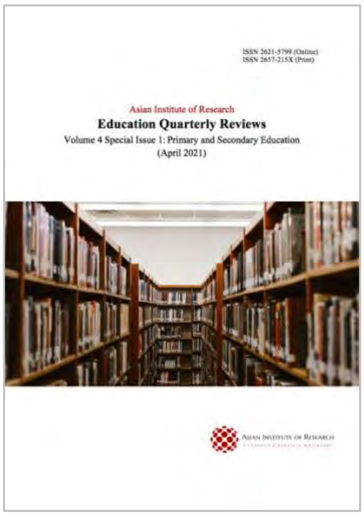

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Experiences of Turkish Middle School Science Teachers' First Science Fair Projects Coordination

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Abstract
This study aimed to reveal the experiences of science teachers conducting a science fair project for the first time. The research used quantitative data based on an online assessment survey for science fair projects. There are twenty-one questions (one of them is open-ended, the others are Likert type) developed by the researcher. The questionnaire was shared with science teachers on the science fair, 4006 science fairs, Tübitak science fairs themed social media pages between June and October 2018. 244 coordinator science teachers marked the survey. The data obtained from the questionnaire was presented in a tabular form by deducting % and frequencies. On the other hand, the last open-ended questions were analyzed by using content analysis. Based on these results, science teachers, who carried out the fair coordinator for the first time and to be able to do it again have some expectations of practicing positive experiences such as the students should gain scientific skills, the fair should be carried out in cooperation, the responsibilities were shared in a balanced way in the school, the school administrators should both support and help the process, the advisors should take ownership of the job, be appreciated by stakeholders with awards, etc. However, this first experience posed a sufficiently unexpected result at least for some of them.

Keywords: Science Fair Project, Science Education, Informal Learning, Project-Based Learning, Teachers' Experiences

1. Introduction

One of the most important aims of science education is to raise scientifically literate individuals. Scientifically literate individuals are those who know the nature and characteristics of scientific knowledge and can effectively use the concepts, principles, theories, and laws of science while interacting with their environment. A science-literate individual is expected to understand the nature of science and scientific knowledge, basic science concepts, principles, and theories, to use scientific process skills while solving problems, to be aware of and understand the interaction between science, technology, and society, and to have scientific attitudes and values (Abd-El-Khalick & Lederman, 2000; Küçük, 2006; Küçük & Yıldırım, 2020; McComas, 1996). Again, science-literate individuals are more effective individuals in accessing and using information, in solving problems, in making decisions about problems related to science and technology, taking into account the possible risks, benefits, and options available, and producing new knowledge. Due to the listed benefits, discussions on how individuals who make up the society can become science literate are increasingly continuing (AAAS, 1993;

Maarschalk, 1988). Since science is an important factor for the progress of societies, raising individuals who know how to obtain and use this scientific knowledge emerges as an important necessity for also sustainability. In the 21st century, improvement in science and technology determined the levels of the countries, so, new approaches in education are applied to make students love science, mathematics, and technology and to direct them to these fields.

The related literature indicated that one of the reasons students science fear is undoubtedly the way science education is taught (Kaya & Yıldırım, 2014). Many experts advocated that it is necessary to apply an education method that is not based solely on presenting scientific knowledge, but is made with scientific methods by questioning, makes the student feel like a scientist, and leads to the enthusiasm for more research and learning with the sense of success achieved during education (Cuevas, Lee, Hart, & Deaktor, 2005; Samarapungavan, Mantzicopoulos, & Patrick, 2008). In this context, the concept of "inquiry-based science and mathematics education" has emerged, based on the views that knowledge is structured through experiences in schools and that learning should be an active process. “Most would agree that the general purpose of scientific inquiry is to develop a comprehensive understanding of the world in which we live” (Haysom, 2013, p.41). This can be achieved not only with lessons in the classical classroom setting but also in an informal way (Küçük & Yıldırım, 2019). For this purpose, children need to have experience of doing projects individually and/or with a team to acquire 21st-century skills. Completing a science fair project teaches all of the 21st-century skills divided into 3 categories as learning and ınnovation skills, digital literacy skills, and career and life skills (Fadel & Trilling, 2009). Participating in the science fair experience is an effective way for students to learn of their physical world in a meaningful and educationally sound way and to form questions constructed by themselves implementing the scientific method. Although the counseling of teachers is important in this process, their role should be to provide the expert support needed for students to find original issues, to project, carry out and conclude them, rather than directing them. However, unfortunately, it reveals that students either do not participate in the calls made to make projects, or in case of possible participation, consultancy support causes the management of the process to be completely under the control of the teacher after a while. As a natural consequence of this, both the resulting product is not a student product, and the students do not enjoy experiencing this process, nor are they able to realize the targeted learning (Küçük & Küçük, 2017). However, project calls opened by the public or non-governmental organizations have an important function to spread the culture of science in the society and to direct children to scientific studies and therefore to career from an early age. Turkey also attaches great importance to this issue like other nations, and related public institutions are run through regular project work programs for students every year. These programs are implemented by TUBITAK (The Scientific and Technological Research Council of Turkey) depend on the Ministry of Industry and Technology in Turkey. TUBİTAK carries out these programs through two presidencies (Science and Society Presidency and Scientist Support Programs Presidency). One of the programs run by the Presidency of Science and Society is known as 4006-Science Fairs. This program has been running for nine years, and each year these science fairs are displayed in an increasing number of schools nationwide. The first fairs were supported in the 2012-2013 academic year by 1000 pilot schools. Then, 881 schools in 2014, 3201 schools in 2015, 5986 schools in 2016, 5334 schools in 2017, and 9876 schools in 2018 have been supported (Okuyucu, 2019).

The main aims of science education are; (i) encouraging the adoption of science and scientific studies by new generations, (ii) associating science with daily life, (iii) spreading research techniques, scientific reporting, and scientific presentation skills to the grassroots, (iv) making and sharing scientific projects creating new environments and possibilities; and (v) learning the importance of science and scientific studies by applying/experiencing the importance of science and scientific studies in finding solutions to real-life questions and problems. In a way that may be directly related to this purpose science, fairs are endorsed by science educators, the Academy of Science, the National Science Foundation, and the National Research Council (2012), and by TUBITAK in Turkey also as a premier tool to teach the process of inquiry through project-based instruction.

