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Iğdır Üniversitesi Sosyal Bilimler Dergisi

E-ISSN: 2147-6152

Yıl 15, Sayı 42, Mayıs 2026

[Araştırma Makalesi] **Atıf/Citation**: Yabanova, U.; Girgin, D.; Satmaz, İ.; Önol, M. (2026). "The Effect of the Science Festival Experience on Fourth-Grade Students' Attitudes Toward Socio-Scientific Issues", *Iğdır Üniversitesi Sosyal Bilimler Dergisi*. (42): s. 369-384. **Gönderim Tarihi**: 02.02.2026 **Kabul ve Yayın Tarihi**: 15.05.2026-19.05.2026 **DOI**:10.54600/igdirsosbilder.1921505

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The The Effect of the Science Festival Experience on Fourth-Grade Students' Attitudes Toward Socio-Scientific Issues*****

Bilim Şenliği Deneyiminin Dördüncü Sınıf Öğrencilerinin Sosyobilimsel Konulara Yönelik Tutumlarına Etkisi

ABSTRACT

This study examined the effect of a science festival experience on fourth-grade students' attitudes toward socio-scientific issues. A single-group pre-test–post-test quasi-experimental design was used. The study group included 303 fourth-grade students attending two primary schools in the central district of a provincial center in the Marmara Region of Türkiye. Data were collected with the Pupils' Attitudes towards Socioscientific Issues Scale, developed by Klaver and van der Molen (2021) and adapted into Turkish by Alkış Küçükaydın, Gökbulut, and Şahinpınar (2021). The intervention consisted of a three-day science festival organized within the 2025 TÜBİTAK 4007 Science Festivals Support Programme. Festival activities addressed socio-scientific issues including health, environment, energy, recycling, climate change, and sustainable living. Descriptive statistics, t-test, and MANOVA were used for data analysis. Findings showed that post-test attitude scores were significantly higher than pre-test scores. However, because pre-test and post-test forms could not be matched individually, the findings were interpreted as group-level differences between measurement sets rather than direct individual change. Significant differences were found in positive emotions, concern, collective efficacy, and dependence on others, while no significant change appeared in personal relevance or school relevance. The results suggest that science festivals can support primary students' socio-scientific attitudes in meaningful ways.

Keywords: Socio-scientific issues, science festival, attitude, primary school students

ÖZ

Bu araştırmada, bilim şenliği deneyiminin dördüncü sınıf öğrencilerinin sosyobilimsel konulara yönelik tutumları üzerindeki etkisi incelenmiştir. Araştırmada tek grup ön test–son test yarı deneysel desen kullanılmıştır. Çalışma grubunu, Marmara Bölgesi'nde bir il merkezinin merkez ilçesindeki iki ilkokulda öğrenim gören 303 dördüncü sınıf öğrencisi oluşturmuştur. Veriler, Klaver ve van der Molen (2021) tarafından geliştirilen ve Alkış Küçükaydın, Gökbulut ve Şahinpınar (2021) tarafından Türkçeye uyarlanan Çocukların Sosyobilimsel Konulara Yönelik Tutumları Ölçeği ile toplanmıştır. Uygulama süreci, 2025 TÜBİTAK 4007 Bilim Şenlikleri Destekleme Programı kapsamında yürütülen üç günlük bilim şenliğinden oluşmuştur. Etkinliklerde sağlık, çevre, enerji, geri dönüşüm, iklim değişikliği ve sürdürülebilir yaşam gibi sosyobilimsel konular ele alınmıştır. Verilerin analizinde betimsel istatistikler, t-testi ve MANOVA kullanılmıştır. Bulgular, son test tutum puanlarının ön test puanlarından anlamlı düzeyde yüksek olduğunu göstermiştir. Ancak ön test ve son test formları bireysel düzeyde eşleştirilemediğinden, bulgular doğrudan bireysel değişim olarak değil, ölçüm setleri arasındaki grup düzeyi farklılıklar olarak yorumlanmıştır. Alt boyutlarda olumlu duygular, endişe, ortak yeterlik ve başkalarına bağımlılıkta anlamlı farklılıklar bulunmuş; kişisel ilgi ve okul ilgisinde anlamlı değişim saptanmamıştır. Sonuçlar, bilim şenliklerinin ilkokul öğrencilerinin sosyobilimsel tutumlarını destekleyebileceğini göstermektedir. Bu nedenle bilim şenliklerinin okul öğrenmeleri, günlük yaşam deneyimleri ve öğrencilerin karşılaştıkları gerçek problemlerle ilişkilendirilmesi önerilmektedir kalıcı ve etkili kazanımların sağlanması açısından önemlidir.

