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The aims and learning attainments of secondary and high school students attending science festivals: A case study

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This study was conducted to determine the aims and learning attainments of secondary school and high school students participating in science festivals. A case study approach which is one of the qualitative research methods was used in the research. This study was carried out in the science festival held in Elazığ, Turkey. The sampling consists of 39 students; 19 secondary school students and 20 high school students were selected on a voluntary basis from the secondary and high school students who were visitors of science festival. In the study, semi-structured interview form and demographic information form were used as data collection tool. Data were analyzed with content analysis. In this study, the aim of students participating in science festivals was acquiring new information, a sense of curiosity, applying the knowledge they acquire in everyday life, entering science competitions with new projects they develop from fresh ideas, and having an interest in science. Students express their learning attainments as acquiring new information, expanding their perspectives, learning about the uses of technology, using the information in daily life and exhibiting a positive attitude toward knowledge and nature.

Key words: Science festival, secondary school, high school, students, learning attainments.

INTRODUCTION

The concept of "lifelong learning" has gained great importance in the 21st century. Training of scientific literacy students is frequently encountered in contemporary science curricula and constitutes the vision of curriculums. In addition to the education provided at educational institutions, students can also participate in activities are done outside school environments to support the students to be as science literate individuals. In this context, science festival and science fair play an important role in educating science literate individuals with lifelong learning skills (Bruce and Bruce, 2000). There are some differences between science festivals, science Olympiads and science fairs. Science festivals are increasingly becoming a global phenomenon, including some small, localised events reaching small groups, up to nationwide events reaching many millions (Bultitude et al., 2011). Science festivals are organizations that include fairs, exhibitions, science shows and

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demonstrations, stage shows, street presentations, workshops, outdoor activities, interviews, etc., to reflect the integrity between science and technology, enabling scientific information to be widely distributed. Science fairs, in which participants share their research results with their friends, teachers, parents, scientists and other people in the society, are generally smaller organizations than science festivals. Although science fairs and science Olympics have different applications, they mostly contain a competition environment. Science fair focuses on a single student's experiment but science Olympiad emphasizes teamwork (Abernathy and Vineyard, 2001).

The science festivals, science Olympiad and science fairs that have taken different forms around the world have the same general aims as follows: they contribute to the creation of creative ideas by arousing scientific curiosity in human beings; allow them to base their everyday events on scientific grounds; contribute to positive developments of the participants' knowledge and scientific studies with various applications.

When the background of non-school learning environments is examined, it is recognized that there are different forms of organizations of countries. First, science exhibitions originated by American Instıtute of Science and Technology in 1828 exposition were public expositions that award the inventors. American Instıtute of Science and Technology held the first student science fair in 1928 (Bellipanni and Lilly, 1999). The first of UK science festivals was the annual conference, that was renamed a Festival of Science in the 1980s and is now the British Science Festival, held by the British Association for the Advancement of Science in 1831 (Buckley and Hordijenko, 2011). In Turkey, Scientific and Technological Research Council of Turkey (TUBITAK) and the Ministry of National Education (MNE) promote various projects that can be named as science festivals; 2201-National Primary School Mathematics Olympiad, 2202-2203-National and International Science Olympics, 2204-Secondary School Students Research Projects Competition for the primary and secondary school students, "This is My Work" Project. There are two different programs that have received much demand in recent years, that participation is high and are supported by TUBITAK. 4007-Science Festival Support Program aims to do the following: spread scientific culture and science communication to wider areas of society, to increase interest of the society, encourage children and young people to make a career in all scientific fields, integrate different sections with scientists and transmit scientific knowledge in an amusing environment exhibitions, workshops, lab workshops and preferably interactive applications such as thematic games, competitions, stage shows, demonstrations, interviews. 4006-TUBITAK Science Fairs Call Program aims to give support to the science fairs which provide an environment where 5th - 12th grade students can show the results of researches on the basis of their interests.