The 4006-Science Fair program aims 5-12. class students in carrying out scientific studies scientific process skills by encouraging and finding solutions to questions and problems, to contribute to gain; at different cognitive, affective and psychomotor levels, providing every student with the opportunity to prepare a project; scientific research method and teaching techniques, reporting and presentation skills to students; by eliminating the competition pressure on students. Science fair is a way for students to choose a topic of discovery and demonstrate their understanding of the scientific method by framing their questions and constructing their procedures (Olive, 2017). Within the scope of this call, the relevant schools prepare projects for at least five of the areas specified in the thematic sub-project areas (see fair call) table. These projects can be prepared individually by a student or in collaboration with study teams. A teacher from the same school advises each project. These projects can be research, study, or design projects in kind. Each fair has a coordinator who is selected and/or assigned by the school administration from among the teachers in the same school and who is directly responsible to TUBITAK. This teacher prepares a standard suggestion form that includes the purpose, method, and expected result of the projects prepared in thematic sub-project areas by the announced calendar and uploads it to the system. Each of the purpose, method, and expected results sections of the project proposals should be written in a minimum of 20 and a maximum of 50 words. In this way, each school uploads up to 25 sub-projects to the system. Each project is scored by Tübitak by three expert faculty members and with a scoring key clearly stated in the call text. In this way, fair score averages are calculated. Support decisions are made based on these scores and contracts are signed. Project fairs are held by this contract and on the dates announced by TUBITAK. The budget was transferred to the coordinator's account. Project exhibitions are supervised by an audience assigned by TUBITAK. These fairs are held in a suitable environment inside or outside the school, other schools, teachers, etc. many people are invited to the exhibition. In these exhibitions, students prepare their posters and introduce them to the visitors. Numerous news about these fairs takes place in the print and visual media.

Some studies have been carried out for the last three years to reveal the reflections of the program that has been carried out for nine years. In these studies, teachers' views on science fairs (Avcı & Özenir Su, 2018; Balcı, 2019; Dede, 2019; Doğan, 2020; Okuyucu, 2019; Selçuk, Atalmış, & Ataç, 2020; Soyuçok, 2018; Tortop, 2013), students' views (Balcı, 2019; Benzer & Evrensel, 2019; Bozdemir, 2018; Kececi, 2017; Keçeci, Kırbağ- Zengin, & Alan, 2018; Okuyucu, 2019; Selçuk, Atalmış, & Ataç, 2020; Sontay, Anar, & Karamustafaoğlu, 2019; Şahin & Önder-Çelikkanlı, 2014; Yasar & Baker, 2003; Yıldırım, 2020), school administrator views (Atalmış, Selçuk, & Ataç, 2018; Doğan, 2020), fair executive views (Atalmış, Selçuk, & Ataç, 2018), opinions of consultants (Yıldırım, 2020), its contribution to education and training (Çolakoğlu, 2018), its impact on students' science skills and problem solving skills perceptions (Çavuş, Balçın, & Yılmaz, 2018; Keskin, 2019; Jaworski, 2013; Özdemir & Babaoğlan, 2019; Schmidt & Kelter, 2017; Yıldırım, 2018), scientific beliefs (Türkmen, 2019; Yavuz, Büyükekşi, & Işık-Büyükekşi, 2014), attitude towards science lesson (Keskin, 2019; Jaworski, 2013; Özdemir & Babaoğlan, 2019; Yıldırım & Şensoy, 2016; Wilson, Cordry, & Unline, 2004), images of scientist (Kahraman, 2019), anxiety levels (Keskin, 2019) have been researched. Based on the results of these studies, students of the fairs have scientific knowledge. İt is an effective activity that directs students to work and stakeholders have a common belief that it leads to an increase in knowledge. However, teachers noted that it is difficult to prepare a science fair report and that it is hard work. that the project budget is not sufficient, and some school administrators stated that they forced the teachers to hold fairs. Although the students participating in the fair with their projects, Although the claim that their solving skills have increased, there is no evidence to support this result. On the other hand, students claim that they get help from their parents and teachers while determining the project topics. There is uncertainty as to whether the scope of this assistance is aimed at projecting the subjects found or chosen by the students or directly giving the subject. Similarly, although it is stated that they have positive contributions to the schools where the fairs are carried out (Avcı & Özenir Su, 2018)., the scope of this contribution is not clear enough. In a study done by (Soyuçok, 2018), 57.5% of the teachers were not willing to join in science fair projects. They also requested seminars and informative meetings on how to construct a science fair Project. At this point, the efficiency of the teachers who participate in an activity by force appears like an issue that needs to be considered for a long time.

Nevertheless, being an executive in science fairs offers science teachers an opportunity to showcase their special field competencies. Based on the fourth special area qualification -cooperation with the school, family, and community- science teachers to be aware of the responsibility of the school and itself in making the school a center of culture and learning, for this purpose should identify institutions and organizations which can cooperate such as TÜBİTAK, science centers, libraries, museums, factories, non-governmental organizations, and technoparks, and inform students within the scope of the education program of these institutions (MEB, 2008). In this context, these science fairs offer important opportunities both for students to gain these competencies and for teachers to provide these competencies. Therefore, the reflections of science teachers working in this organization for the first time on planning, implementation, and finalization will reveal important information about the adequacy of teacher training undergraduate programs on the one hand, and the interventions to be made in-service on the other. On the other hand, it can also provide an opportunity for a more accurate understanding of the relationship between project calls and those made in the field.

This study aimed to reveal the experiences of science teachers conducting a science fair project for the first time. In this way, the results obtained from the research can guide schools' stakeholders that will participate in the science fair and teachers and also researchers who plan to work in this field.

2. Method

This research used quantitative data based on an online assessment survey for science fair projects. A survey is an appropriate tool for a non-experimental, descriptive research study to gather information from a group of subjects (Ary, Jacobs, Razavieh, & Sorensen, 2006). It serves to collect both quantitative and qualitative data to answer the research questions. This study especially aimed to examine the science fair management experiences of the participants. In this context, the study also has a phenomenology pattern in terms of examining the science fair experiences (Cresswell, 2003). This qualitative pattern is used as a study to reveal how a certain number of people make sense of a concept or a phenomenon they experience.