Anahtar Kelimeler: Sosyobilimsel konular, bilim şenliği, tutum, ilkokul öğrencileri

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***** The study protocol was approved by the Çanakkale Onsekiz Mart University Social and Human Sciences Ethics Committee Commission (Decision No: 06/72, Date: 22 August 2025).

Introduction

Rapid advancements in science and technology are driving innovative applications that considerably impact daily life across various sectors such as health, environmental sustainability, energy, and manufacturing. Simultaneously, these developments underscore discrepancies in opinions, conflicts of values, and ethical challenges within society. These "science-related, social, and controversial" issues highlight the importance of conceptual understanding as well as broader objectives, including the evaluation of evidence, reasoning, decision-making, and the promotion of responsible citizenship within the framework of science education (Başkan Takaoğlu, 2023).

Socio-scientific issues (SSI) are regarded as real-world problems that have a conceptual or technological connection to scientific knowledge; however, they lack a definitive correct solution, involve elements of uncertainty and risk, require value-based reasoning, and often stimulate debate due to their societal implications (Klaver & Walma van der Molen, 2021; Sadler, 2004; Zeidler & Nichols, 2009). Within this context, Pupils' Attitudes toward Socioscientific Issues (PASSI) become pedagogical priorities aimed not merely at enabling students to 'learn science', but at understanding science within a social framework, discussing diverse perspectives, and devising evidence-based, rational decisions.

The primary reason that emphasizes the importance of SSI within science education resides in its adoption of a 'functional' approach to scientific literacy. This methodology anticipates that students should be capable of evaluating evidence, constructing well-founded opinions, and making informed decisions by anticipating the repercussions of science-related issues that are subject to public discourse (Sadler, 2004; Zeidler et al., 2005). The explicit focus on fostering reasoning and decision-making skills through the implementation of SSI in science curricula across Turkey underscores the approach's legitimacy at the curricular level (Ministry of National Education, 2018). Nevertheless, the integration of SSI into classroom practice is not automatic. The inclusion of SSI in curriculum texts may not be equivalently reflected in actual teaching practices; indeed, reports have indicated scenarios where SSI content has been marginalized, with educators perceiving this area as of lesser importance or relegating it to a secondary role within the instructional process (Hughes, 2000). Furthermore, it is recognized that teachers require comprehensive knowledge, confidence, and pedagogical support for the effective instruction of SSI; and, owing to the inherently controversial and complex nature of SSI, educators might face challenges in determining appropriate structuring methodologies.

1. Literature Review

This section presents the literature on attitudes toward socio-scientific issues, the role of science festivals as out-of-school learning environments, and how primary school students are influenced by such learning experiences within an integrated framework.

1.1. Socio-Scientific Issues and the Early Formation of Attitudes at Primary School Level

Although SSI research has historically concentrated mainly on secondary school students and teacher/trainee samples, it is posited that 'attitudes' and 'interaction tendencies' associated with SSI develop at an earlier age. Consequently, addressing SSI at the primary school level may promote both motivation for learning and the cultivation of value-based decision-making habits (Başkan Takaoğlu, 2023; Klaver & Walma van der Molen, 2021; Macalalag et al., 2020). In particular, the development of curiosity and interest in primary education is closely associated with experiences of "sensitivity to social issues" and "the ability to develop solutions collaboratively with others"; this renders the organized implementation of SSI at an early stage significant (Klaver & Walma van der Molen, 2021; Küçük, 2021; Zeidler & Nichols, 2009).