When the literature was searched, studies related to science festivals and science fairs were encountered (Grote, 1995; Bunderson and Anderson, 1996; Abernathy and Vineyard 2001; Kankelborg, 2005; Rennie, 2007; Yayla and Uzun, 2008; Bultitude, McDonald and Custead, 2011; Durant, 2013; Mernoff et al, 2017). Extracurricular science activities are encouraged by many researchers. For the findings of the recent studies, both number of organizations named as science festival and the number of participants participating in these organizations increased (Yaşar and Baker, 2003), the participants saw science fairs as fun places and found new things in these fairs (Abernathy and Vineyard, 2001). These projects are aimed to provide students to participate in scientific research process, to support their development in line with their interests and skills, to gain the features of thinking, curiosity and inquiry. Science festivals help participants to carry out experiments at the point of creativity, to develop scientific literacy and to conduct projects (Tortop, 2013a). Science festivals help to increase curiosity about new areas of scientific knowledge (Jensen and Buckley, 2014).

As there are positive effects of the science festivals on the participants, there are also negative effects of science fairs. It is observed that the number of students receiving awards in science fairs is very small compared to the number of students participating in science fairs. This situation causes disappointment in the students and the participants in science fairs have a negative attitude towards "competition" and "equal opportunity" points (Yaşar and Baker, 2003). The competition platform also causes students to feel worried and stressed and increases their anxiety level (Wang and Yang, 2003). According to Hampton and Licona (2006), the science fairs have led to negative experiences that prevent especially border students from enjoying science and achieving science understanding.

When the studies in Turkey on science festivals and fairs are examined, it is realized that the existing studies are mostly about "This is My Work" project (Tortop, 2013a, b, c; Bolat et al., 2014; Tortop, 2014; Özel and Akyol, 2016). The aims of some other studies in Turkey are that; a study examined the attitudes of participants to nature and insects (Tezcan and Gülperçin, 2008), the effect of science fairs on students' attitudes towards chemistry lessons were examined (Şahin, 2012), the effects of science festivals on scientific beliefs and Science Teachers' success were examined (Yavuz et al., 2014), the impacts of a secondary school science exhibition on the students in charge in the exhibition were examined (Şahin and Çelikkanlı, 2014), the effect of science fairs on the 6th grade primary school students'attitude towards the science course was examined (Yıldırım and Şensoy, 2016) and in another study the effects of science fair practices on the attitudes of prospective science teachers towards science teaching and students towards science were examined (Durmaz et

al., 2017).

This study was conducted with the secondary and high school students who were visitors of 4007-Science Festival supported by TUBITAK. The science festival had workshops that addressed groups from pre-school to adult levels and also lab workshops and preferably interactive applications such as thematic games, competitions, stage shows, demonstrations, interviews. This study was carried out with the reason of the limited number of studies of secondary school and high school students in the science festivals. In this study, it is aimed to determine the aims and learning attainments of secondary school and high school students participating in science festivals.

METHODOLOGY

A case study approach which is one of the qualitative research methods was used in the research. A case study is used in cases where an event, a person, or a group is examined (Çepni, 2012). Case studies are generally preferred to pose the questions "how" or "why" and to focus on a contemporary phenomenon within some real-life context (Yin, 2003) According to Baxter and Jack (2008), a case study is an excellent chance to gain insight into a case, and facilitates the researcher to gather data from a variety of sources.

This study was carried out in the science festival held in Elazığ. It is estimated that it welcomed almost 2000 visitors to science festival over the 3 days. Averaging almost 400 secondary and high school students visited the science festival. Purposive sampling, a type of non-random sampling technique, was used in the study (Özen and Gül, 2007; Çepni, 2012). The sampling was selected on a voluntary basis from the secondary and high school students who were visitors of 4007-Science Festival. The study group consists of 39 students, 19 secondary school students and 20 high school students.