2.1. The Sample

The study group included 244, 86 male (35,2%) and 158 female (64,8%) science fair project coordinators who are the first time on this special duty. Besides, 211 (86.5%) of the participants are undergraduate and 33 (13.5%) of them were graduate programs. 115 (%47) of the participants declared that they participated in any project supported by TÜBİTAK before, while 129 (%53) of them did not take part. They were also from a wide group with professional experience periods of 1-3 to 22 and above. Table 1 includes the sample group's professional experience levels.

Table 1: Distribution of the professional experiences of the participants

Professional experiences of teachers	*f*	*%*
1-3 years	51	20,9
4-6 years	64	26,2
7-11 years	74	30,3
12-16 years	32	13,1
17- 21	12	4,9
22- above	11	4,5
Total	244	100,0

Table 2 also contains the channel through which participants were informed about the call for the relevant science fair project.

Table 2: Distribution of channels that make participants aware of the science fair call

Information channel about science fair call	*f*	*%*
Through the Directorate of National Education	133	54,5
Via friend/colleague	42	17,2
From the TÜBİTAK* website	40	16,4
Via social media	14	5,7
Other	13	5,3
By student request	2	,8
Total	244	100,0

** The Scientific And Technological Research Council of Turkey*

2.2. Data Collection

There are twenty-one questions (one of them is open-ended, the others are Likert type) developed by the researcher. The questionnaire was shared with science teachers on the science fair, 4006 science fairs, TUBITAK science fairs themed social media pages between June and October 2018. These social media pages were established by the teachers who carry out 4006 projects to communicate and share their experiences. These pages have thousands of members. They marked the first 20 questions from five-point Likert type (I strongly agree, I agree, Partly I agree, I do not agree, I strongly disagree) and also wrote their views on the last questions (you can write about your experiences of managing a science fair for the first time as a science teacher).

2.3. Data Analysis

The data obtained from the questionnaire was presented in a tabular form by deducting % and frequencies. On the other hand, the last open-ended questions were analyzed by using content analysis. Although different analysis steps are followed in each of the qualitative research designs, there are some common steps followed in the data analysis process: (i) data processing, (ii) visualization of data, and (iii) interpretation of findings. Processing of data in the process, (i) decipher, (ii) encoding, and (iii) category creation steps were followed. The answers given to the last question to be used for qualitative analysis were already written, the printout was taken and only the errors caused by the spelling mistakes were corrected. In the new process, also called diving into data the researcher needs to read all the data, reread them over and over, and reflect on them (Barbour, 2014). To ensure data familiarity, both the data collection process and the data deciphering process were done by the researcher (Tracy, 2013). Coding, on the other hand, is the separation of the data converted to text into meaningful parts and preserving the integrity of meaning between these parts (Miles & Huberman, 1994); also text or the collection of visual data into small categories of information and different information used in a study. It includes the process of searching for evidence from databases (Cresswell, 2003). In this section, the researcher did not change the expressions of the participants (in-vivo coding) has made labeling (Cresswell, 2003). The author of this research has been a science fair manager for four times as a science teacher and has also made presentations at various scientific meetings on the subject. After the codes were created, they were carefully reviewed by the researcher. After that, the researcher should know when to stop coding. In this context, when all data is easily classified, codes are saturated (new code the coding process is complete when it cannot be written) and a layout is now created (Corbin & Strauss, 2007). The categories were considered as basic patterns, findings, or abstractions that emerged as answers to the questions were produced (Merriam, 2009). Creating a category starts inductively and becomes deductive progress. In creating a category, first, small parts were examined one by one, codes have been created. Then the codes were examined and temporary categories were determined. The suitability of these categories was checked by another expert faculty member in the field of science education from Recep Tayyip Erdoğan University. Every single data I have whether it fits the categories or not. What is important in this process is that the category reaches saturation it does not reach (inductive process). Any new information, perspective, or since the concept was not produced, the saturation decision was made. Post-created categories have been checked for compliance with the codes (deductive process). Visualizing data in qualitative analysis types (sorting, integration, for styling). Visual elements in qualitative data analysis are figures about what is in the report (Cresswell, 2003). In this context, categories and relationships are presented as visual elements.

3. Results

In this section, firstly the quantitative findings obtained from the answers given by the science fair project coordinators to the five-point Likert-type 20 questions, and then the analysis of the qualitative data obtained from the answers they gave to the last open-ended question are presented.

3.1. Quantitative Findings

The frequency and% distribution of the answers given to each question in the questionnaire by the science teachers, who conducted a science fair for the first time, are shown in Table 3.

Table 3: Distribution of answers to the questions in the survey for the evaluation of the science fair projects

Question Number	*Questions*	I strongly agree	I agree	Partly I agree	I do not agree	I strongly disagree
		f (%)	*f (%)*	*f (%)*	*f (%)*	*f (%)*
1.	I made an effort to create a science fair atmosphere in my school.	*228 (%93,4)*	*13 (%5,3)*	*1 (%0,4)*	-	*2 (%0,8)*
2.	I received support from the school administration for the science fair organization.	*153 (%62,70)*	*46 (%18,85)*	*26 (%10,65)*	*13 (%5,32)*	*6 (%2,45)*
3.	With the projects, students reached original data and results.	*134 (%54,91)*	*87 (%35,65)*	*18 (%7,37)*	*4 (%1,6)*	*1 (%0,04)*
4.	The project subject has the potential to contribute to the production of new projects in the related field.	*132 (%54,0)*	*84 (%34,42)*	*23 (%9,42)*	*3 (%1,2)*	*2 (%0,08)*
5.	I would like to carry out science fairs projects again in the following years.	*112 (%45,90)*	*61 (%25,00)*	*37 (%15,16)*	*14 (%5,73)*	*20 (%8,19)*
6.	The sub-project proposals were examined and feedback was given to the students.	*159 (%65,16)*	*68 (%27,86)*	*15 (%6,14)*	*1 (%0,04)*	*1 (%0,04)*
7.	Support was also received from other experts (eg academics) in the preparation and implementation of the project.	*64 (%26,22)*	*61 (%25,00)*	*68 (%27,86)*	*28 (%11,47)*	*23 (%9,42)*
8.	The project was carried out by the working schedule.	*212 (%86,88)*	*28 (%11,47)*	*3 (%1,2)*	-	*1 (%0,04)*
9.	Project topics were determined by the students.	*95 (%38,3)*	*95 (%38,93)*	*33 (%13,52)*	*10 (%4,09)*	*11 (%4,5)*
10.	The projects were prepared to have scientific content.	*174 (%71,31)*	*59 (%24,18)*	*9 (%3,6)*	*2 (%0,08)*	-
11.	I think students' interest in science has increased.	*194 (%79,50)*	*46 (%18,85)*	*2 (%0,08)*	*2 (%0,08)*	-
12.	Students' motivations were supported.	*216 (%88,52)*	*24 (%9,83)*	-	*4 (%1,6)*	-
13.	It was aimed to gain scientific process skills in the projects.	*202 (%82,78)*	*37 (%15,16)*	*3 (%1,2)*	*2 (%0,08)*	-
14.	The projects presented at the fair were prepared in a way that will direct students to new projects.	*165 (%67,62)*	*60 (%24,59)*	*16 (%6,55)*	*2 (%0,08)*	*1 (%0,04)*
15.	The projects were associated with daily life.	*195 (%79,91)*	*44 (%18,03)*	*3 (%1,2)*	*1 (%0,04)*	*1 (%0,04)*
16.	Care was taken to ensure that the projects were questioning.	*174 (%71,31)*	*61 (%25,00)*	*6 (%2,45)*	*2 (%0,08)*	*1 (%0,04)*
17.	Before the project, the students were given adequate training about the project processes.	*170 (%69,67)*	*59 (%24,18)*	*11 (%4,50)*	*3 (%1,2)*	*1 (%0,04)*
18.	The research question was included in the projects.	*193 (%79,09)*	*45 (%18,44)*	*5 (%2,04)*	*1 (%0,04)*	-
19.	The projects were prepared in a way that could solve the problem.	*190 (%77,86)*	*45 (%18,44)*	*6 (%2,45)*	-	*3 (%1,2)*
20.	Parents attended the science fair as visitors.	*165 (%67,62)*	*50 (%20,49)*	*17 (%6,96)*	*5 (%2,04)*	*7*