The capacity to quantify and monitor attitudes towards SSI at the primary school level further enables the assessment of the efficacy of SSI pedagogical strategies within this demographic. Indeed, within the adaptation study of the "Pupils' Attitudes Towards Socioscientific Issues" into Turkish, it was established that the scale is a valid measurement instrument from Year 4 onward; consequently, attitudes towards SSI can be systematically evaluated at the primary education

stage (Alkış Küçükaydın et al., 2021). Conversely, a quasi-experimental study conducted with Year 4 primary students reported that, although positive shifts in attitudes towards SSI were observed, these differences did not consistently attain statistical significance. This finding implies that attitudes towards SSI at an early age may be influenced by factors such as the nature of the intervention, its duration, and the characteristics of the learning environment (Yurtbakan & Batmaz, 2024).

Furthermore, with regard to SSI's decision-making process, it is essential to consider not only the students' "knowledge" level but also cognitive and metacognitive processes such as reading comprehension, evidence interpretation, and assessment of value conflicts play. for example, a study conducted within the SSI framework regarding electronic waste has demonstrated that, although students' knowledge levels may be enhanced by the scenario, their decision-making abilities may still be limited; this limitation may be attributed to their reading comprehension skills (Özcan & Gücüm, 2021). Such findings underscore the importance of enhancing learning experiences that foster positive attitudes towards socio-scientific issues (SSI) through linguistic, cognitive, and social support.

1.2. The Potential of Science Festivals and Informal Science Learning Environments

Science festivals and analogous events are categorized as informal science learning environments outside the formal school setting. These festivals primarily aim to foster a scientific culture through interactive workshops, practical experiences, exhibitions, demonstrations, and lectures. Comprehensive synthesis studies concerning out-of-school learning environments underscore that such settings may contribute to outcomes such as curiosity, interest, identity development, motivation, a sense of community, and continuity in learning (Lin & Schunn, 2016; Yıldırım, 2020). In this context, science festivals offer a notable opportunity, especially for younger demographics, to foster a 'positive emotional connection' with science and to relate scientific concepts to everyday life (National Research Council, 2009).

In the Turkish context, science festivals have become widespread through various support mechanisms with the aim of bringing science communication and science culture to a wider audience. In particular, programmes such as the "4007 Science Festival Support Programme" run by TÜBİTAK emphasise objectives such as raising awareness of scientific fields among participants, fostering a positive attitude towards scientific knowledge and scientists, and strengthening scientific thinking skills. Such objectives naturally intersect with the aims of SSI, which include contextualising science within a social framework, decision-making, and ethical thinking.

Regarding attitude outcomes, the existing literature on science festivals generally indicates a positive potential; however, the design elements of the event such as the level of participation, competitive structure, guidance, and continuity can influence the results. For instance, a study of a science festival in Turkey reported that participants regarded the event as 'productive and enjoyable', citing experiences such as conducting experiments and engaging in hands-on activities as particularly prominent (Yılmaz İnce et al., 2022). Similarly, another study involving trainee teachers and students examined the impact of participation in a science festival on attitude-related outcomes (Durmaz et al., 2017). Furthermore, an assessment of a science festival conducted under the TÜBİTAK 4007 programme revealed elevated satisfaction levels among primary and secondary school pupils as well as workshop leaders (Gülgün et al., 2019).

Currently, the correlation between the experience at the science festival and attitudes towards SSI is founded on two primary reasons. Firstly, science festivals frequently juxtapose students with themes that encompass significant social dimensions, such as environment, technology, health, and sustainability; these themes align with the conventional contexts of SSI (Zeidler & Nichols, 2009). Secondly, science festivals can cultivate a sense of 'action and competence' the capacity to perform tasks, develop solutions, and collaborate effectively; this potential may lead to significant transformations, particularly in sub-dimensions such as 'shared competence' and 'dependence on others' (Klaver & Walma van der Molen, 2021). Therefore, analyzing which

elements of SSI attitudes are affected by involvement in science festivals, and determining the direction of this influence, aids in comprehensively considering both the in-school and out-of-school facets of SSI education.