Data were gathered through semi-structured interviews using five questions to determine the following: who are influential at the point of participating in science festival, if there was a compelling effect on their participation after they were directed to science festivals, students' purpose of attending science festival, what learning attainment they have achieved in festival and whether there was a relationship between students' participation in science festival and their desire to be appreciated. A group of experts were asked to comment on the reliability of the interview questions. Interviews lasted for approximately 15 to 25 min with each student and recorded on time. Some of the students who participated in the interviews had not attended all the events in the festival yet. A second brief interview was held with these students to find out their learning attainments. In addition to the semi-structured interview form, a demographic information form was used to clarify the characteristics of secondary and high school students involved in the working group, including the sexes of students, class levels, economic status of their families and so on. Qualitative data, obtained from semi-structured interviews were analyzed with content analysis. Content analysis is a method used to classify the data based on identified themes and to determine their frequency and their relationships (Cohen et al., 2007; Yıldırım and Şimşek, 2005).

FINDINGS

This section contains the content analysis of the data obtained from the semi-structured interview form and the demographic characteristics of secondary and high school students participating in the science festival held in Elazığ.

Table 1. Gender frequency table of students.

Gender	f	%
Female	7	17.95
Male	32	82.05

Table 2. Grade levels of students.

School	Grade	f	%
Secondary School	5th Grade	2	5.13
	6th Grade	-	-
	7th Grade	4	10.26
	8th Grade	13	33.33
High School	9th Grade	9	23.08
	10th Grade	6	15.38
	11th Grade	1	2.56
	12th Grade	4	10.26

The demographic characteristics of secondary and high school students

The demographic characteristics of secondary and high school students participating in the study are as follows. The frequency table for the gender of the students participating in the study is given in Table 1. The genders of the students involved in the study are 82.05% males and 17.05% females. The data of the class levels of the students are shown in Table 2. Table 2 indicates that 33.3% of the students of the study group are in the eighth grade, 23.08% in the ninth grade, 15.38% in the tenth grade, 10.26% in the twelfth grade, 10.26% in the seventh grade, 5.13% in the fifth grade and 2.56% in the eleventh grade students. According the Table 2, the highest participation rate belongs to the 8th grade students with 33.33%. Since the interviews are conducted voluntarily, it can not be said that there is no 6th grade visitor. The data of parents' educational status is shown in Table 3.

Table 3 indicates parents' educational status. When we look at the findings of parents' educational status; 39 students in the study group had a primary school graduation percentage of 36% for mothers and 23% for fathers; the percentage of secondary school graduate parents was found to be 10.3% for mothers, 21% for fathers and 26% for parents with high school graduates, both in mothers and fathers. Percentage of parents with undergraduate and above education is 15.4% for

Table 3. Parents' educational status.

Educational Status	Educational status of mother		Educational status of father	
	f	%	f	%
Primary School	14	35.90	9	23.08
High School	10	25.64	10	25.64
University	4	10.26	9	23.08
Middle School	4	10.26	8	20.51
Literate	3	7.69	1	2.56
Master	2	5.13	2	5.13
Not Literate	2	5.13	-	-

Table 4. The professions of the mother and father.

Professions	Mother		Father	
	f	%	f	%
Housewife	30	76.92	-	-
Civil Servant	4	10.26	12	30.77
Worker	4	10.26	9	23.08
Artisan	-	-	8	20.51
Farmer	-	-	5	12.82
Other	1	2.56	4	10.26
Retired	-	-	1	2.56

Table 5. Monthly income status of the family.

Monthly Income	f	%
0-750 TL	1	2.56
751-1500 TL	14	35.90
1501-2250 TL	8	20.51
2251-3000 TL	10	25.64
3001TL and up	6	15.38

mothers; for fathers is 28.2%. Two students stated that her mothers were not literate. The data on the professions of the mother and father are shown in Table 4.

