

The Effect Of Planetarium Trip On Pre-Service Science Teachers' Metaphorical Perceptions About Planetariums

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ABSTRACT

The study aimed at examining the effect of the planetarium trip on metaphors developed by the pre-service science teachers about the concept of planetarium. Within this context of the study, a trip was organized to Ondokuz Mayıs University (OMU) Planetarium. Pretest-posttest control group design, one of the experimental designs, was used in the study. Total 64 fourth year pre-service science teachers, 42 females and 22 males, participated in the study. As a result of the study, it was observed that the pre-service teachers in experimental group participated in the planetarium trip and developed metaphors related to the concept of planetarium in a six week process and all of these metaphors changed completely except for one participant. There was no change with the metaphorical perceptions of nearly fifth quarters of the pre-service teachers' in control group in the same time interval. It was determined that the pre-service teachers in experimental and control groups mostly grouped planetariums in the space research centre's category during the pre-interviews.

Keywords: *Planetarium, Metaphor, Pre-service Science Teachers, Field trip*

INTRODUCTION

In addition to teaching activities carried out in schools, there is need for active involvement of out-of-school settings because the new knowledge obtained with the rapid developments in science and technology must be acquired comprehensibly by the increasing population. Students' benefiting from out-of-school settings as far as possible will make contributions to actualize lifelong learning philosophy.

When compared to education and teaching activities carried out in schools, these environments are more natural, flexible, and fun and they also provide opportunities for individuals to learn in their fields of interest and at their own learning pace with the activities they offer. In addition to this, these environments are rich resources which save teaching from relying heavily on books and classroom atmosphere and they promote teaching and learning activities in the school (Demir, 2007; Özgen, 2011; Tatar and Bağrıyanık, 2012; Taylor and Caldarelli, 2004). When considered from this aspect, science course which generates attitudes towards science, scientific thinking skills, and scientific knowledge substructure is one of the primary courses where out-of-school settings can be used effectively. Thus, the science curriculum up-dated in 2013 in Turkey states, "... *in-class and out-of-school settings are designed according to the inquiry-based learning strategy so that students can learn the knowledge in science field meaningfully and permanently. Within this framework, informal learning environments are also used.*" (MEB, 2013) and it refers to the importance of out-of school settings with this statement.

Out-of-school settings enable students to establish direct relationship with real objects and thus, students gain positive attitudes, values, and new perspectives which lead them to have permanent knowledge and these environments include many social places. These are mass media, sports centres, science centres, natural history museums, government agencies, factories, zoos, botanical gardens, forestland, libraries, aquariums, planetariums, natural monuments, and national parks (Davies, 1997; Demir, 2007; Gerber, Cavallo and Marek, 2001; Hannu, 1993; Howe and Disinger, 1988; Kelly, 2000; Martin, 2004; Özgen, 2011; Pedretti, 2004). As is seen, planetariums are one of these places.

The first planetarium was founded in Deutsches Museum in Munich in the first quarter of the 20th century (Ateş, 2009) and today the number of the planetariums is increasing. A virtual reality is generated with the simulations projected to the doom in planetariums and giving visitors the feeling that they are travelling in space (Burney and Lock, 2007; Chastenay, 2015). Planetariums are places which increase visitors' knowledge about space and make contributions to them to explore and understand the secrets of the universe (Jingbao, 1992; Pires, 2007; Sumners, Reiff and Weber, 2008) and they provide opportunities for their visitors to observe the motions of celestial bodies in a few minutes which take them to complete days or years (Plummer, 2009). There are studies existing in literature about the educational dimension of planetariums which use the latest technologies. These studies demonstrate that subjects and concepts of astronomy which students have difficulty in visualising in their minds can be taught easily in these environments in a short time (Bishop, 2003; Fletcher, 1980; Mallon and Bruce, 1982; Türk, 2010; Türk and Kalkan, 2015). In addition to this, it was found that they yielded effective results about understanding the periodical movements of stars and planets with simulations (Plummer, 2009; Plummer, Kocareli and Slagle, 2014).

