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THE EFFECT OF SCIENCE FESTIVALS ORGANIZED FOR LOWER SECONDARY SCHOOLS ON STUDENTS' ATTITUDES TOWARDS SCIENCE FESTIVALS

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ABSTRACT

This study examined the attitudes of lower secondary school students who observed science festivals towards science festivals. The study a used quasi-experimental design and method-based pre-test-post-test one-group experimental design from quantitative research methods. The research was applied to lower secondary school students in a province in the first semester of the 2023-2024 academic year. In this study, the 'Science Festival Attitude Scale' prepared by Keçeci, Zengin, and Alan (2017), which can be used to measure lower secondary school students' attitudes towards science festivals or science fairs supported by TÜBITAK, was used. The Cronbach's alpha reliability coefficient of the scale, which was prepared in 5-point Likert type from 'Strongly Agree' to 'Strongly Disagree', was found to be .816 for the original study, and as a result of validity and reliability studies, a scale of 22 items, 11 positive and 11 negatives, was prepared. The pilot study of the scale was conducted for the study, and as a result of the statistical analyses, Cronbach's alpha reliability coefficient was found to be .826. As a result of the validity and reliability studies, it was concluded that the 'Science Festival Attitude Scale' was applicable. The study sample consists of 160 students who visited the Science Festivals and voluntarily participated in the research, selected by a simple random sampling method to represent the universe. The study used a simple random sampling method to create or select the sample. At the end of the study, it was determined that the attitudes of the students in the experimental group who observed the science festival towards science festivals increased significantly.

Keywords: Science festival, science fair, project exhibition.

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INTRODUCTION

Science is an effort to understand and explain nature using observations, experiments and logical thinking, and can generally be defined as producing knowledge based on verifiable evidence (Sönmez, 2013). The 21st century is an age based on science and technology, and scientific infrastructure is needed for society to keep up with this rapidly advancing age and scientific developments and to correctly evaluate the requirements of the age (Çepni, 2023; Özdemir & Koçer, 2020). In order to create this infrastructure, individuals should be provided with various skills from an early age. Skills such as collecting data through various observations and experiments, establishing cause-and-effect relationships between data, analyzing data, and relating data to each other are important in developing scientific thinking (Çepni, et al., 2004). In addition, these skills constitute a fundamental part of the scientific thinking process. Scientific activities play a major role in the acquisition of these skills. Science fairs or science festivals are among such activities. Science fairs allow young people to use their creativity, explore their curiosity and apply scientific methods (Albernathy & Vineyard, 2001; Bunderson & Anderson, 1996). This contributes to the development of future scientists and technology leaders. In their study on science centers, Rennie and Williams (2002) concluded that out-of-school learning environments are effective in understanding science. In another similar study, Benedetti and Crouse (2020) concluded that students were more interested in science after science festivals.

Many teachers think science festivals benefit students and state that they develop students' creativity, provide opportunities for independent research by choosing their projects, and increase their interest in science (Bultitude et.al., 2011; Bunderson & Anderson, 1996). Science festivals provide a model for students to understand how scientists work. Science festivals allow students to apply the knowledge they have learned in lessons (Young, 2000). Perry (1995) states that science festivals increase students' interest in science, develop students to conduct research, and enable students to publish their completed projects and share their work.

Science festivals are scientific activities that will positively develop students' science course attitudes and learning skills (Yıldırım, 2016). It is thought that the interest of teachers and students in science lessons will increase even more thanks to the realization of similar activities such as science festivals. In this context, it will be possible to carry out studies such as science festivals at a higher level and more comprehensive in the future (Durmaz et al., 2017). The activities that can be implemented or projects that can be exhibited in science festivals can make students aware of the connection of science with daily life, and students' interest and attitudes towards science can be increased by improving their knowledge and skills towards science. In addition, when the related studies are examined, it is noticeable that the studies on science festivals lack students' interest in science lessons and their effects (Dionne et al., 2012; Finnerty, 2013).