1.3. Current Trends in Research on Socioscientific Issues

Research on SSI has increased in recent years at both national and international levels; however, a concentration is observed in specific areas concerning sample and theme. Document analyses indicate that studies are predominantly conducted with trainee teachers; themes tend to centre particularly on argumentation and knowledge levels, and SSI knowledge levels are frequently reported as low (Özcan & Kaptan, 2020). Reviews of postgraduate theses in Turkey have also revealed that samples generally consist of secondary school pupils and science teachers; themes such as affective characteristics, argumentation, reasoning and achievement have emerged as prominent (Başkan Takaoğlu, 2023). These trends highlight two notable research gaps: (1) the paucity of practice-based studies concentrating on younger age groups, and (2) the inadequacy of unidimensional attitude measures in capturing the complexity of SSI interaction. Research involving trainee teachers suggests that attitudes may differ according to various variables and that trainees do not invariably regard themselves as competent in SSI instruction (Erkol & Gül, 2020; Çepni & Geçit, 2020). Although intervention studies conducted with students are associated with SSI-based teaching, argumentation, and decision-making processes, the impact of extracurricular activities such as science festivals on SSI attitudes has been examined more limitedly (National Research Council, 2009; Yılmaz İnce et al., 2022).

Although the development of tools to measure attitudes towards SSI at primary school level offers new opportunities, there is a particular need for studies that reveal how short-term and intensive experiences (e.g., science festivals) affect different sub-dimensions of attitude, especially at the 4th grade level (Klaver & Walma van der Molen, 2021; Alkış Küçükaydın et al., 2021). Addressing this gap is essential for the early development of SSI and for more effectively linking out-of-school activities to SSI objectives. (Yurtbakan & Batmaz, 2024; Zeidler & Nichols, 2009).

1.4. Research Aim

The aim of this study is to examine the changes in fourth-year students' attitudes towards SSI before and after their participation in the science festival. In addition to examining SSI attitudes at the total score level, the study aims to assess potential changes in the subdimensions of "Personal Relevance", "Relevance to School", "Positive Feelings", "Concern", "Collective Efficacy" and "Dependency on Others", taking into account the multidimensional nature of the attitude (Alkış Küçükaydın et al., 2021; Klaver & Walma van der Molen, 2021). This objective aligns with the assumption that participation tendencies concerning SSI are influenced not solely by "interest" but also by the emotional climate and perceptions of competence (Dauer et al., 2021; Zeidler & Nichols, 2009).

Aligned with this overall aim, the research questions are organised as follows:

- Do fourth-year students' attitudes towards socio-scientific issues show a significant difference before and after participating in the science festival?
- Does participating in the science festival lead to a significant change in students' sub-dimensions of "Personal Relevance," "Relevance to School," "Positive Feelings," "Concern," "Collective Efficacy," and "Dependency on Others"?

These questions have the potential to generate practical implications regarding both the early support of SSI and the integration of out-of-school learning activities with SSI objectives by revealing which components of SSI attitudes are most strongly influenced by the science festival experience (Ministry of National Education, 2018; National Research Council, 2009; Yılmaz İnce et al., 2022).

2. Method

2.1. Research Design

In this study, a single-group pre-test–post-test quasi-experimental design was employed to investigate the effect of fourth-year students' science festival experience on their attitudes towards socio-scientific issues. In this design, pre-test data were collected from the same group of students prior to the intervention, and post-test data were collected afterwards to examine the changes. The single-group pre-test–post-test quasi-experimental design involves measuring students' attitudes before and after the intervention to assess its effect.

The purpose of selecting this design was to examine the change in students' attitudes toward socio-scientific issues before and after the science festival experience. As it is generally not possible to randomly assign students to groups in school settings, the single-group design, which is widely used in educational research, was deemed appropriate for this study. The aim was to assess the initial attitude levels of the study group via the pre-test and to compare the changes following the science festival experience using the post-test.

2.2. Study Group

The study sample consists of fourth-year students from two primary schools in the central district of a provincial capital in the Marmara Region, representing a range of socio-economic backgrounds. The fact that the schools are situated in different socio-economic environments has enabled a more balanced assessment of the potential effects of the science festival experience on various pupil profiles.

Purposive sampling was used in the study. Under this method, schools that had the opportunity to participate in the science festival and possessed suitable conditions for conducting the research were selected. Fourth-year pupils from two different schools took part in the experimental study, whilst maintaining the existing class structures. A total of 303 fourth-year pupils participated in the study. Of the participants, 132 were from School 1 and 171 from School 2. Of these students, 132 were girls (43.6%) and 171 were boys (56.4%). Information regarding the study group is presented in Table 1.