Based on table 3, the majority of the participating science teachers who declared that they were the coordinators of science fairs for the first time are strongly agreed and/or agree about they made efforts to create a fair atmosphere in the school (see Question 1), feedback was given to students about sub-projects (see Question 6), the projects were prepared in scientific content (see Question 10), student's interest and motivation for science increased (see Question 11,12), they gained scientific process skills (see Question 13), the projects were prepared to daily life (see Question 15), and adequate training was given to the students (see Question 17). On the other hand, on some issues encountered in similar studies in the literature, the distribution of the answers appears to have varied somewhat from the same temptation to partially agree and/or disagree. Among these, the support of the administration in the fair organization (see Question 2), the projects that students have reached original data and results (see Question 3), the preference to work in the fair coordinator in the following years (see Question 5), the availability of support from other experts (see Question 7), selection of the project subjects by the students (see Question 9) and the participation of families in the exhibition (see Question 20).

3.2. Qualitative Data

In this section, the content analysis of the answers provided for the last question in the measurement tool by teachers who are conducting a science fair for the first time is included. In this analysis process, the contributions of the fair projects carried out by the students to them were analyzed by considering their main and sub-skills within the scope of their 21st skills. Besides, the themes of achievements for teachers, issues related to the nature of the projects, problems related to project management, honor share, consultant teacher inadequacy for the science fair process, and participation problem themes based on the written statements of the advisory teachers are given in separate tables and relation to the relevant categories. However, the codes describing the relevant categories are presented by directly quoting.

Table 4: Theme 1- 21st-century skill acquisitions for students

Theme	**21st-century major skills**	**Category / 21st-century sub-skills**	**Code**	**f**	**tf**
21st Century Skill Acquisitions for Students	Learning and Innovation (4C) Skills	Critical Thinking and Problem Solving Skills	They gain scientific skills.	1	3
			They are living the scientific process.	2	
		Creative Thinking and Innovation Implementing Skills	-		-
			-		
		Communication and Collaboration Skills	It helped children express themselves and increase their curiosity about something.	1	3
			Quiet students had the opportunity to express themselves.	1	
	Information, Media and Technology Skills Information Literacy Media Literacy Information and Communication Technology (ICT) Literacy		Scientific literacy of the students improved by taking part in scientific studies.	1	1
	Life and Career Skills	Flexibility and Adaptability	-	-	-
		Entrepreneurship and Self-Orientation	Some students give up participating in the process or who want to participate in projects because they did not want to work at first and later saw them from their friends.	1	1
		Leadership and Responsibility	-	-	-
		Productivity and Responsibility	It was best to see them I am taking responsibility light in the students' eyes.	1	1
		Social and Intercultural Skills	-	-	-

Continuation of Table 4: Theme 1- 21st-century skill acquisitions for students

Theme	**21st-century major skills**	**Category / 21st-century sub-skills**	**Code**	**f**	**tf**
21st Century Skill Acquisitions for Students	Uncertainty		I think that the experience students have gained through these fairs is very useful and valuable.	1	12
			The education model by doing and living was adopted in terms of students.	1	
			This fair was very effective in terms of the active participation of the student.	1	-
			It made students love science and increased their curiosity and increased research awareness.	3	
			It was useful for children.	4	3
			The 4006 fair gave students an experience they will remember throughout their lives.	2	

Table 5: Theme 2-learning outcomes for teachers

Theme	**Category**	**Code**	**f**	**tf**
Learning Outcomes for Teachers	Professional Contribution	It contributes to vocational guidance.	1	2
	Personal Contribution	I think it contributed greatly to my personal development.	1	

Table 6: Theme 3- issues regarding the nature of the projects

Theme	**Category**	**Code**	**f**	**tf**
Issues Regarding the Nature of the Projects	Unoriginal Quality Projects	It was a process in which children were not involved at all or enough and teacher-schools competed.	3	14
		More original projects should be included.	3	
		Students should take a more active role in determining projects.	1	
		It may be more efficient to showcase projects that reflect scientific skills.	1	
		Research projects should be weighted.	1	
		If the number of projects is reduced, more original and scientific projects may arise.	1	
		The fact that 50% of the projects were researched limited the choice of subject.	2	
		Experiments and projects on the market are carried out over and over again.	1	
		It would be more beneficial if a science application center was opened in each district instead of the money spent for the fair.	1	