When the literature is examined, it is seen that the studies that have determined the positive effects of festivals on students are predominant. When the studies of Balcıoğulları & Çaydaş, 2003 and Serin, 2004 were examined, it was found that there was a directly proportional relationship between students' attitudes towards science course and their success in science courses. When the research results are analyzed in this context, according to the observations of the students, it was concluded that science festivals made positive contributions in terms of being fun, providing them with experience, and developing their imagination. As a result of the related studies, there are results that students find out-of-school environments more fun and express positive opinions about out-of-school environments (Bozdoğan, 2007; Bozkurt Altan et al., 2019; Buluş Kırıkkaya et al., 2011; Cavaş, 2011; Karamustafaoğlu & Ermiş, 2020; Park et al., 2019). When other studies conducted in Turkey were examined, it was concluded that the science festivals or science fairs organized developed positive attitudes of students towards the related fields and also increased their success (Tezcan & Gülperçin, 2008; Şahin, 2012; Yavuz et.al. 2014; Yayla & Uzun, 2008).

When the literature is examined, it is seen that there are a limited number of studies in the literature research on science festivals, and the studies conducted belong to a period close to the present day (Avcı & Özenir, 2019; Başar et. al. 2018; Bozdemir, 2018; Yavuz et.al., 2014; Camcı, 2008; Çolakoğlu, 2018; Kızılcık, et. al. 2018; Şahin, 2012; Sontay et. al. 2018; Soyuçok, 2018; Tezcan & Gülperçin, 2008; Tortop, 2010; Tortop, 2013; Yavuz Çavuş et. al. 2018; Yayla & Uzun, 2008).

Although science festivals provide many advantages to students, it was stated that some negative effects may occur after the festivals ends. Among these effects, increased levels of worry, stress and anxiety stand out. In order to cope with this situation and to ensure that students benefit more from scientific activities, it is important that institutions organizing science festivals provide support and guidance to students. In addition to the competitive aspect of science festivals, studies have also shown that giving importance to activities focused on cooperation and learning helps students to establish a positive relationship with science (Albernathy & Vineyard, 2001; Bunderson & Anderson, 1996; Gomez, 2007; Mupezeni & Kriek, 2018).

Teaching aims to transfer knowledge and develop students' cognitive, affective, and psychomotor skills so that they can easily adapt to daily life and have the equipment and self-efficacy to deal with the problems they may encounter. For this reason, science festivals can be seen as one of the most effective methods that can be used to develop students' self-efficacy skills, such as critical, creative, inquisitive and scientific thinking and to develop the intended changes in students (Eshach, 2007). In science festivals, students are expected to present original, creative and real solutions to a problem or problem. An important obstacle encountered in students' participation in project competitions or science festivals is that students cannot produce projects of sufficient quality, to the extent and level intended, or they cannot show an intrinsic motivation in producing and designing projects (Bozkurt, 2020; Öztürk, et al., 2023). One of the efforts to develop students' creativity and overcome their observed deficiencies is encouraging them to participate in science festivals and project competitions as observers. Such activities help students to see different ways of thinking, develop new ideas and increase their problem-solving skills. They also provide an opportunity to analyze other students' projects and develop innovative approaches and creative solutions for their projects. Competitions and festivals stimulate scientific curiosity in students and allow them to develop teamwork, time management and presentation skills. Even if participating as observers does not give students direct experience, it can help them gain a deeper understanding and inspiration by watching other students' work and engaging in discussions. This process contributes theoretically and practically (Jensen, 2014a; 2014b).

In line with these studies, our research aims to test the accuracy of this observation and to examine whether there is an improvement in the attitudes of students participating in science festivals towards science festivals by comparing their attitudes towards science festivals before and after science festivals.

METHOD

Research Model

In this study, a quasi-experimental design with pretest and posttest applications on a single group was preferred. The experimental research design is the most appropriate method to test the cause-and-effect relationship between certain variables (Neuman, 2013). Although there are some similarities between the experimental and quasi-experimental research designs, there are differences in the selection of groups. In quasi-experimental designs, participants are not randomly assigned. A quasi-experimental design is preferred in cases where the experimental design cannot be applied because the random assignment is not made (Büyüköztürk, 2001). The one-group pretest-posttest quasi-experimental design can be used especially in studies such as the development and implementation of a new educational model (Creswell, 2012)

A simple random sampling method was used in the study. The principle of randomness or the lottery method was used to select students who experienced the exhibition. Since the students in the study group were not selected by the principle of randomization or lottery method when selecting the students in the study group, and since the school suitable for the research was used, the research is quasi-experimental. The design based on a quasi-experimental method and method in quantitative research is called pretest-posttest one-group experimental design (Cohen et.al., 2000).