Table 1. Demographic Information on the Study Group

	Girls	**Boy**	**Total**
School-1	63	69	132
School-2	69	102	171
Total	**132**	**171**	**303**

2.3. Data Collection Tools

In this study, The Pupils' Attitudes Towards Socioscientific Issues was used to determine the attitudes of fourth-year students towards socio-scientific issues. The scale was adapted into Turkish by Alkış Küçükaydın, Gökbulut and Şahinpınar (2021) based on the "Pupils' Attitudes Towards Socioscientific Issues" developed by Klaver and Walma van der Molen (2021), and validity and reliability studies were conducted.

The Attitude Scale towards Socioscientific Issues includes 24 items and six sub-dimensions. These sub-dimensions are organised as follows: "Personal Relevance," "Relevance to School," "Positive Feelings," "Concern," "Collective Efficacy," and "Dependency on Others". Items are rated on a 5-point Likert scale, from "Strongly disagree (1)" to "Strongly agree (5)". It is understood that as the total score increases, students' attitude levels towards social science subjects also rise positively.

The results of the confirmatory factor analysis carried out during the Turkish adaptation of the scale showed that the six-factor structure is valid at the primary school level. The Cronbach's Alpha reliability coefficient for the entire scale was reported as .86. It was noted that the reliability coefficients for the sub-dimensions ranged between .65 and .84 (Alkış Küçükaydın et al., 2021).

These values suggest that the scale is a reliable tool for assessing the attitudes of Year 4 primary school pupils towards socio-scientific issues.

2.4. Implementation Process

The research was conducted during a science festival held at a school in the central district of a provincial capital in the Marmara Region. The three-day science festival constituted the experimental phase of the research.

Prior to the start of the study, the Pupils' Attitudes Towards Socio-Scientific Issues test was administered to the pupils as a pre-test. The pre-test was administered approximately one week before the science festival in order to assess the pupils' current attitudes towards Socio-Scientific issues.

The experimental phase of the study was carried out as part of a science festival organised in 2025 under the TÜBİTAK 4007 Science Festival Support Programme (project number 126B672). The study involved fourth-year students who actively participated in the events by exploring the science festival grounds. These pupils took part in a total of 29 different workshops and interactive activities organised within the project area, each led by an academic specialising in their respective fields. Throughout this process, the pupils had the opportunity to engage with content relating specifically to socio-scientific issues.

The activities included in the implementation process were designed not only to convey scientific knowledge but also to enable students to recognise the relationship between scientific knowledge and social life, to reflect on everyday problems, and to participate in decision-making processes. In this context, the content of the activities was designed to be directly related to socio-scientific issues such as health and quality of life, clean water usage, energy sources, environmental pollution, recycling, climate change, sustainable consumption, the protection of biodiversity, and the creation of a liveable environment. The aim here is to help students realise that scientific knowledge is closely linked to decisions that affect social life, human health, the environment and the future, extending beyond the school environment. Furthermore, throughout this process, pupils are encouraged to reflect on the environmental and social issues they encounter, establish cause-and-effect relationships, and evaluate potential solutions. In this respect, the science festival experience offers fourth-year students the opportunity to engage with socio-scientific problem scenarios appropriate to their age group.

2.5. Post-Test Administration

At the end of the science festival, the "Pupils' Attitudes Towards Socio-scientific Issues Scale" was administered to the students once again as a post-test. The final test was conducted approximately one week after the science festival had ended. The aim was to identify any potential changes in the "Students' Attitudes Towards Socio-Scientific Issues Scale" resulting from the students' experience of the science festival.

2.6. Data Collection

Data for the study were collected through pre-test and post-test assessments. The data collection process was planned in accordance with the study's quasi-experimental design and included measurements taken before and after the experimental intervention.

The pre-test was conducted approximately one week before the start of the science festival. The aim of administering the pre-tests was to determine the students' existing attitudes towards socio-scientific issues prior to the science festival experience. The pre-test was conducted in the classroom under the supervision of the researcher and the class teacher. The scale was distributed to the students in printed form and the instructions were explained verbally by the researcher. Students were given sufficient time to complete the scale, and the process took approximately 20–25 minutes.