Table 7: Theme 4- project management issues

Theme	Category	Code	f	tf
Project Management Issues	Executive Issues	Mandatory/reluctant participation	1	40
		The coordinator must have a sub-project limitation.	1	
		A completely individually coordinated fair process.	1	
		A tired and long process	3	
		I don't think to do it again because it is tiring and stressful.	1	
		In schools, there is a perception that the coordinators will do the subprojects	1	
		There is a need to share responsibility as a coordinator.	12	
		Project incentive bonus is not enough.	4	
		There is a misperception about science teachers being an advisor at the fair.	1	
		Lack of project management experience	1	
		There was a billing issue.	5	
		The responsibility for material affairs was very tired.	1	
		The anxiety created by the financial process in the preparation phase of the projects.	1	
		We experienced company-related difficulties in accessing materials.	4	
		The coordinator role should be given to technology and design teachers, especially with fewer lesson hours.	1	
		At least two teachers should be appointed as fair coordinators or no projects should be given to them.	1	
		The fair coordinator even made efforts for sub-projects in other fields in line with the inadequate participation of colleagues, and some of the advisory teachers did not work with devotion.	1	
	Issues arising from advisory teachers	Mandatory/reluctant participation	5	39
		Sub-project proposals that are not written according to the format	19	
		Limited guidance service for students.	2	
		Not owning the fair process.	4	
		Branch teachers not participating in a balanced way.	4	
		They took things slow.	1	
		They believe that the subjects of the project should be from the field of science.	3	
		Teachers to be appointed to other schools.	1	
	Student-related Problems	Lack of knowledge about chemicals	1	11
		Scheduling for bussed students	1	
		More information should be given to teachers and students on how to prepare the report for participation in the Science Fair and the fair.	2	
		We had a hard time spending time with the students because there was no vehicle on the weekend. We ran this business together at lunch break every day, this worn us out and the school administration did not support us in finding a vehicle.	1	
		It should be included in students who are not only hardworking and successful but also have difficulties in expressing themselves.	1	
		Difficult for students to find topics.	1	
		It is a disadvantage that the students dropped out of the course, albeit a little at that time.	1	
		Excitement problem in presentations as it is the first experience of students.	1	
		They do not want to stay at the stands for a long time.	1	

Continuation of Table 7: Theme 4- project management issues

Theme	Category	Code	f	tf
	School Administrative Issues	They are not motivating	1	10
		They should also bear legal responsibility.	2	
		No support	4	
		The unwillingness of the responsible administrator excludes teachers' active participation	1	
		School administrators should be informed more about the process.	1	
		The attitudes and evaluations of their administrations are problematic and they try to force more schools for financial support.	1	
	Parent-based Issues	There is no effective cooperation with parents.	2	2
	Problems Arising from the Fair Audience	Audiences are not equipped	1	4
		Audience not excited	1	
		No audience	2	
	Problems arising from the Physical Conditions of the School	Absence of the exhibition area	2	7
		Lack of exhibition equipment	1	
		School facilities are not enough	2	
		Projects have no storage space	1	
		Due to the weather, the exhibition area needs to be changed.	1	
	TUBITAK-Originated Problems	Having a limited budget	19	41
		There are problems in the project call schedule (result explanation, revision, approval, etc.).	9	
		The project budget is not timely.	3	
		Promotional and announcement posters are not enough.	3	
		No feedback is given for sub-projects whose applications are rejected.	2	
		I think the criteria for the number of projects are wrong. The number of students and teachers, rather than the service area and region, should be the basic criterion.	1	
		Application s must be started early	1	
		If the same regional schools' presentations are made in a common area at the same time, it will be a bigger feast.	1	
		Project responsible teachers should enter the project information themselves.	1	
		Since our project was not accepted, it bothered me to give appropriate answers to some questions.	1	

Table 8: Theme 5- honor share

Theme	Category	Code	f	tf
Honor Share	TUBİTAK Honor Share	Tübitak 4006 does not care enough, and positive feedback from both students and teachers makes the fair more self-sacrificing.	1	2
		Work should be done in harmony with the Ministry of National Education, and the importance required for projects should not only be expected from us. The feeling that we care was unfortunately not felt.	1	
	School Administration Honor Share	Our efforts should be seen and thanks.	1	3
		I suggest the reward mechanism work	2	
	Problems arising from Province / District Bureaucrats	Nobody from the District National Education Directorate was with us in the project.	1	3
		There was an insufficient number of participants.	1	
		School administration and national education should participate more actively in the fair	1	

Table 9: Theme 6- the inadequacy of advisors for the science fair process

Theme	Category	Code	f	tf
Inadequacy of Advisors for the Science Fair Process	Education Need	Scientific language use problem	1	8
		Lack of information about the fair	1	
		There is a problem in writing a research project	4	
		More education about science can be given to teachers in in-service training.	2	

Table 10: Theme 7- visit problem

Theme	Category	Code	f	tf
Visit Problem		Ensure the participation of teachers and students from other schools in the district.	1	4
		More people should join	1	
		The participation and support of all teachers and administrators within the scope of the project are very important for both the director and the students.	1	
		It is necessary to collaborate between schools to increase visitor participation during the fair.	1	

Table 11: Theme 8- no problem

Theme	Category	Code	f	tf
No Problem	No Problem	There was no problem.	44	46
	Cooperation	We solved all problems with my students and the school administration	1	
		We worked in harmony with my fellow teachers and the administration.	1	

4. Discussion

Science fair should be a way for students to choose a topic of discovery and demonstrate their understanding of the scientific method by framing their questions and constructing their procedure. Including science fairs in the science, the curriculum promotes the use of inquiry-based and project-based science instruction. It can also be used as a curriculum tool to teach science standards. In this study, the science fair, the scope and purpose of which were explained in detail in the introduction section of the paper, experiences of science teachers who were appointed for the first time as the coordinator of science fairs, were examined for the first time. There are many studies on science fairs in which stakeholders' views are presented. For example, teachers' views (Avcı & Özenir Su, 2018; Balcı, 2019; Dede, 2019; Doğan, 2020; Okuyucu, 2019; Tur, 2020), students' views (Benzer & Evrensel, 2019; Bozdemir, 2018; Selçuk, Atalmış, & Ataç, 2020; Sontay, Anar, & Karamaustafaoğlu, 2019; Şahin & Önder-Çelikkanlı, 2014; Yıldırım, 2020) school administrators' views (Atalmış, Selçuk, & Ataç, 2018;

Doğan, 2020), fair coordinators' views (Atalmış, Selçuk, & Ataç, 2018) and also consultant teachers' views (Yıldırım, 2020) were examined. The other studies revealed that science fairs contributed to teaching (Çolakoğlu, 2018), developed students' both science and problem solving skills perceptions (Çavuş, Balçın, & Yılmaz, 2018; Keskin, 2019; Özdemir & Babaoğlan, 2019; Yıldırım, 2018), scientific beliefs (Türkmen, 2019; Yavuz, Büyükekşi, & Işık-Büyükekşi, 2014) and attitude towards science lessons (Keskin, 2019; Özdemir & Babaoğlan, 2019; Yıldırım & Şensoy, 2016), images of scientist (Kahraman, 2019), reduced anxiety levels of students (Keskin, 2019).