The number of planetariums is few in Turkey. It is important that their numbers should be increased and a bridge should be built between science course and planetariums about teaching of subjects and concepts of astronomy. Thus, they will make important contributions to raise new generations who are scientifically literate, like, understand and use/do science. Within this scope, because it is a new concept in Turkey and the studies carried about planetariums are very few in number, it is considered that especially teachers and pre-service teachers do not have much information about the content and functions of planetariums. Moreover, the research studies reveal that teachers generally have some reservations about using out of school settings (Carrier, 2009; Moseley, Reinke and Bookout, 2002; Simmons, 1998; Smith-Sebasto and Smith, 1997). One of the main reasons why teachers do not prefer out of school settings more is that they are pedagogically incompetent (Griffin and Symington 1997; Kisiel 2003; Michie, 1998; Olson, Cox-Petersen and McComas, 2001; Tal and Morag, 2009). When considered from this aspect, if the pre-service teachers who will be teachers in the future have any incorrect perceptions about planetariums, these wrong perceptions will have negative effects on them about organizing trips to these places. This study carried out within this scope aimed at detecting pre-service teachers' perceptions about planetariums via metaphors and determining the effect of the field trip on changing these perceptions. The most important reason for using metaphors in the study is that metaphors are strong tools to make contributions to developments in education (Balci, 1999; Goldstein, 2005). It is stated that metaphors are used in education to visualise an abstract concept and to define it in a more concrete way (Singh, 2010) and they have important effects on generating images in individuals' mind and restructuring them (Çelikten, 2006). Moreover, the most important reason for using field trips in the study is that these trips have positive effects on visitors. There are studies in literature which reveal that these trips have positive effects on visitors' cognitive (Anderson and Lucas, 1997; Miglietta, Belmonte and Boero, 2008) affective (DeWitt and Storksdiack, 2008; Lai, 1999; Orion and Hofstein, 1994) and psychomotor learning (Houser *et. al.*, 2011; Morag and Tal 2012), raise their awareness, (DeWitt and Storksdiack, 2008) and develop their social skills (Houser *et. al.*, 2011; Morag and Tal, 2012). This research study examined the effect of field trips on pre-service teachers' change of perceptions about planetariums. It can be generally stated that this study tried to reveal what kind of perceptions pre-service teachers had about planetariums which started to be founded in Turkey and also to test whether or not this trip organized to a planetarium made positive contributions to the change of perceptions. The study sought to answer two research questions:

1. What are the pre-service science teachers' metaphorical perceptions and metaphor categories related to planetarium concept?
2. Does the planetarium visit change the pre-service science teachers' metaphors and metaphor categories which they develop about planetarium concept permanently?

Methodology of Research

Pretest-posttest control group design, one of the experimental designs, was used in the study. Quasi-experimental method, one of the experimental research designs, involves comparison of two groups considering specific variables (Büyüköztürk *et al.*, 2013). This method was chosen because this study aimed at examining the effect of the trip organized to the planetarium on pre-service science teachers' perceptions about planetariums. The research design was presented in Table 1.

Table 1. The research design

Groups	Pre-test	Implementation	Post-test-1 (2 days later)	Post-test-2 (6 weeks later)
Experimental	Semi-structured interview	Planetarium trip	Semi-structured interview	Semi-structured interview
Control	Semi-structured interview	----	----	Semi-structured interview

Within this context of the study, a trip was organized to Ondokuz Mayıs University (OMU) Planetarium with the pre-service teachers in experimental group. The details about the trip are given below.

1. The trip started at 8:30. Before the trip, a leaflet prepared about the site of the trip was handed-out to the pre-service teachers on the bus. All the participants in the trip were asked to read the brochure.

2. The bus arrived at OMU Planetarium at 14:35. Before a simulation in the planetarium, a guide gave information about the structure of the planetarium and the organization for nearly ten minutes at 14:45. Then, another guide or chaperone gave a presentation including basic information about space and astronomy for nearly ten minutes.

3. Next, the group went to the main hall where simulations and demonstrations took place. A guide presented variety of information via visuals thanks to computer and projector and it lasted 15 minutes. Then, a video presentation about solar system was performed via projector. After a 20 minute presentation, the group left the main hall and went out.