Table 4 shows the professions of the parents. When the answers given to the question of mother's profession are examined, while the first order takes the option of housewife with the mark of 30 students, there are civil servants and workers options with the indication of the second profession. In the case of the father's profession, the civil servant option took the first place with a rate of 30.8%. Findings related to the monthly incomes of the families are shown in Table 5.

Table 5 indicates that the income status of the 14 students is between 751-1500 TL, while the income status of the 1 student is below 750 TL. Income status of families is compatible with their professions. Findings of the settlements where the families live are given in Table 6.

Table 6. Settlement units of families.

Placement Unit	f	%
Provincial Center	25	64.10
Village	9	23.08
District Center	5	12.82

Table 6 indicates the settlements of the families. The table shows that 64.1% of the students participating in the science festival live in the province center and 23.1% live in the village. It can be said that the number of students participating in the science festival living in the province center is higher than those living in the villages.

Students' views on science festival

In this section, findings from the semi-structured interview form are given. Content analysis was used to analyze the data obtained as a result of the semi-structured interview form. The frequencies of the obtained data and the percentages of these frequencies were calculated and tabulated. The students were asked who are influential at the point of participating in science days. Findings of the answers to the question are shown in Table 7.

Table 7 shows the people who guide students to attend the science festival. It is shown that most of the students (48.72%) visit the festival by their own volition without any guidance. It is indicated that students visit the science festival respectively by the guidance of their teachers, friends, chance and families. Only one student pointed out that both their family and school teachers guided him. Some of the students' views are given below.

Secondary School Student 6: "*I participated in the science festival because I wanted."*

Secondary School Student 13: *"My science teacher*

Table 7. People who guide students to attend the science festival.

Codes	f	%
Own Will	19	48.72
Teacher	10	25.64
Friend	5	12.82
By Chance	2	5.13
Parents	2	5.13
Family and Teacher	1	2.56

Table 8. Impact on participation of science festival.

Codes	f	%
Own Wish (No Compulsory Request)	39	100.00
Someone Else's Compulsory Request	-	-

guided me to participate in the science festival. He said that the workshops were very interesting."
High School Student 21: "*My best friend would attend the science festival. I came with her."*
High School Student 33: *"I saw the poster of science festival in social media by chance."*

The students were asked if there was any oppressive effect on their participation after they were informed about the science festival. The answers of the students are given in Table 8. Table 8 shows that all of the 39 students who participated in the science festival did willingly; they were not forced forced to participate in the festival anyway. Some of the students' views are given below.

Secondary School Student 3: *"Nobody forced me to join the science festival. I came on my own will."*
High School Student 35: "*I am interested in Science and it is my own will to participate in the science festival."*

There were 21 workshops and various activities in the scope of organized science festival. Even though the workshops addressed different age groups, students who wanted to spend a full festive occasion had chance to watch other workshops they were curious about. It is very important to know the purpose of the students participating in the science festivals in order to determine whether the units that organize the festivals overlap with their aims. Therefore, the students were asked about their purpose of attending science festival. Students' purposes of joining science festival are shown in Table 9. Some students have pointed out more than one purposes; therefore, there are more purpose codes than the number of samples.

Table 9 deals with students' purposes of joining science festival. It is shown that 48.72% of the students participating in the science festival expressed their intention for acquiring new knowledge, followed by students who expressed their curiosity in science festivals with a rate of 25.64%. The lowest rate is 2.56% of the interest in science, to transfer the acquired knowledge to everyday life, and to enter the scientific competitions with the knowledge gained. Some of the students' views are given below.

High School Student 28: *"My purpose to join the festival is acquiring new knowledge. I hope the workshops are interesting."*
Secondary School Student 17: *"I wonder what experiments and workshops are in the festival."*
Secondary School Student 1: *"When I visited science center I really enjoyed. So, I think it will be funny."*
High School Student 21: *"Because my friend participates in the science festival, I also visit the science festival. I plan to wander."*

Students were asked to determine what learning attainments they have achieved in science festival. The data on the contribution of science festival to the students are shown in Table 10.