In the pretest-posttest experimental design, the measurement tool is applied to the group or groups to be researched before the application. Then, the measurement process is repeated at the end of the application, and the experimental process is completed. After the experimental study, it is concluded whether the independent variable, that is, the application, affects the significant difference between the mean scores of the application group (Büyüköztürk et. al., 2017).

Study Group of the Research

The research group consisted of middle school students who were going to observe the science festivals or visit the exhibition and who voluntarily participated in the study. The study was conducted with a total of 160 students, 40 students from 5th grade, 40 students from 6th grade, 40 students from 7th grade, and 40 students from 8th grade, selected from each grade level, who voluntarily participated in the study and observed the exhibition to represent the students in the population.

Table 1. Descriptive Statistics Results Regarding Gender Distribution of Students

Gender	n	%
Female	88	55.0
Male	72	45.0
Total	160	100.00

When Table 1 is examined, it is seen that 55% of the sample consists of female students and 45% of male students.

The descriptive statistics results regarding the distribution of students according to their grade levels are shown in Table 2.

Table 2. Descriptive Statistics Results Regarding Students' Class Level Distribution

Group	Class Level	n	%
Students Experiencing the Exhibition	5	40	25,0
	6	40	25,0
	7	40	25,0
	8	40	25,0
	Total	160	100,0

When Table 2 is examined, the distribution of students across grade levels is equal, and the distribution of students from each grade level constitutes 25% of the total students. The population of the study consists of 5th, 6th, 7th and 8th grade middle school students studying in a public middle school affiliated with the Ministry of National Education in a province in Turkey. The study was conducted in the 2023-2024 academic year, and the study sample consisted of 160 students representing the universe who visited the science fairs supported by TÜBITAK, who studied at the same school and voluntarily participated in the study.

Data Collection Tools

In this study, the "Science Festival Attitude Scale" prepared by Keçeci, Zengin, and Alan (2017), which can be used to measure lower secondary school students' attitudes towards science festivals or science fairs supported by TÜBITAK, was used. The Cronbach's alpha reliability coefficient of the scale, which was prepared in a 5-point Likert type from "Strongly Agree" to "Strongly Disagree", was found to be .816. As a result of the calculated validity and reliability studies, a scale of 22 items, 11 positive and 11 negative, was prepared. As a result of the validity, reliability studies and statistical analyses, it was concluded that the ‘Science Festival Attitude Scale’ was valid and reliable.

In the analysis of the data obtained in the preliminary application of the scale, for each positive statement in the items, "Completely Agree" was scored 5 points, "Agree" was scored 4 points, "Partially Agree" was scored 3 points, "Disagree" was scored 2 points, and "Strongly Disagree" was scored 1 point. Accordingly, the lowest score that can be obtained from this scale is one, and the highest score is 5.

The study was applied to a total of 80 students, consisting of 20 students from each grade level, studying in the 5th, 6th, 7th and 8th grades in a public lower secondary school in a province in Turkey as a pilot study before the implementation. The scales were administered to the students as a pre-test one month before starting the study in the first semester of the 2023-2024 academic year and evaluated with student feedback during the application. The application lasted approximately one class hour. As a result of the pre-test, the reliability of the scales was found to be high, and the item analysis showed that the discrimination and item difficulty of the items were at a sufficient level. Expert opinion was taken on content validity, and it was determined that the content validity of the scales was sufficient. Students found the scales applied to them in the pilot application appropriate regarding language and comprehensibility. As a result of the data and feedback received as a result of the preliminary application, there was no obstacle to conducting the study with the determined scale, and it was decided that the study would be conducted in line with the pilot application.

In the study we conducted as a preliminary application, the Cronbach alpha value was found to be .826 (0.70<). Since this value was greater than 0.70, the reliability of the scale was found to be high (Büyüköztürk, 2001). When the item analysis of the scale was performed, it was seen that each item's discrimination and difficulty indices were at a sufficient level. The scale's content validity was examined by three science teachers and one Turkish teacher. As a result of the expert opinions, it was determined that the scale was applicable. As a result of the preliminary test, the scales applied to the students were also evaluated by the students and found appropriate in terms of language and comprehensibility in line with the feedback received. The scale, which was examined in line with the expert opinions, was asked to read the scale to six students studying in the 5th, 6th, 7th and 8th grades of lower secondary school and to determine the parts they did not understand about the items. Considering how many minutes the students answered the scale in this process, the answering time of the scale was determined as 30 minutes.