4. Information was exchanged via question and answer method with the guide outside the main hall and it lasted nearly 10 minutes. After that, pre-service teachers were given 10 minutes free time. At the end of the visit, photographs were taken.

5. The bus started for return journey at 15:50 after the trip which approximately lasted 1 hour 15 minutes.

Participants

Total 64 fourth pre-service science teachers, 42 females and 22 males, participated in the study which was conducted in 2014-2015 academic year. The pre-service teachers participating in the study ranged between 21 and 25 years. The demographic characteristics of the pre-service teachers in control and experimental group were given in Table 2.

Table 2. The demographic characteristics of the pre-service teachers in control and experimental group

Demographic Information	Experimental group (f)	Control Group(f)
Gender		
Male	9	13
Female	22	20
Type of High School Graduation		
High school	20	18
Anatolian High School	6	7
Other(s)	5	8
Participation in field trips in the past years		
Yes	24	22
No	7	11
Who they went on a trip with in the past		
School	22	19
Family/ Friends	2	3
When they went on a trip in the past years		
At university	6	5
In high school	10	9
In primary school	8	8
Where they visited in the past years		
Science Centre/ Museum	5	3
Zoo	6	7
Botanical Park	3	2
National Park	4	6
Natural Monument	3	2
Industrial/ Public Organizations	3	2
Planetarium	---	---
N	31	33

Data Collection Tools

Semi-structured interview form developed by the researcher and carried out with the pre-service teachers were utilised during the collection of data.

Semi-structured interview form: The measurement tool designed by the researcher consisted of seven questions. Six questions were prepared to determine the demographic information of the pre-service teachers participating in the study. The questions providing pre-service teachers' demographic information were collected with an interview form instead of questionnaire form due to convenience and data integrity. The last question is the question which was developed to determine and analyse how pre-service teachers perceived the concept of planetarium. The question is like / is similar to because is used to reveal metaphors because this question is frequently used as a tool to gather data via metaphors in literature (Kilcan and Akbaba, 2013; Saban, 2009). Within this context, the participating pre-service teachers in the study were asked to answer the question "A Planetarium is like / is similar to.....because Total three interviews were performed with the pre-service teachers from the experimental group: one before the trip (pre-interview), two days after the trip (post-interview-1), and six weeks after the trip (post-interview-2). Total two interviews, a pre-interview and a post-interview six weeks later, were carried out with the control group pre-service teachers in the time interval when the experimental group went on a trip were carried out. The implementation timeline for the semi-structured interviews were given below.

Table 3. The Distribution of the Questions Asked to the Pre-service Teachers from the Control and Experimental Groups within the Semi-structured Interviews

Semi-structured Interview Questions	Experimental group			Control Group	
	Pre-interview	Post Interview 1 (2 nd day)	Post interview 2 (6 th week)	Pre-interview	Post interview2 (6 th week)
1.What is your name and surname? How old are you?	✓	---	---	✓	---
2.Which high school did you graduate from?	✓	---	---	✓	---
3.Have you ever participated in an educational trip?	✓	---	---	✓	---
4.Who did you join the trip with?	✓	---	---	✓	---
5. When did you go on this trip?	✓	---	---	✓	---
6. Where did you visit?	✓	---	---	✓	---
7. Can you fill the gap in the statement “Planetarium is like/similar to because.....”	✓	✓	✓	✓	✓

Data Analysis

The first six questions which were asked to determine the demographic information of the pre-service teachers participating in the study were tabulated via using frequencies (f), one of the methods of descriptive statistics. 7th question in the semi-structured interview form was analyzed via content analysis. The data obtained from the voice recordings of the pre-service teachers were analysed by the two researchers separately and the pre-service teachers’ statements were coded by denominating them. Then, these codes were brought together and themes were composed regarding their common points. Finally, the researchers organized these codes and themes and presented them in tables. The reliability of the research was calculated with the formula suggested by Miles and Huberman (1994) (Agreement /Agreement + Disagreement) and nearly 93% agreement was found. Within this scope, the pre-service teachers’ responses to the question “A Planetarium(1)..... is like/ is similar to because(2)....” were recorded one by one. During this process, the metaphors (1) they used for the planetarium and the sections which identified the reason / source (2) for the metaphors were examined and both metaphors and metaphor categories were determined. As a result, four categories were generated from the pre-service teachers’ responses. These categories include “learning environment where the space is explained”, “a research centre where the space is explored”, “physical features”, and “a celebrity”.