Table 10 indicates the learning attainments of students in science festival. Twenty-three of the students who were included in the study group stated that they were getting new knowledge within the scope of the science festival they attended, while seven students said that their perspective of science was expanding thanks to the science festivals. Some students stated that thanks to the science days, they learned about the usage areas of technology, they could use the information they got in daily life, they showed a positive attitude towards knowledge and nature. Examples of secondary school students and high school students' views are as follows.

High School Student 22: *"I have acquired new knowledge that is very interesting."*
Secondary School Student 15: *"I have enjoyed while observing 3D models in Augmented Reality integrated in real time in their actual size. I have learnt much more usage areas of technology."*
Secondary School Student 18: *"Joining the science festival has made me noticed interesting events in the nature. I have got various knowledge. I discovered that science can be fun."*
High School Student 37: *"I wondered what I would observe before joining the science festival. After the workshops I observed my curiosity increased. I began to think where I could use my learning attainments."*

A last question was asked for determining whether there was a relationship between students' participation in science festival and their desire to be appreciated. The views of the students about the effects of community appreciation to join the science festival are given in Table 11. It is shown in Table 11 that in the answers to the

Table 9. Students' purposes of joining science festival.

Codes	f	%
Acquiring New Knowledge	19	48.72
Curiosity	10	25.64
Fun	7	17.95
Personal Development Contributed	6	15.38
Wander	4	10.26
To Learn the Current Developments	3	7.69
Producing an Individual Project by Taking Ideas from Events	2	5.13
Interest to Science	1	2.56
Acquired Knowledge to Daily Life	1	2.56
Entering the Science Competitions with the Knowledge Gained.	1	2.56

Table 10. Contribution of the science festival.

Codes	f	%
Acquiring New Knowledge	23	58.97
Increasing Perspective	7	17.95
Triggering The Sense of Curiosity	5	12.82
Having an Idea About the Events	3	7.69
Interest in Technological Developments	3	7.69
Fun	2	5.13
To Learn the Usage Areas of Technology	1	2.56
Using Acquired Knowledge in Daily Life	1	2.56
Positive Attitude Towards Knowledge and Nature	1	2.56

Table 11. The impact of community appreciation on involving science festivals.

Codes	f	%
There Is Influence	26	66.67
Unstable	12	30.77
No Effect	1	2.56

question "Is participation in the science festivals influential in your appreciation of the society?" 26 students answered, "there was an effect", 12 students were undecided, and 1 student responded "no effect". Some of the students' views are as follows.

High School Student 38: *"Participation in science festivals has the effect of being appreciated in society. When I talk about science, at least I will have an idea and I can say that I go to science festival."*
High School Student 26: *"There is an influence. We will earn new ideas if we enter into scientific competitions with the knowledge that we have here."*

High School Student 24: *"Participation in science festivals has no appreciable effect in society, because society gives little importance to Science."*

DISCUSSION

In this study, the aims and learning attainments of the secondary and high school students participating in the science festival were determined. When the genders of the participants are examined, it is ilustrated that there are much more male students than female students. It would not be right to interpret this situation that female students are less interested in science festivals because of the fact that interviews were done on a voluntary basis. There were participating students from all secondary and high school levels except 6th grade students. There were no volunteer participants in interviews of the study at the sixth grade level. When the educational levels of the parents of the participating students are examined, it is found that the vast majority are not university graduates. This situation represents that the high education levels of the families do not affect the participation in the science festivals. Similarly, the professions and income levels of parents do not affect the number of participants of science festival. Science festival was organized in the city

center, but the students who reside in the village also participated in the science festival, owing to the fact that, the number of participants from the provincial center was higher.