Based on these studies, it has been claimed that the fairs have produced important outcomes in terms of creating a rich environment for both students and also for society to value science culture. However, quite new and different inferences were made in the current study based on both quantitative and qualitative data referring to the experiences of the sample science teachers. To coincide with the findings of other studies, teachers in the study group provided the expected answers to the quantitative questions about the sub-projects prepared and exhibited by students (see table 3). However, it is understood from the qualitative data analysis that student outcomes were quite insufficient at the point of 21st-century skills introduced by Fadel and Trilling (2009). It was even surprising that no code for creative thinking and creative thinking and innovation implementing skills of learning and innovation (4C) skills that could be associated with the objectives of the fair project call was produced (see table 4). Similarly, no code appeared in the fields of flexibility and adaptability, leadership and responsibility, and social and intercultural skills of life and career skills. On the other hand, with the sub-projects carried out, the others, which are among the 21st skills that students earn, are quite limited and negligible. However, the limited code under the unspecified theme was not found sufficient, although it revealed some codes that are difficult to associate with 21st-century skills for students. Preparing students with the skills needed for 21st-century jobs, included in the new standards, such as writing and speaking well, analyzing complex problems, finding and synthesizing information from many sources for creative problem solving are skills needed for all citizens (Tucker, Darling-Hammond, & Jackson, 2013) and learned from the science fair experience. Based on this result, the fair experience of science teachers who are conducting a science fair for the first time makes it clear that it is an activity indirectly providing some learning outcomes for students but not an activity direct providing 21st century skills. This study examines the experiences of teachers as both the principal owner of the science fair process and as an expert who observes it in all its dimensions, the possible 21st-century skills acquired by the students can still be investigated by other studies.

It is another surprise that the fair coordinator teachers who run the fair for the first time should not have experienced the fairs as an event that provides professional and/or personal development (see table 5). Science fairs are not seen as an activity that contributes to coordinator teachers and counselor teachers in terms of professional knowledge and personal development. Perhaps science fairs are perceived only as an activity that contributes to the school and students. The focus on student learning outcomes in studies that examine the views of students, teachers, and even school administrators about science fairs supports this result. However, it is best to change the belief that this process is an important gain for all stakeholders, including teachers.

Participating in the science fair experience is an effective way for students to learn of their physical world in a meaningful and educationally sound way and to form questions constructed by themselves implementing the scientific method. It teaches students to think like a scientist, which can help them become better problem solvers (Ebbel, 2010; Wren, 2015). In this way, it is possible to initiate original student projects by consultants. In this context, although the option for originality was selected in the online survey regarding the projects exhibited at the fair, there is a situation that reveals the opposite in the qualitative data (see table 6). In other words, the fair is not structured as an experience in which original sub-projects are carried out. In support of this situation, other studies are showing that the subprojects are not specific and that they mostly consist of repetitions of what is known in the literature (Yıldırım, 2020).

The project management experience is structured as an experience in which intensive management problems are experienced in abundance, as in other studies. The participant teachers and administrators agreed that teachers do not have enough information on designing a project, the projects are considered as being compulsory, and they give rise to teachers' workload (Atalmış, Selçuk, & Ataç, 2018; Lu, 2013; Doğan, 2020). It is stated that required support is received in the online survey, however, the production of critical codes for sharing responsibility reveals that teachers experience this science fair process not as an activity in which responsibility is shared equally, but as a difficult process in which the responsibility, unfortunately, remains on the only coordinator. In this management process, most of the fair coordinators refer to many problems such as advisors teachers, Tubitak, and school administrators (see table 7). The limited project management experience that coordinator science teachers are expected to gain in the pre-service period reveals this outcome. It can be accepted to some extent that teachers who experience this process as an intensely problematic subject are unlikely to be candidates for doing the same job again before the problem is solved. Teachers who are not experienced in projects face difficulties and are not productive.

It was also revealed that the coordinator teachers had an expectation of receiving an honor share in this fair, but this was not sufficiently met (see table 9). In other words, it is seen that the executive teachers have structured fair management as an activity where the honor share is earned, rather than an activity in which the labor of the expense is paid. Receiving a share of honor by the nature of human creation enables him to concentrate on his work and therefore perform more successfully. Therefore, this expectation when starting a new business, for example, a science fair coordinator is quite normal.

From the qualitative data, the theme about the inadequacies of counselor teachers (see table 9) made the fair coordinators realize the problem regarding the training needs of their colleagues. DeClue, Johnson, Hendrickson, and Keck (2000), Bulunuz, Tapan-Brouti, and Bulunuz (2016) pointed out that teachers have difficulty in finding original themes for the projects. The studies about projects and science fairs in the literature are examined, it is seen that teacher training about trained as mentors about project-based learning and projects management is one of the most common aspects of the suggestions (Çiğdemoğlu, Tekeli, & Köseoğlu, 2019; Ndlovu, 2013). It was noticed by the coordinators during the fair that the counselor teachers did not have experience in selecting, structuring, and directing students' sub-projects. In this process, the fact that the scientific language could not be used, the purpose, scope, method, and expected results were not written by the rule explained in the fair project call. Probably, to solve these problems, coordinators had to bear a higher workload than expected. In this context, the fair process was experienced as not a very positive experience in terms of coordinators, in which the inadequacies of advisors were also noticed and they had to be dealt with.

The other problem is that fairs are seen as an activity that cannot reach the expected number of visitors in qualitative data, either quantitatively or qualitatively, although it does not appear in quantitative data (see table 7). Regarding this issue, the fair coordinators attach importance to the participation of other students and teachers at the same school, parents, and especially the bureaucrats in the province and district. Similarly, they await a reward with a document as a result of this work, which is done and labor-intensive. This situation is also related to the honor share at the point of seeing and valuing the work done. If this is not met, they probably do not want to do this again.