The post-test was administered to the students approximately one week after the science festival had ended. In the post-test, the "Scale of Students' Attitudes Towards Socio-Scientific Issues" used in the pre-test was re-administered. The purpose of administering the post-test some time

after the science festival was to identify more lasting changes in attitudes rather than any temporary effects that might arise immediately following the festival experience. Like the pre-test, the post-test was also conducted in a classroom setting and under similar conditions.

Ethical principles were strictly adhered to throughout the data collection process. Prior to the commencement of the research, ethical approval was obtained from the Çanakkale Onsekiz Mart University Social and Human Sciences Ethics Committee Commission (Decision No: 06/72, Date: 22 August 2025). In addition, permission to collect data was granted by the Çanakkale Provincial Directorate of National Education (Decision No: MEB.TT.2025.029265.01). Informed consent forms were obtained from the parents of the participating students, and the students' participation in the study was voluntary. It was clearly stated to the students that refusing to participate in the study would not result in any academic or administrative sanctions.

Throughout the study, participants' personal information was kept confidential, and the data collected was used solely for scientific purposes. Personal information relating to students was not used in the data analysis and reporting processes, and the principles of participant confidentiality and data security were strictly adhered to.

2.7. Data Analysis

JASP software was used to analyse the quantitative data collected in the study. Prior to the analyses, the data were coded, imported into the software, and checked for missing values and outliers. A significance level of .05 was adopted for all analyses. Although the data were collected from the same study group before and after the science festival, the pre-test and post-test forms could not be matched at the individual student level. Therefore, the data could not be analysed as paired or repeated measurements. For this reason, the pre-test and post-test scores were treated as independent measurement sets. To address the first research question, an independent samples t-test was conducted to compare the total attitude scores obtained from the pre-test and post-test measurements. Accordingly, the findings were interpreted as group-level differences between the two measurement sets rather than as individual-level change scores.

To address the second research question, the six sub-dimensions of the scale Personal Relevance, Relevance to School, Positive Feelings, Concern, Collective Efficacy, and Dependency on Others were analysed using MANOVA. Before conducting MANOVA, univariate normality was examined through skewness and kurtosis values. In addition, multivariate outliers were checked using Mahalanobis distance, the homogeneity of covariance matrices was assessed using Box's M test, and the homogeneity of variances was examined through Levene's test. Correlations among the dependent variables were also inspected to determine whether multicollinearity posed a problem. Pillai's Trace was used as the multivariate test statistic because it is considered relatively robust in multivariate analyses. Following the MANOVA, independent samples t-tests were conducted for each sub-dimension to identify the dimensions in which the pre-test and post-test measurement sets differed.

3. Findings

The pre-test and post-test data were analysed in accordance with the research questions. The analysis process was structured in two stages. In the first stage, it was examined whether students' overall attitude scores towards SSI differed before and after the science festival. In the second stage, considering the multidimensional nature of attitude, changes in the sub-dimensions of "Personal Relevance," "Relevance to School," "Positive Feelings," "Concern," "Collective Efficacy," and "Dependency on Others" were analysed.

RQ1. Do fourth-year students' attitudes towards socio-scientific issues show a significant difference before and after participating in the science festival?

Before analysing the changes in fourth-grade students' attitudes, an analysis was carried out to determine whether the data met the assumption of normality. The descriptive statistics for the pre-test and post-test scores concerning attitude change are as follows:

Table 2. Descriptive Statistics

	N	Mean	SD	Skewness	Kurtosis
Pre-test	303	55.45	9.56	-0.325	0.294
Post-test	303	57.97	10.03	-0.572	-0.047

When examining the descriptive statistics of students' socio-scientific attitude scores before and after participating in the science festival, the pre-test (M=55.45, SD=9.56) and post-test (M=57.97, SD=10.03) scores were obtained. Large samples make normality tests overly sensitive; therefore, normality, skewness, and kurtosis statistics can be used for evaluation (Field, 2018; Hair et al., 2014). It was observed that the skewness and kurtosis values of the scores remained within the ±1 range, indicating that these values satisfied the assumptions of normality (Field, 2018; Tabachnick & Fidell, 2019).