RESULTS OF RESEARCH

Control and experimental group pre-service teachers’ metaphorical perceptions and metaphor categories related to planetarium concept were presented in Table 4 and Table 5.

Table 4. Metaphors developed by the pre-service teachers from the control and experimental groups about “planetarium” concept.

Experimental Group				Control Group		
Code	Pre-interview metaphors	Post- interview1 metaphors (2 nd day)	Post- interview2 metaphors (6 th week)	Code	Pre-interview metaphors	Post- interview metaphors (6 th week)
M ₁	Observatory	Mosque	Sky	F ₁	Eternity	Eternity
F ₂	Telescope	Space shuttle	Space shuttle	F ₂	Telescope	Telescope
F ₃	Telescope	Summit	Space shuttle	F ₃	Planet	Planet
M ₄	Telescope	Mosque	Mosque	M ₄	Space	Space
F ₅	Mustafa Topaloğlu	Bath	Bath	F ₅	Telescope	Telescope
M ₆	Heavenly bodies	Sky	Sky	M ₆	Planet	Planet
F ₇	Tent	Sky	Space shuttle	F ₇	Church	Space
F ₈	Bigbang theory	Summit	Summit	M ₈	Space	Space
M ₉	Telescope	Movie of the universe	Mosque	M ₉	Space	Telescope
F ₁₀	Space	The summit of the Ararat	The summit of the Ararat	M ₁₀	Space	Space
F ₁₁	Telescope	Travel in the universe	Dream	F ₁₁	Observatory	Observatory
F ₁₂	Space	Space Cam	Space Cam	F ₁₂	Planet	Planet
F ₁₃	TÜBİTAK	Eye of the universe	A window opening to the universe	F ₁₃	Dream	Dream
F ₁₄	Mars	Sky	Sky	F ₁₄	Space	Telescope
M ₁₅	Astronomical trip	Sky	Sky	F ₁₅	Sky	Sky
F ₁₆	Telescope	Explore space	Space Shuttle	M ₁₆	Space	Space
F ₁₇	Information nest	Ascending to the sky	Ascending to the sky	M ₁₇	Space	Space
F ₁₈	Observatory	Observatory	Bath	F ₁₈	Observatory	Telescope
F ₁₉	Planet	Star house	Mosque	F ₁₉	Mosque	Mosque
F ₂₀	Space	Mosque	Mosque	F ₂₀	Telescope	Space
F ₂₁	Space	Motion picture	Bath	M ₂₁	Telescope	Telescope
M ₂	Space	Travel in Universe	Space travel	M ₂₂	Space shuttle	Space
M ₂₃	Space	Looking at the sky in a clear weather	Looking at the sky in a clear weather	F ₂₃	Sky	Sky
F ₂₄	Observatory	Exploring planets	Land of planets	F ₂₄	Space	Space
F ₂₅	Space	Artificial universe	Artificial universe	F ₂₅	Telescope	Telescope
M ₂₆	Planet	Summit of Mt. Everest	Summit of Mt. Everest	F ₂₆	Space	Space
M ₂₇	Space	Dream	Dream	F ₂₇	Sky	Sky
M ₂₈	Observatory	Dream	Dream	F ₂₈	Space	Planet
F ₂₉	Earth	Flying	Dream	F ₂₉	Star	Star

F ₃₀	3D film	A door opening to the universe	A door opening to the universe	F ₃₀	Star	Star
F ₃₁	Telescope	Sky	Sky	F ₃₁	Space	Space
				M ₃₂	Telescope	Telescope
				F ₃₃	Space	Space

