesson to be held.

The OSL activities, in the science center and planetarium were effective in changing students' perceptions of OSLEs in a positive way. After analyzing the pre-interview and post-interview data, we determined the categories as definition, integration with science, learning benefits, and affective influence. It is seen that the dimensions of involvement and incentive for learning in the OSLEPS could not be obtained from the post-interview data of the CG. In the EG, on the other hand, it is seen that the diversity of the codes increased and the codes that could be included in the content of the dimension of involvement and incentive for learning (information sharing, participation in the lesson, learning desire, research desire, etc.) were added. These codes were evaluated under the category of learning benefits.

Discussion and Conclusion

In this study, it was aimed to investigate the effects of the applications conducted in the science center within the scope of the science lesson "Solar System and Beyond" unit of the 7th-grade students in the secondary school, on the perceptions of the students about the OSLEs. Perception is the primary form of human cognitive contact with the world around them. The study of perception has always been of unique importance to philosophy and

science, as all conceptual knowledge is based on or derived from this basic form of awareness (Efron, 1969). Perception is shaped by expectation, memory, and learning. In this sense, when the pre-tests and pre-interview findings are evaluated together, it can be said that students' perceptions of OSLEs that are tried to be determined remain at the level of expectations. When the post-tests and the post-interview findings are evaluated together, it is concluded that the perceptions of the EG students towards OSLEs are shaped by memory and learning.

Quantitative findings of this study show that the CG and EG are not equal in terms of their perceptions of OSLEs according to the pre-test findings. The results from the quantitative data indicate that the expectations of the CG students are higher than the expectations of the EG students. However, the results from the qualitative study show the EG and CG students' perceptions are similar at the beginning. It can be said that choosing the mixed research method is more explanatory in this sense. The perceptions of the CG students, which were determined by the post-tests and post-interviews, remained at the level of expectation since they did not experience the science center and planetarium as an OSL environment. It is also seen that there is no statistically significant difference between the pre-test and post-test scores. Although the averages of the OSLEPS pre-test of CG were higher than the EG, there was no significant increase in the number of codes obtained with the pre-interviews and post-interviews in the qualitative findings and there was no change in scope. The small change observed in the post-interviews under the category of "integration with science", one of the categories determined by the qualitative study in the CG, can be attributed to the completion of the "Solar System and Beyond Unit" of the students. It is seen that some concepts (stars, satellites, and telescopes) in the unit have been added to the codes obtained here.

As a result of the research, when the perception scores of the EG students before and after the science center activities were examined, it was seen that their perceptions of OSLEs differed positively. Moreover, in the results obtained in the qualitative study of the EG students, it is seen that there is a change in the number of codes and the scope of the codes, especially under the "learning benefits" category. It can be stated that, it is important for students to experience these environments in shaping and developing perceptions toward OSLEs. When the follow-up test scores of the EG were evaluated according to the OSLEPS post-test scores; It can be said that students' perceptions of OSLEs are permanent. We can state that the practices in the science center and in-class complementary activities have a positive and permanent effect on students' perceptions. OSLEs are an important tool for supporting learning and gaining experience (Balkan Kıyıcı & Yavuz Topaloğlu, 2016).

The results obtained from the "defining OSLEs" category of the students show that the EG students define the OSLEs more scientifically than the CG students. When the codes obtained under the "learning benefits" category are examined, it is remarkable that the EG students change compared to the CG students. As a result of their experiences, the students realized the benefits and contributions of the activities carried out in the science center for them and were able to express the scope of these contributions in detail. It is apparent that the EG students can express this contribution and benefit from different perspectives, for example, they can talk about the benefit for "choosing a profession". Anderson et al. (2000), in their study with 11- and 12-year-old students, state that visiting an interactive science museum has an important place in structuring the knowledge gained in OSLEs. In their study, Ok and Aslan (2020) investigated the effect of workshops held in the science center on primary and secondary school students. The results obtained reveal that as the age gets older, the students realize the contribution of the activities to themselves more, while the younger students are more interested in the fun side of the activities. All students stated that they were comfortable, peaceful, and happy. It has been determined that the objectives are achieved more in the activities carried out with secondary school students.

When the codes under the category of integration with science and the expressions of the students are examined, the importance of the concepts emphasized in the science center and the planetarium activity they experience for this category emerges. The statement of one of the EG students is given below:

> *"We see in the books that pollution is like this, but when we went there, we saw the space pollution as if we were in space. I learned better about space rockets and astronauts. I felt like astronauts there, as if I was in outer space. The dome is three-dimensional like a cinema, but it rotates like a space shuttle." (EGPost3)*

Küçük and Yıldırım (2020) stated in their study that out-of-school teacher guidance improves students' understanding of science, technology and environment. Yılmaz (2018)'s research, it was used the planetarium trip as a complement to the education together with the activities implemented in the classroom; in the study, it is stated that the students' participation in the lesson by asking more questions in the lesson, their interest and curiosity about space increased and also positively affected the development of their concepts. The result of the research shows that the desire to participate in the course and the awareness of the professions increased among students. When science subjects are examined, some units describe nature and events in na-

ture at every grade level. Moreover, for students to understand these subjects, they need to watch, feel, smell, hear, try by doing and experience, and be curious (Türkmen, 2010).

Under the affective effect category, the EG students who experienced the science center stated that they wanted to learn and explore more, they felt more comfortable in the science center, and they were excited and happy. Salmi (1993) states that the field of science education, from kindergarten to the highest research level, is broad and complex, consisting of informal effects not only on the formal education system but also on modern society, technology, and cultural education. It emphasizes that science centers also affect the emotional aspect of learning, especially motivation. Likewise, in the study of Kırgız (2018) in which science center activities were evaluated by students, he reached the following results: students found the science lesson more enjoyable, their desire to research the lesson increased, they liked studying the science lesson more, they found the lesson interesting, they enjoyed listening to the lesson more, and the students associated the lesson with daily life. Plakitsi (2013) states that students feeling that science is exciting in science centers, and they want to experience what they did not do at school.

Recommendations and Limitations

OSLEs are always seen as more interesting and different by students, as it is always about "going out of the routine". However, it is clear that the influence of experiences in shaping perception is very important. The students, who are aware of the benefits of these environments, will participate in activities more willingly and voluntarily. In this sense, it is obvious that students should study in these environments to experience OSLEs.

The economic situation of families can be a factor in the approach of students to OSLEs (Köse, 2007). Especially the students who study in village schools far from the city or district centers can experience these environments thanks to the schools and their teachers. Activities to be carried out by schools and their teachers will enable students to change their perspectives and perceptions positively. In this study, OSLEs are limited to the science center and planetarium. It can be investigated how students' different OSLEs will affect their perceptions. Also, it is limited to the subject of the "Solar System and Beyond" unit. Perceptions of students can be determined through OSL research on different subjects.

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