Data Analysis

SPSS 22 statistical analysis program was used to analyze the study's quantitative data. Descriptive statistical techniques (mode, median, arithmetic mean, standard deviation) were used to determine the general distribution of the student's responses to the scale and to investigate whether the quantitative data showed normal distribution. In addition, central tendency (mean, mode and median) and central dispersion (standard deviation, skewness and kurtosis) values of the scale scores were also used in the analysis. In the study, in order to determine whether there was a significant difference between the pretest and posttest mean scores of the experimental group, "Wilcoxon Signed Ranks Test," also known as the "Dependent Groups Wilcoxon Test" analysis was applied as a nonparametric test depending on the normality distribution. All analyses were evaluated at a significance level of .05 (Büyüköztürk et al., 2017).

Parametric statistical analysis methods are based on the assumption that the data conform to a normal distribution. These methods are generally more powerful but should be used with caution as the data must fit certain characteristics. Before statistically analyzing the attitude pretest and posttest scores of the students in the experimental group in the study, it was determined which statistical method would be used to analyze the quantitative data obtained from the attitude scale. In quantitative research, both parametric and nonparametric statistical methods can be used to analyze the data. In order to use parametric analysis methods, parametric statistical methods can be used if the quantitative data obtained from the tests and scales applied during the research fit the normal distribution (Sim & Wright, 2002).

In the context of this information, to determine the statistical method to be applied to the data obtained from the attitude scale, analyses were performed and the findings obtained are shown in Table 3, and it was examined whether the scores showed a normal distribution.

Table 3. Descriptive Statistics Results of Science Festival Attitude Pre-Test and Post-Test of Students in the Experimental Group

Test	n	$\bar{X}$	S	Median	Mode	Kurtosis	Skewness
Pretest	160	71.20	5.087	71	71	0.460	0.097
Posttest	160	93.53	5.840	94	92	0.827	-0.498

When Table 3 is examined, it is seen that the mean, median and mode values of the students' pretest and posttest posttest scores are close to each other. It is seen that the kurtosis and skewness values of the students' pretest and posttest posttest scores are between -1.5 and +1.5. The range of kurtosis and skewness values (-1.5 to +1.5 range) indicates that the data are normally distributed since the sample size is greater than 30 (Tabachnick & Fidell, 2013).

Research Implementation

In the implementation phase of the research, while teaching the Science Curriculum in parallel with the teaching, studies on science festivals and science fairs supported by TÜBITAK were included in the 15-minute part of one lesson each week, and what kind of projects would be done in these projects were explained to the students. Students were guided about the purpose of science festivals, how the projects should be done, and what they should do in producing projects. During the teaching process in the research, information, videos, and presentations were made about science festivals, scientific methods, project-research steps, and project diaries. In addition, case studies were shown to open students' horizons. Students were asked to identify a problem for a science festival or TÜBITAK Science Fair based on the topics that interest them and to research to solve this problem. As a result of the students' observations and research, the activities designed by the students to solve the problem they identified based on the information they obtained were applied to the science fair supported by TÜBITAK under the guidance and consultancy of their teachers. As a result of the application, our school was entitled to participate in the science fair supported by TÜBITAK and to exhibit the students' projects. Students prepared their projects, posters and presentations for the exhibition under the guidance of their teachers. As a result of the projects and preparations made by the students, the TÜBITAK Science Fair was opened, and the projects were presented to the visitors by the students who prepared projects for two days. Before the exhibition, the science fair attitude scale was applied as a pre-test to a group of 160 students: 40 students from 5th grade, 40 students from 6th grade, 40 students from 7th grade, 40 students from 8th grade, 40 students from 6th grade, 40 students from 7th grade and 40 students from 8th grade, who were selected by simple random sampling method from each grade level to observe the exhibition in a way to represent the students in the population who were studying at the same school and who voluntarily participated in the research. The TÜBITAK Science Fair exhibition was held, and all projects were introduced and explained to this group of 160 students who participated in the research together with the students from the whole school by the project owner students in charge of the exhibition. One week after the end of the TÜBITAK Science Fair, when the event's excitement did not affect the students, the science festival attitude scale was applied as a post-test. In light of the data collected from the students, it was investigated whether there was a significant difference between the pre-test and post-test.