When Table 4 is examined, it is revealed that experimental group pre-service teachers developed total 14 metaphors about the “planetarium” concept before the trip. Out of 14 metaphors, 10 of them are represented by only one participant. 2-8 participants represent the remaining 4 metaphors. When the frequency distribution of the metaphors about this value is considered, the most frequently used metaphors are “space” (8 people), “telescope” (7 people), and “observatory” (4 people). In the interview carried out with the pre-service teachers 2 days after the trip, it was found that they developed 23 different metaphors related to the “planetarium” concept. Only one participant represents 19 of the metaphors developed. The remaining 4 metaphors are represented by 2-5 participants. When the frequency distribution of the metaphors about this value is viewed, the most frequently used metaphors are “sky” (5 people), “mosque” (3people), and “summit” (2 people). It is revealed that the pre-service teachers created 18 different metaphors about “planetarium” concept 6 weeks after the trip. 13 metaphors are represented by only one participant and the remaining 5 metaphors are represented by 2-5 participants. When the frequency distribution of the metaphors about this value is considered, the most frequently used metaphors are “sky” (5 people), “space shuttle” (4 people), “mosque” (4 people) and “bath” (3 people). It was found that the metaphors developed by the pre-service science teachers participating in the study about “planetarium” in the first interview and the metaphors they created 2 days after the trip completely changed except for one participant (F₁₈) and the metaphors which they developed before the trip and the ones they developed 6 weeks after the trip changed completely. Moreover, while the metaphors which 18 pre-service teachers developed in the interviews which were carried out two days after the trip and the metaphors they developed during the interviews performed 6 weeks after the trip remained the same, the metaphors developed by 13 of them changed.

It is found that control group pre-service teachers generated 11 different metaphors regarding “planetarium” concept in the pre-interviews. 5 metaphors are represented by only one participant and the remaining 6 metaphors are represented by 2-12 participants. When the frequency distribution of the metaphors about this value is considered, the most frequently used metaphors are “space” (12 people), “telescope” (6 people), “planet” (3 people) and “sky” (3 people). It is found that pre-service teachers generated 8 different metaphors regarding “planetarium” concept in the post-interviews. 5 metaphors are represented by only one participant and the remaining 4 metaphors are represented by 2-12 participants. When the frequency distribution of the metaphors about this value is regarded, the most frequently used metaphors are “space” (12 people), “telescope” (8 people), “planet” (4 people) and “sky” (3 people). It was revealed that while the metaphors which 26 control group pre-service teachers developed in the pre-interviews about “planetarium” concept and the metaphors they developed in the post-interview carried out 6 weeks later remained the same, only 7 pre-service teachers’ metaphor changed.

Table 5. Metaphor categories generated by the pre-service teachers from the control and experimental groups about “planetarium” concept.

Experimental Group			Control Group							
Categories	Pre-interview metaphors	Total metaphors	Post-interview metaphors 1 (2 nd day)	Total metaphors	Post-interview metaphors 2 (6 th week)	Total metaphors	Pre-interview metaphors	Total metaphors	Post-interview metaphors (6 th week)	Total metaphors
A research centre where the space is explored	Space (6) Telescope(5) Observatory (4) Planet (2) Heavenly body(1) TUBITAK(1) Mars (1)	20	---	---	---	---	Space (9) Telescope(5) Planet (3) Star(1) Observatory (2) Sky(2) Space shuttle (1) Eternity (1) Dream 1)	25	Space (10) Telescope(6) Planet (2) Sky(2) Star(1) Observatory (1) Eternity (1) Dream(1)	24
	Space (2) Telescope(2) Tent(1) Information nest (1) Earth (1) 3D film(1) Big bang(1) Astronomical Trip (1)	10	Sky(5) Summit(2) Travel in Universe (2) Dream (1) Dream (1) Summit of Mt. Everest (1) Summit of Mt. Ararat (1) Space Shuttle(1) Movie of the universe (1) Space camp(1) Eye of the universe (1) Observatory(1) Star house(1) Motion picture(1) Artificial universe(1) Flying(1) A door opening to the universe(1) Watching the sky in the clear weather (1) Exploring space (1) Exploring space (1) Getting into sky(1)	27	Sky(5) Space shuttle(4) Dream (2) Dream (1) Dream (1) Summit(1) Summit of Mt. Everest (1) Summit of Mt. Ararat (1) A door opening to the universe (1) A window opening to the universe (1) Space travel (1) Space camp(1) Artificial universe (1) Watching the sky in clear weather (1) Getting into the sky (1) Land of planets (1)	24	Space (3) Telescope(1) Star(1) Sky(1)	6	Space (2) Telescope(2) Planet(2) Star(1) Sky(1)	8
Physical features	---	---	Mosque(3) Bath(1)	4	Mosque (4) Bath (3)	7	mosque(1) Church(1)	2	Mosque(1)	1
A celebrity	Mustafa Topaloglu (singer)	1	---	---	---	---	---	---	---	---