5. Conclusion

Based on these results, for science teachers, who carried out the fair management for the first time, to be able to become a re-executive, it was stated that the students gained 21st century skills, carried out in cooperation, the responsibilities were shared in a balanced way in the school, the school administrators both supported and helped the process, the counselors took ownership of the job, etc. positive experiences are expected. However, this first activity poses the opposite situation. The studies on science fairs refer to many learning outcomes about students as a result of the fair. However, on the other hand, according to science teachers who are running a fair for the first time, the fair remains as not a positive enough memory that there were many problems related to the management, the project consultants did not own the job besides the skill inadequacies, the managers avoided sharing the responsibility, the project subjects were not original, the series was not sufficiently participated and the honor was not given. For this process to be initiated and finalized successfully, all stakeholders are expected to be aware of their responsibility, receive training, and realize that it is a rewarding activity. At this point, coordinator teachers' self-efficacy and professional training to initiate and manage projects and then train teachers who will provide consultancy and students who will do sub-projects can transform the work into an effective way. Fair projects should be authentic and all stakeholders should participate in projects voluntarily. Thus, the correct model of science fair starts with a teacher certified in the appropriate field of science. This is to assure content confidence and experience in the application of the scientific method.

References

AAAS. (1993). *Benchmarks for Science Literacy.* New York: Oxford University Press.

Abd-El-Khalick, F., & Lederman, N. G. (2000). The influence of history of science courses on students' views of nature of science. *Journal of Research in Science Teaching, 37*(10), 1057-1095.

Ary, D., Jacobs, L., Razavieh, A., & Sorensen, C. (2006). *Introduction to research in education* (7 ed.). Canada: Thomson Wadsworth.

Atalmış, E. H., Selçuk, G., & Ataç, A. (2018). Manager, coordinator and student views about TUBITAK 4006 projects. *Ahi Evran University Journal of Kırşehir Education Faculty, 19*(3), 1999-2020. doi: 10.29299/kefad.2018.19.03.006

Avcı, E., & Özenir Su, Ö. (2018). Evaluation of science fair process from project coordinator teachers' point of view. *Elementary Education Online, 17*(3), 1672-1690. doi:10.17051/ilkonline.2018.466417

Balcı, E. (2019). *Assessment of TUBITAK 4006 science fair: Polatlı sample* (Unpublished master thesis). Bolu: Bolu Abant İzzet Baysal University.

Barbour, R. S. (2014). Mixing qualitative methods: Quality Assurance or qualitative quagmire? *Qualitative Health Research, 8*(3), 352-361.

Benzer, S., & Evrensel, E. (2019). Students' views about TUBİTAK 4006 science fair. *Journal of Steam Education, 2*(2), 28-38.

Bozdemir, E. (2018). *Assessment of the effectiveness of the projects made at TUBİTAK science fairs on the students* (Unpublished master thesis). Çanakkale: Çanakkale Onsekiz Mart University

Bulunuz, M., Tapan-Broutin, M. S., & Bulunuz, N. (2016). Pre-service teacher scientific behavior: a comparative study of paired science project assignments. *Eurasian Journal of Educational Research*(62), 195-218. doi:10.14689/ejer.2016.62.12

Corbin, J., & Strauss, A. (2007). *Basics of qualitative research: Techniques and procedures for developing grounded theory.* Thousand Oaks: Sage.

Council, N. R. (2012). *National Science Education Standards.* National Academy Press.

Cresswell, J. W. (2003). *Research design: Qualitative, quantitative, and mixed methods approach* (2nd ed.). Sage.

Cuevas, P., Lee, O., Hart, J., & Deaktor, R. (2005). Improving science inquiry with elementary students of diverse backgrounds. *Journal of Research in Science Teaching, 42*(3), 337–357.

Çavuş, R., Balçın, M. D., & Yılmaz, M. M. (2018). The impact of science fair activities on secondary school students' science skills and problem-solving skills perceptions. *Inonu University Journal of the Graduate School of Education, 5*(10), 1-17. doi:10.29129/indulge.395132

Çiğdemoğlu, C., Tekeli, A., & Köseoğlu, F. (2019). The impacts of a teacher who received mentorship support from a teacher professional development program for informal learning on students' reflections-a case study. *Kastamonu Education Journal, 27*(5), 2311-2330. doi:10.24106/ kefdergi.3521

Çolakoğlu, M. H. (2018). The contribution of TUBİTAK 4006 science fairs towards education and training. *Journal of STEAM Education, 1*(1), 48-63.

DeClue, M. E., Johnson, K., Hendrickson, H., & Keck, P. (2000). Stimulate high school science fair participation by connecting with a nearby college. *Journal of Chemical Education, 77*(5), 608.

Dede, A. (2019). *Evaluation of 4006 TUBİTAK science fairs for science teachers* (Unpublished master thesis). Rize: Recep Tayyip Erdogan University.

Doğan, S. (2020). Do Tubitak-4006 science fairs achieve its objectives? the viewpoints of school administrators and teachers. *International Journal of Progressive Education, 16*(2), 26-41. doi:10.29329/ijpe.2020.241.3

Ebbel, E. (2010). Learning science from scientists. *NSTA Reports, 21*(8), 10-11.

Fadel, C., & Trilling, B. (2009). *21st Century Skills: Learning for life in our times.* San Francisco: Jossey-Bass.

Haysom, J. (2013). *Science fair warm-up "Learning the practice of scientists-Teachers Guide.* Virginia: NSTA Press.

Jaworski, B. A. (2013). *The effects of science fairs on students' knowledge of scientific inquiry and interest in science* (Unpublished master thesis). Montana: Montana State University.

Kahraman, Ü. (2019). *TUBİTAK 4006 science fair has an effect on scientist image of students* (Unpublished master thesis). Ağrı: Agrı Ibrahim Çecen University.

Kaya, E., & Yıldırım, A. (2014). Science Anxiety among failing students. *Elementary Education Online, 13*(2), 518-525.

Kececi, G. (2017). The aims and learning attainments of secondary and high school students attending science festivals: A case study. *Educational Research and Reviews, 12*(23), 1146-1153.