FINDINGS

It was decided to use parametric tests to analyze the data, which were determined to be normally distributed as a result of descriptive statistics. In this context, the "Dependent Groups t Test" was used to investigate whether there was a significant difference between the experimental group's pretest and posttest posttest mean attitude scores. The total score obtained from the scale was divided by the number of items on the scale, and the attitude score was calculated for each student.

Table 4. Science Festival Attitude Scale of Students Visiting the Exhibition Pre-test-Post-test Dependent Groups t-Test

Scale	Test	n	$\bar{X}$	S	df	t	p
Students Visiting the Exhibition	Pretest	160	71.20	5.087	160	-36.190	,001*
	Posttest	160	93.53	5.840	160		

When the data in Table 4 were analyzed, it was found that there was a significant difference in students' attitude scores towards the science festival ($p= 0.01$; $p<.05$). In other words, it was observed with the findings that the attitudes of the students who observed the exhibition towards science festivals increased significantly between the pretest and post-test scores. When the pretest ($X=71.20$) and posttest ($X=93.53$) mean scores of attitudes towards science festivals were examined, it was found that there was a significant difference between the pretest and post-test mean scores of the students who visited the exhibition, and this difference was in favor of the post-test.

In this study, a control group with equal academic achievement levels could not be formed to compare the course outcomes of the students who visited the exhibition at the science festival. Therefore, a one-group pretest-posttest quasi-experimental design was used as the experimental model. In this model, a selected group is first given a pretest with a specific measurement tool. During the experimental process, the independent variable whose effect is to be examined is applied to this group, and then a post-test is conducted using the same measurement tool. In analyzing the differences between the pretest and post-test, the t-test or Wilcoxon signed-rank test, which is a non-parametric alternative, is used. As a result of these tests, if the difference between the pretest and post-test is significant in favor of the post-test, the program or independent variable is considered successful (Yenilmez & Teke, 2008).

The study examined whether the pretest and post-test scores of the students who visited the exhibition for the class levels of the attitude scale towards science festivals differed. Descriptive analysis results of the test data obtained from the study are given in the table below.

Table 5. Science Festival Attitude Scale Pre-Test Dependent Groups t-Test According to the Grade Level of the Students Visiting the Exhibition

Science Festival Attitude Scale	Tests	n	$\bar{X}$	S	df	t	p
Grades 5 and 6	5th Grade Pre-Test	40	71,47	6,397	40	0,173	,864
	6th Grade Pre-Test	40	71,27	4,308	40		
Grades 5 and 7	5th Grade Pre-Test	40	71,47	6,397	40	0,284	,778
	7th Grade Pre-Test	40	71,12	4,333	40		
Grades 5 and 8	5th Grade Pre-Test	40	71,47	6,397	40	0,424	,674
	8th Grade Pre-Test	40	70,92	5,205	40		
Grades 6 and 7	6th Grade Pre-Test	40	71,27	4,308	40	0,144	,886
	7th Grade Pre-Test	40	71,12	4,333	40		
Grades 6 and 8	6th Grade Pre-Test	40	71,27	4,308	40	0,316	,754
	8th Grade Pre-Test	40	70,92	5,205	40		
Grades 7 and 8	7th Grade Pre-Test	40	71,12	4,333	40	0,171	,865
	8th Grade Pre-Test	40	70,92	5,205	40		

As can be seen in Table 5, the dependent group's t-test results regarding whether the students who visited the science festival showed a significant difference in the pre-test scores of the science festival attitude scale according to their grade levels after the festival was given. According to the analysis results, there is no significant difference between the pre-test scores and the attitudes of the students who observed the exhibition towards science festivals.