When Table 5 was examined, the metaphors generated about “planetarium” by experimental group pre-service teachers were grouped under 4 conceptual categories regarding their common points. Each metaphor was classified in line with the pre-service teachers’ explanations within the context of ideas which were the reasons for the metaphor. Within this context, it was revealed that there was a distribution of total 7 metaphors and 20 participants in the pre-interview under the title of “a research centre where the space is explored”. It was found that pre-service teachers did not generate any metaphors included in this category in the interviews carried out 2 days and 6 weeks after the pre-interview. The distribution for the category “a learning environment where the space is explained” was observed like that: total 8 metaphors and 10 participants in the pre-interview, total 21 metaphors and 27 participants in the interviews carried out 2 days after the pre-interviews; total 16 metaphors and 24 participants in the interviews carried out 6 weeks after

the pre-interviews. It was found that pre-service teachers did not generate any metaphors in the pre-interviews for the category “physical features”. There was a distribution of total 2 metaphors and 4 participants in the interviews carried out 2 days after the pre-interviews and total 2 metaphors and 7 participants in the interviews carried out 6 weeks after the pre-interviews. It was reported that only one teacher generated one metaphor for the fourth and last category “a celebrity” only in the pre-interview.

The metaphors generated about “planetarium” by the control group pre-service teachers were grouped under the same 4 conceptual categories regarding their common points. Within this context, it was revealed that there was a distribution of total 9 metaphors and 25 participants in the pre-interview and total 8 metaphors and 24 participants in the interviews carried out 6 weeks after the pre-interviews for the category “a research centre where the space is explored”. Considering the category “a learning environment where the space is explained”, it was observed that there was a distribution of total 4 metaphors and 6 participants in the pre-interviews and total 5 metaphors and 8 participants in the interviews carried out 6 weeks after the pre-interviews. In addition, there was a distribution of total 2 metaphors and 2 participants in the pre-interviews and 1 metaphor and 1 participant in the interviews carried out 6 weeks after the pre-interviews for the category “physical features”. It was found that pre-service teachers did not develop any metaphors for the other category called “a celebrity”. For example, the pre-service teacher coded as F₂ in the experimental group stated, *“A planetarium is like a telescope because the planets are observed”* before the trip. The reason why the pre-service teacher used telescope as a metaphor reveals that the pre-service teacher perceived planetariums as a research centre where the space was explored at the beginning. In the interview carried out two days after the trip to the planetarium, the same pre-service teacher expressed her opinion like that: *“A planetarium is like a space shuttle because we travelled to the space and came back.”* The same pre-service teacher used the same metaphor with the same reason in the interview performed 6 weeks later and stated, *““A planetarium is like a space shuttle because we travelled to the space and saw the galaxies.”* The reason for the pre-service teacher’s using space shuttle metaphor and this metaphor results from the fact that the simulations used to explain the space make them feel as if they are travelling in the space in a space shuttle. As seen, the pre-service teacher’s initial perceptions about the planetariums were replaced by the perception of learning environment where these places were taught. Moreover, it is viewed that the pre-service teacher still had the same perception even six weeks after the trip. In addition, the pre-service teacher coded as M₂₂ in the experimental group expressed his opinion in that way before the trip: *“A Planetarium is like a space because it is the place where the planets in the space are explored.”* When the pre-service teacher’s reason for using the space metaphor is examined, it is revealed that in the beginning he perceived planetariums as a research centre where the space was explored. Moreover, it was observed in the interviews carried out two days and six weeks after the trip that his perception of planetarium changed permanently. While this pre-service teacher said , *“A planetarium is like a travel in the universe because it gave me the sense of feeling that I was travelling among the celestial bodies”* two days after the trip, he developed a similar metaphor six weeks after the trip like *““A planetarium is like a space travel because it gives this feeling.”* because different information about the space was given to the pre-service teachers participating in the trip via special simulations projected on to the planetarium dome. This presentation with simulations replaced the pre-service teacher’s initial perception about planetariums with the perception of “learning environment where the space was explained.” Similarly, the pre-service teacher coded as F₂₀ stated, *“A planetarium is like a space because we explore life there.”* Moreover, she generated the following metaphors like *“A planetarium is like a mosque because it has got a dome”* two days after the trip and *“A planetarium is like a mosque because it has got a dome”* six weeks after the trip. As seen, while the pre-service teacher’s initial perception was “a research centre where the space was explored”, after the trip this perception changed and became planetarium’s “physical features” category. The pre-service teacher coded as F₅ in the control group stated, *“A planetarium is like a telescope because we can see the stars and planets.”* In the pre-interview and in the interview performed six weeks later he developed a similar metaphor like *““A planetarium is like a telescope because stars are explored.”* Both the metaphor and the reason generated by this pre-service teacher remained the same. In other words, the pre-service teacher’s perception about the planetarium did not change and it remained in the same category as “a research centre where the space is explored”. Likewise, in the pre-interview the pre-service teacher coded as M₁₆ said, *“A planetarium is like a space because the space is observed.”* However, in the post-interview, similarly he stated, *“A planetarium is like a space because the celestial bodies in the space are observed.”*