Table 3. Independent Samples t-Test

	t	df	p	Cohen's d	SE Cohen's d
Total	-3.163	604	.002	-0.257	0.082

According to the results of the independent samples t-test analysis, the attitude scores of Year 4 students towards socio-scientific issues were 55.45 (M = 55.45, SD = 9.56) before participation in the science festival and 57.97 (M = 57.97, SD = 10.03) after participation; the t-test results revealed a significant difference ($t(604) = -3.16$, $p = .002$). The higher mean score in the post-test measurement suggests that students' attitudes toward socio-scientific issues were more positive after the science festival at the group level. However, since the pre-test and post-test forms could not be matched individually, this result should be interpreted as a group-level difference between two measurement sets rather than as direct individual-level change. In the effect size analysis, Cohen's d was found to be 0.26, indicating a small effect (Cohen, 1988; Lakens, 2013).

RQ2. Does participating in the science festival lead to a significant change in students' sub-dimensions of "Personal Relevance," "Relevance to School", "Positive Feelings", "Concern", "Collective Efficacy," and "Dependency on Others"?

Changes in the subdimensions were analysed using a MANOVA test. Before the analysis, the data were checked to see if they followed a normal distribution. It was found that the skewness and kurtosis values for all subdimensions were within the ±1 range; therefore, the data were considered to follow a normal distribution, and parametric analyses were used (Field, 2018; Hair et al., 2014). In addition to univariate normality, MANOVA assumptions were also checked. The data were examined for multivariate outliers, homogeneity of variance, homogeneity of covariance matrices, and multicollinearity among the dependent variables. The assumption checks indicated that the data were suitable for MANOVA. Therefore, the pre-test and post-test measurement sets were compared in terms of the six sub-dimensions using MANOVA.The descriptive statistics related to the subdimensions are as follows:

Table 4. Descriptive Statistics

Test	Factors	N	Mean	SD	Skewness	Kurtosis
Pre-test	F1	303	12.71	2.195	-0.465	0.061
	F2	303	9.75	2.065	-0.783	0.093
	F3	303	8.49	2.440	-0.463	-0.275
	F4	303	8.62	2.947	-0.554	-0.733
	F5	303	10.60	3.267	-0.399	-0.570
	F6	303	5.29	2.047	-0.367	-0.874

Post-test	F1	303	12.70	2.442	-0.578	-0.105
	F2	303	9.83	2.106	-0.936	0.403
	F3	303	8.89	2.467	-0.435	-0.719
	F4	303	9.15	2.586	-0.712	-0.144
	F5	303	11.31	2.940	-0.427	-0.282
	F6	303	6.10	1.757	-0.707	-0.383

F1 – Personal Relevance, F2 – Relevance to School, F3 – Positive Feelings, F4 – Concern, F5 – Collective Efficacy and F6 – Dependency on Others represent the sub-dimensions.

When analysing the descriptive statistics for the subdimensions of students' socio-scientific attitudes before and after participating in the science festival, only limited increases were observed in some subdimensions. In the pre-test, the mean score for the Personal Relevance sub-dimension was M=12.71 (SD=2.20), while in the post-test it remained similar at M=12.70 (SD=2.44). For the Relevance to School sub-dimension, mean scores were M=9.75 (SD=2.07) in the pre-test and M=9.83 (SD=2.11) in the post-test, showing a slight increase. For Positive Feelings, the mean was M=8.49 (SD=2.44) in the pre-test and M=8.89 in the post-test; for Concern, M=8.62 (SD=2.95) in the pre-test and M=9.15 (SD=2.59) in the post-test; for Collective Efficacy, the pre-test mean was 10.60 (SD=3.27), and the post-test mean was 11.31 (SD=2.94); for Dependency on Others, the pre-test mean was 5.29 (SD=2.05), and the post-test mean was 6.10 (SD=1.76). It is particularly notable that the increase in mean scores in the Collective Efficacy and Dependency on Others sub-dimensions was greater than in the other sub-dimensions. Changes in the sub-dimensions were analysed using a MANOVA test.