Table 6. Science Festival Attitude Scale Posttest Dependent Groups t-test According to the Grade Level of the Students Who Visited the Exhibition

Science Festival Attitude Scale	Tests	n	$\bar{X}$	S	df	t	p
Grades 5 and 6	5th Grade Pre-Test	40	83,60	8,604	40	-5,982	**,001***
	6th Grade Pre-Test	40	93,30	6,377	40		
Grades 5 and 7	5th Grade Pre-Test	40	83,60	8,604	40	-7,202	**,001***
	7th Grade Pre-Test	40	93,90	4,850	40		
Grades 5 and 8	5th Grade Pre-Test	40	83,60	8,604	40	-7,418	**,001***
	8th Grade Pre-Test	40	95,45	5,870	40		
Grades 6 and 7	6th Grade Pre-Test	40	93,30	6,377	40	-0,522	,605
	7th Grade Pre-Test	40	93,90	4,850	40		
Grades 6 and 8	6th Grade Pre-Test	40	93,30	6,377	40	-1,790	,081
	8th Grade Pre-Test	40	95,45	5,870	40		
Grades 7 and 8	7th Grade Pre-Test	40	93,90	4,850	40	-1,553	,128
	8th Grade Pre-Test	40	95,45	5,870	40		

As seen in Table 6, the t-test results of whether the students who visited the science festival show a significant difference in the post-test scores of the science festival attitude scale according to their grade levels after the festival are given. According to the analysis results, there is a significant difference between the post-test scores of the 5th and 6th-grade classes, 5th and 7th-grade classes, and5th and 8th-grade classes in the attitudes of the students who observed the exhibition towards science festivals (p= 0,01; p<,05).

The study examined whether the pre-test and post-test scores of the students who visited the exhibition for the sub-dimensions of the attitude scale towards science festivals differed. Descriptive analysis results of the test data obtained from the study are given in the table below.

Table 7. Pre-test-Post-test Dependent Groups t-test for the Sub-Dimensions of the Attitude Scale Towards Science Festivals of the Students Who Visited the Exhibition

Group	Scale Subscales	Tests	n	$\bar{X}$	S	t	p
Students Visiting the Exhibition	1.Contribution to Personal Development	Pretest	160	25,293	2,928	-20,908	,001*
		Posttest	160	32,875	3,347		
	2.Belief that the Science Festival is Engaging	Pretest	160	22,7438	2,822	-28,821	,001*
		Posttest	160	30,7375	2,321		
	3.Impact of Science Festival on Social Life	Pretest	160	23,162	2,489	-25,530	,001*
		Posttest	160	29,925	2,393		

This section presents the findings obtained by comparing the pre-test and post-test scores of the sub-dimensions of the "Science Festival Attitude Scale" of lower secondary school students who organized science project exhibitions. In this study, the sub-dimensions of students' attitudes towards science festivals were examined, and a t-test for dependent groups was applied to determine the significant difference between pre-test and post-test scores. When Table 7 is examined, a statistically significant difference was found between the pre-test and post-test scores of the project students in all sub-dimensions of "Contribution to Personal Development", "Impact of Science Festival on Social Life" and "Impact of Science Festival on Social Life" (p=,001<,05).

Based on the findings obtained from the research, we can conclude that the social lives and personal development of students who participate in science festivals or observe these exhibitions are also affected by these exhibitions or festivals. Another result of the research is the belief that the science festival is interesting. As a result of the significant pre-test and post-test scores of the sub-factors of the effect of science festivals on social life and personal development in the students who observed the exhibition, we can make the following interpretation: The observation of the process during the exhibition by the students who observed the exhibition in the science project exhibition both affected their personal development and enabled them to socialize by causing them to communicate with their peers. With this study, the purpose of students' participation in the exhibition was achieved in this way. This research also proved that there is a belief that the science festival is interesting. It was concluded that the purpose of the exhibition was to make students socialize and get to know themselves, to ensure their personal development, to learn completely new things and to contribute to science. Science festivals are aimed to provide these skills for social and personal purposes, and this was also achieved in this study (Başar et. al., 2018).

CONCLUSION and DISCUSSION

This study investigated the effect of science festivals on the attitudes towards science festivals of middle school students who observed the exhibition. The attitude scores of the students in the experimental group who observed science festivals or visited the science fair exhibition at the end of the study were significantly higher than those at the beginning of the study. This finding can be interpreted as science festivals effectively improve students' attitudes towards science festivals. Şahin (2012) concluded in a study that science festivals positively affect the development of high school students' attitudes towards chemistry courses. This result of Şahin (2012) supports the conclusion reached in this study that students observing science festivals effectively develop their attitudes towards science festivals. According to another study conducted by Perry (1995), the fact that science festivals increase students' interest in science is parallel with the result of this study. Karadeniz and Ata (2013) concluded that students developed positive attitudes towards the fair, which was in line with the opinions and thoughts of the students who participated in the social studies project fair.