Keçeci, G., Kırbağ- Zengin, F., & Alan, B. (2018). Comparing the science festival attitudes of students participating as observers in school science fairs. *Acta Didactica Napocensia*(11), 175-183.

Keskin, D. (2019). *The effect of science fairs on science process skills, motivation and anxiety levels of secondary school students* (Unpublished master thesis). Denizli: Pamukkale University.

Küçük, A., & Yıldırım, N. (2019). Nature education and nature schools. In A. İ. Sen (Eds.), *Out-of-School Learning Environments* (pp. 246-272). Ankara: Pegem Akademi.

Küçük, A., & Yıldırım, N. (2020). The effect of out-of-school learning activities on 5th grade students' science, technology, society and environment views. *Turkish Journal of Teacher Education, 9*(1), 37-63.

Küçük, M. (2006). *A study toward teaching the nature of science for seventh grade primary students* (Unpublished PhD thesis). Trabzon: Karadeniz Teknik University.

Küçük, M., & Küçük, A. (2017). A study on the project self-efficacy of TUBİTAK 4006- science fair project coordinators. *IV. International Eurasian Educational Research Congress.* Antalya.

Lu, C.-C. (2013). Explore Elementary teachers' professional knowledge of guiding science fair product by using different ınstruction model. *US-China Education Review A, 3*(2), 92-99.

Maarschalk, J. (1988). Scientific literacy and informal science teaching. *Journal of Research in Science Teaching, 25*(2), 135– 146.

McComas, W. F. (1996). Ten myths of science: Reexamining what we think we know about the nature of science. School Science and Mathematics, 96, 10-16.

MEB. (2008). *Teacher competencies; general and special field competencies for teaching profession.* Ankara: Devlet Kitapları Genel Müdürlüğü.

Merriam, S. B. (2009). *Qualitative research: A Guide to design and ımplementation* (4th ed.). John Wiley & Sons.

Miles, M., & Huberman, A. M. (1994). *An expanded sourcebook qualitative data analysis.* Thousands of Oaks: Sage Publications.

Ndlovu, M. (2013). Science fair learners' evaluation of theır experience of scientific investigations in the classroom and during their project work. *6th International Conference on Education, Research and Innovation,* Seville.

Okuyucu, M. A. (2019). Teacher and student opinions concerning 4006-TUBITAK science fair. *International Journal of Social Sciences and Education Research, 5*(2), 202-218.

Olive, S. M. (2017). *The value of science fair and the factors that have led to the decline in Ohio science fair competition* (Unpublished ph.d. thesis). Ohio: Youngstown State Unıversity.

Özdemir, B. B., & Babaoğlan, B. (2019). The scientific process skills of the 6th grade students of TUBITAK 4006 science fairs and their relationship with the attitudes towards science course. *Journal of Research in Informal Environments, 4*(1), 22-36.

Samarapungavan, A., Mantzicopoulos, P., & Patrick, H. (2008). Learning science through inquiry in kindergarten. *Science Education,* 92, 868-908.

Schmidt, K. M., & Kelter, P. (2017). Science fairs: A qualitative study of their impact on student science inquiry learning and attitudes toward the stem. *Science Educator, 25*(2), 126-132.

Selçuk, G., Atalmış, E. H., & Ataç, A. (2020). 4006 TUBITAK science fairs effectiveness according to teachers and students: Validity and reliability study. *Kahramanmaras Sütcü Imam Uviversity Journal of Social Sciences, 17*(2), 750-774. doi:10.33437/ksusbd.770025

Sontay, G., Anar, F., & Karamustafaoğlu, O. (2019). Opinions of secondary school students attending 4006-TUBİTAK science fair about science fair. *International e-Journal of Educational Studies, 3*(5), 16-28.

Soyuçok, H. (2018). *Views of different participants in studies about science projects prepared in scope of tubitak 4006 scientific fairs* (Unpublished master thesis). Ağrı: Agrı Ibrahim Çecen University.

Şahin, E., & Önder-Çelikkanlı, N. (2014). The impacts of a secondary school science exhibition on the students in charge. *Necatibey Faculty of Education Electronic Journal of Science and Mathematics Education, 8*(2), 71-97. doi: 10.17522/nefefmed.57100

Tortop, H. S. (2013). Science teachers' views about the science fair at the primary education level. *Turkish Online Journal of Qualitative Inquiry, 4*(2), 56-64.

Tracy, S. J. (2013). *Qualitative research methods.* West Sussex: Wiley-Black Well.

Tucker, M., Darling-Hammond, L., & Jackson, J. (2013). Note to congress: Fewer, better tests can boost student achievement. *Education Week, 33*(7), 24.

Tur, S. (2020). *Teachers' views on TUBİTAK 4006 projects (Denizli Pamukkale sample)* (Unpublished master thesis project). Denizli: Pamukkale University.

Türkmen, H. (2019). The Impact of science fairs on adults' scientific perceptions & scientific epistemological beliefs. *Malaysian Online Journal of Educational Sciences, 7*(3), 22-32.

Wilson, J. D., Cordry, S., & Unline, C. (2004). Science fairs: Promoting positive attitudes towards science from student participation. *College Student Journal, 38*(1), 112-116.

Wren, K. (2015). Rush Holt wants everyone to think like a scientist. *Science*, 1430-1431.

Yasar, S., & Baker, D. (2003). The impact of involvement in a science fair on seventh-grade students. Paper presented at the Annual Meeting of the National Association for Research in Science Teaching (Philadelphia, PA, March 23- 26, 2003) .

Yavuz, S., Büyükekşi, C., & Işık-Büyükekşi, S. (2014). The effect of science festival on scientific beliefs. *Karaelmas Journal of Educational Sciences, 2*(2), 168-174.

Yıldırım, H. İ. (2018). The effect of science fairs on the 6th grade students' problem solving skills. *Trakya University Journal of Education Faculty, 8*(2), 390-409. doi: 10.24315/trkefd.364050

Yıldırım, H. İ. (2020). The views of students participating in science fairs with their projects and advisory teachers on science fair. *e-Kafkas Journal of Educational Research, 7*(1), 28-51. doi:10.30900/kafkasegt.677181

Yıldırım, H. İ., & Şensoy, Ö. (2016). The effect of science fairs on the 6th grade students' attitude towards the science course. *The Journal of Turkish Educational Sciences, 14*(1), 23-40.