DISCUSSION AND CONCLUSION

Although instruction carried out-of-school settings are more difficult, complex, and costly than instruction in the classroom environment (Orion *et al.*, 1997; Osborne and Dillon, 2007), it is stated that they have very important functions for having students gain cognitive, affective, and psychomotor skills (Orion and Hofstein, 1994; Tal and Morag, 2009). However, teachers have a very important role for the effective use of these places which occur as appealing educational settings. There are many factors why teachers cannot use these places effectively. One of them is the teachers' perceptions (Kisiel, 2005, 2007). The results of the study reveal the effect of the trip organized to the planetarium on pre-service teachers' perceptual changes.

The results of the study exhibited that the metaphors generated by nearly fifth-quarter of the control group pre-service teachers about planetariums did not undergo any change for six weeks. In other words, the perceptions of control group pre-service teachers about planetariums did not change. The pre-service teachers in the control group mostly used "space", "telescope", "planet", and "sky" metaphors about the concept of planetarium both in the pre-interview and post-interview. However, it was determined that the metaphors which pre-service teachers from the experimental group developed about planetariums in the first interview carried out before the trip and the metaphors which they generated in the interviews performed two days after the trip changed completely except for one pre-service teacher (F_{18}). It was found that the experimental group pre-service teachers generated mostly "space", "telescope", "observatory" metaphors before the trip. These metaphors reveal that both the experimental group and the control group developed the same kind of metaphors about planetariums in the beginning. It was revealed that pre-service teachers mostly used "sky", "mosque" and "summit" metaphors two days after the trip. In addition to this, it was found that the number of metaphors generated by the pre-service teachers after the visit increased by 60%. It was found that nearly five-thirds of the metaphorical perceptions did not change in the third interview carried out six weeks after the trip with the intention of identifying at what level the metaphors generated by the pre-service teachers about planetariums after the visit would become permanent. It was viewed that the pre-service teachers mostly used "sky", "mosque", and "space shuttle" metaphors. These results reveal that the trip organized to the planetarium totally changed the metaphors which pre-service teachers developed about planetariums at the beginning and also it promoted the variety of metaphors. The metaphors substantially remained unchanged in the interviews carried out six weeks after the trip and this reveals that the trip made contribution to the change of metaphors generated permanently. In other words, it can be stated that the trip organized to the planetarium changed the pre-service teachers' initial perceptions about the planetarium permanently. Another important finding of the study is that the trip organized to the planetarium has an effect on the conceptual categories under which the metaphors generated by the pre-service teachers about planetariums were classified. Within this context, it was determined that the metaphors generated by the control group pre-service teachers both in the pre-interviews and post interviews carried out six weeks later were included in the same categories at the same rate. In other words, it can be stated that the conceptual categories under which the metaphors were classified did not change in the control group. In other words, there was not a change with the control group pre-service teachers' perception categories about planetariums. Nearly three-quarters of the pre-service teachers had the perception in the pre-interview that planetariums were a research centre where the space was explored and it was determined that this perception did not change in the post interview. However, the conceptual categories under which the metaphors which experimental group pre-service teachers generated before the trip and after the trip were classified differ considerably. Within this scope, it was determined that nearly two-thirds of the metaphors generated by the experimental group pre-service teachers were grouped under the category of a research centre where the space was explored in the pre-interview just like the control group. In other words, it can be stated that in the beginning the pre-service teachers from the experimental group perceived planetariums as a research centre where the space was explored. But, it was found that the pre-service teachers did not generate any metaphors included in this category in the interviews carried out two days and six weeks later. It was determined that the metaphors which the pre-service teachers generated during the interviews performed two days after the trip (87%) and six weeks after the trip (77%) were gathered under the category of "learning environment where the space is explained".