According to a study by Camcı (2008), science fairs contributed more to students' interest in science and the scientific process. In light of these results reached by Camcı (2008), Karadeniz and Ata (2013), it can be said that science festivals significantly affect the development of affective characteristics such as attitude, which is in parallel with our research.

When the literature on the cognitive, affective and kinesthetic development of students in extracurricular learning environments is examined, Bodur (2015), Bozdoğan (2007), Çavuş et.al., (2013), Ertaş el.al. (2011), Knapp (2000), Rapp (2005), Yıldırım & Altan (2017), Yılmaz (2015), concluded that informal learning environments contribute to the development of student's cognitive skill levels. In the studies conducted by Bodur (2016), Bozdoğan (2007), Knapp (2000), Nadelson and Jordan (2012), Tatar & Bağrıyanık (2012), it was stated that informal learning environments contribute to the development of students' affective characteristics such as interest and attitude. These results support the conclusion reached in our study that science festivals or science fairs, which are informal learning environments, positively improve attitudes towards affective traits. However, in contrast to these studies, Altıntaş (2014) concluded in his study that the education given to students in the Soil Science School, an informal learning environment, did not cause any change in students' attitudes towards nature and soil. Wulf et.al. (2010) and Gökbayrak & Karışan (2017) also stated that informal education did not cause any change in students' attitudes. Benedetti and Crouse (2020) concluded that students' interest in science increased more after science festivals. These results obtained by Altıntaş (2014), Gökbayrak & Karışan (2017), Wulf, Mayhew and Finkelstein (2010) do not overlap with the results of our study that science festivals, which are an informal learning environment, positively improve attitudes towards science festivals. Based on the results of all these positive or negative studies, science festivals will positively affect students' development as long as they are planned and controlled.

As a result of the research, it was seen that the attitude levels of the students who observed the science festival increased significantly. These results show that science festivals significantly improve students' attitudes towards science, produce projects, find a solution to a problem or contribute. The main reason for this result can be explained by the fact that students who observe science festivals actively participate in the exhibition process of the projects and listen to the purpose of the projects from their peers, personally observing how the scientific research process is, directly participates in this activity in practice, personally experience the construction process of the projects and the work of some projects, observe the excitement of working like a scientist, finding a solution to a problem or producing a product from their peers, and observe and experience the benefits of taking part in the science festival through their peers. In this context, we can say that using science festivals or exhibitions in the education process can contribute to the emergence of products and result in effective learning. Considering the positive effect of taking part in science festivals and actively participating in the process with observations on students' attitude levels in producing and exhibiting projects, it is thought that activities such as science festivals, project competitions, and project exhibitions should be made widespread in all schools in our country, informal learning environments should be expanded. Student's participation in such activities should be encouraged. Educators have a great responsibility in this regard. Even observing the projects with this study, we have triggered creativity, production, responsibility, benefit, and solution generation in students and encouraged the emergence of domestic and national projects, which are the most important for our country. For this reason, activities such as TÜBITAK Science Fairs, competitions organized by TÜBITAK, and competitions such as Teknofest, which encourage production, increase participation in competitions that will open the horizons of students, and the importance of these competitions should be included in the lessons.

SUGGESTIONS

When the process and results of this study are analyzed, the following suggestions can be made;

- A student-oriented, constructivist approach in which students construct knowledge in their minds should be preferred in teaching courses.
- Informal learning environments are out-of-class environments such as science museums, science festivals or science fairs, project competitions, zoos, botanical gardens, and nature trips. Out-of-class activities and trips should be included for students' cognitive and affective development. In out-of-class activities, students actively participate in the learning process, and it is easier for them to associate what they have learned with daily life and transfer it to their daily lives.
- Project-based and student-centred activities can be included in lessons. In order to ensure that students are active in the teaching process, students can be encouraged to increase their motivation towards the lesson.
- Workshops and exhibition halls can be established in schools to develop creativity, such as project work.

- Experiments and activities related to the subjects in science lessons and other lessons should be given more space, and these experiments and activities should be carried out by students as much as possible so that effective and creativity-enhancing learning can be realized.
- Research assignments can be given to increase and encourage students' interest in science and scientific processes. In order to increase students' self-confidence, the choice of topics in these assignments can be left to the students. In addition, students who do homework or research can be asked to present these assignments to their friends.

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