When the data of semi-structured interview form was analyzed, it is found that most of the students participated in the science festival on their own volition. The majority of the other students were directed by their teachers. The participation of the students in the science festivals without guidance led to the idea that their scientific awareness was high. Nevertheless, it was observed that some of the students came to the science festival with their parents. These results show that the interaction of children with their families plays a supporting role at the point of participation in social activities, but it also supports the idea that families are more likely to support schools (Aslan and Arslan Cansever, 2007).

The students were asked if there was any oppressive effect on their participation after they were informed about the science festival. All of the students involved in the study answered that they had voluntarily participated in the science festival. It is promising to notice the students participate in such scientific events not by force but by their own will. In this study, the students participated in science festival with the aim of acquiring new information, with a sense of curiosity to transfer the acquired knowledge to everyday life, to enter the scientific competitions with the knowledge gained and have interests in science. Although there are different practices in different countries, science festival, science fair, science olympiad are generally aimed to provide students to participate scientific research process, to understand and use scientific methods while designing and conducting experiments, to support their development in line with their interests and skills, to gain the features of thinking, curiosity and inquiry (Tortop,2014). The aims of students' participation in science festivals in this study overlap with the aims of science festivals.

According to the students' answers to the question of what learning attainments they got, the learning attainments of the participant students are; acquiring new knowledge within the scope of the science festival, expanding their perspective, triggering the sense of curiosity, having an idea about the events, interest in technological development, fun, learning the usage areas of technology, having positive attitude towards knowledge and nature. These findings are consistent with the literature. Science fairs, as fun places (Abernathy and Vineyard, 2001; Tortop, 2014), help participants to make experiments at the point of creativity, to develop scientific literacy and to conduct projects (Tortop, 2013a; Jensen and Buckley, 2014). Science fairs promote interest in science (Vazquez, France and Perkins, 1994), promote enthusiasm about science, benefit students about communication and scientific skills (Fisanick, 2010), give students the opportunity to interact with other students interested in science (Grote, 1995), increase in students' attitude towards science course (Yıldırım and Şensoy, 2016), help the students to think critically (Tortop, 2014). There are negative effects besides positive effects especially in the literature due to the competition environment of science fairs in particular (Wang and Yang, 2003), dishonesty (Tortop, 2013b), apprehension (Fisanick, 2010) and cheating in science fairs (Syer and Shore, 2001). The participant students did not mention a negative effect in this study. It can be because of the differences between science fair and festival and the variety of different activities in the science festival.

Most of the students said that participating in science festival was influential on their appreciation in society. It is thought that students' participation in science festival has great effect to create "science culture" in society. Students create awareness within the society with the information they receive in science festivals and encourage people to know scientific activities by conveying this information to the people in their environment in a clear and understandable way.

CONCLUSION AND RECOMMENDATIONS

The results of this study show that secondary school and high school students participating in the science festival get considerable learning attainments. Given the benefits of science festivals, it is suggested to encourage administrators and teachers to organize science festivals. Science festivals should be supported for the dissemination of science culture and for social consciousness. The students who attended the science festival were guided by themselves and their teachers. Only three of the students were guided by their parents. It is believed that if parents direct their children to science festivals, often held in non-school environment, their participation with their children will contribute to the realization of the aims of science festivals. Before the science festivals and during the science festivities, conferences and seminars should be organized on the role of the families so that the students can get the best from these activities.

When studies on science festivals are being carried out problems such as limited time and the noise generated by the crowd in the environment may be encountered. The interview forms and tests can be applied to the students that participate in science festivals in their schools. Science festivals, which are mostly held in private educational institutions, should also be realized in public schools and the number of science festivals to be organized in all educational institutions in general should be increased. In this context, it is needed to encourage teachers and managers in educational institutions to organize science festivals. Students who participate in the science festivities should be provided with the opportunities to reflect and apply the observations.

CONFLICT OF INTERESTS

The author has not declared any conflict of interests.

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