In other words, it can be stated that the experimental group pre-service teachers had the perception that instruction could be performed in planetariums.

This study is important because it reveals that the field trips have an effect on pre-service teachers' perceptions. The research findings demonstrated that the field trip considerably changed pre-service teachers' perceptions about planetariums. At first, the pre-service teachers regarded planetariums as a research centre where the space was explored. However, this perception changed considerably and it was observed that planetariums were imprinted on the pre-service teachers' minds as learning environments where the space was explained. This change in pre-service teachers' perceptions can have a positive effect on their desire to take their students on a trip to planetariums within the context of science courses because the studies carried out suggest that teachers do not exactly know what kind of trips to organize to which environments, how to plan the trip and how to actively engage themselves in the process (Anderson, Bethan and Mayer-Smith, 2006; Bowker, 2004; Bozdoğan, 2012; Ferry, 1993; Tal, 2004; Tal, Bamberger and Morag, 2005). From this point of view, the pre-service teachers' change of perceptions regarding planetariums as learning environments where the space is explained will also positively affect their desire to organize trips to these places in the future. Another important finding in this study is that field trips eliminate wrong or inadequate information. When the metaphors generated by the experimental group pre-service teachers and the reasons for these metaphors were examined, it was found that nearly two-thirds of them assumed that planetariums were research centres where the space was explored. There was a considerable change with the experimental group pre-service teachers' perceptions after the trip and it was determined that they considered planetariums as a learning environment where the space is explained.

IMPLICATIONS

Teacher trainers can focus their attention on studies to reveal pre-service science teachers' perceptions regarding out-of-school settings which they will use in their lessons because the negative or wrong perceptions pre-service teachers have about these settings can have a negative effect on their trip organizations in the future and also they can prevent them from benefiting from these environments utmost. In addition to this, this research study examined planetariums, one of the out-of-school-settings. However, it is considerably important that studies about many locations used in science education like science centre, zoos, botanical gardens, aquariums, national parks and natural monuments should be conducted. Moreover, studies with different pre-service teachers and teacher groups can be carried out to increase the reliability and validity of the findings of this research study. Thus, the data will be obtained and discussed in a much broader perspective.

LIMITATIONS

Within the context of the study carried out, the trip which lasted nearly one and half an hour was planned and organized with the pre-service teachers and the change in their perceptions about the concept of planetarium was examined at the end of this trip. Within this framework, the new studies can make contributions to the research data by increasing the number of the trips and the duration of the visit. In addition to this, considering the six week period of time between the pre-interviews and post-interviews in the study carried out, external variables which can have an effect on the perceptions of both experimental group and control group are supposed to have an effect on both groups at the same level.

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