Table 5. MANOVA Test

Cases	df	Approx. F	Tracepillai	Num df	Den df	p
(Intercept)	1	4030.829	0.976	6	599.0	<0.001
Group	1	5.853	0.055	6	599.0	<.001
Residuals	604					

The results of the MANOVA conducted to examine the effect of participation in the science festival on the sub-dimensions of the scale were found to be significant ($F(6, 599) = 5.85$, $p < .001$). This indicates that the sub-dimension scores of the pre-test and post-test groups differed (Field, 2018; Tabachnick & Fidell, 2019). When the effect size (Pillai's Trace = .055) was considered, it was concluded that it represented a small effect (Tabachnick & Fidell, 2019). Following the multivariate analysis, an independent samples t-test was conducted for each subscale to determine in which subscales the difference between pre-test and post-test scores emerged.

Table 6. Independent Samples t-Test for Pre-test and Post-test Scores by Sub-dimension

Factors	t	df	p	Cohen's d	SE Cohen's d
F1	0.035	604	.972	0.003	0.081
F2	-0.467	604	.640	-0.038	0.081
F3	-1.987	604	**.047**	-0.161	0.082
F4	-2.359	604	**.019**	-0.192	0.082
F5	-2.810	604	**.005**	-0.228	0.082
F6	-5.217	604	**.001**	-0.424	0.083

F1 – Personal Relevance, F2 – Relevance to School, F3 – Positive Feelings, F4 – Concern, F5 – Collective Efficacy and F6 – Dependency on Others represent the sub-dimensions.

Upon examining the results of the independent samples t-tests for the sub-dimensions, the pre-test and post-test scores for Personal Relevance ($t(604) = 0.035$, $p = .972$, $d = 0.003$) and Relevance to School ($t(604) = -0.467$, $p = .640$, $d = -0.038$), no statistically significant difference was found between the pre-test and post-test scores.

However, significant differences were observed in the sub-dimensions of Positive Feelings ($t(604) = -1.987$, $p = .047$, $d = -0.161$) and Concern ($t(604) = -2.359$, $p = .019$, $d = -0.192$). However, when Cohen's d values are taken into account, it is evident that these differences are quite small. More pronounced differences were found in the subdimensions of Collective Efficacy ($t(604) = -2.810$, $p = .005$, $d = -0.228$) and Dependency on Others ($t(604) = -5.217$, $p = .001$, $d = -0.424$). Upon examining the effect sizes, it is observed that the effect size in the Collective Efficacy sub-dimension is small, whilst that in the Dependency on Others sub-dimension falls between small and medium.

4. Results and Discussion

This study examined group-level differences in fourth-year students' attitudes toward socio-scientific issues before and after the science festival experience. The findings showed that the post-test mean score was significantly higher than the pre-test mean score. However, because the pre-test and post-test forms could not be matched at the individual student level, this finding should be interpreted as a group-level difference between two measurement sets rather than as direct evidence of individual-level attitude change. The small Cohen's d value further indicates that this difference was limited in magnitud. However, the calculated Cohen's d value indicates that this change corresponds to a small effect size. According to this finding, a short-term and intensive informal learning experience has led to a meaningful yet limited level of development in students' attitudes towards socio-scientific issues. This group-level difference is consistent with previous research regarding the potential of science festivals to foster interest, curiosity, and positive attitudes toward science among students. Science festivals enable students to view scientific knowledge within a context that is relevant to daily life, experiential and socially oriented. Indeed, the literature on informal learning environments emphasises that out-of-school scientific activities can play a supportive role in fostering affective outcomes such as curiosity, interest, participation, the development of a scientific identity, and the continuity of learning (Jekel Könnel et al., 2025; Lin & Schunn, 2016; National Research Council, 2009; Salmi & Thuneberg, 2019). Studies conducted in Turkey on science festivals similarly demonstrate that such events strengthen students' positive attitudes towards scientific activities, increase their desire to participate in scientific processes, and make the connection between science and daily life visible (Avan et al., 2019; Bozkurt & Şensoy, 2025; Gülgün et al., 2019; Yılmaz İnce et al., 2022). Socioscientific issues hold particular importance in science education. This is because these issues lie at the intersection of scientific knowledge and social, ethical, environmental, economic, and political decision-making processes. Sadler (2004) notes that informal reasoning regarding socio-scientific issues plays a significant role in individuals' decision-making processes based on scientific knowledge. Similarly, Zeidler and Nichols (2009) state that socio-scientific issues develop scientific literacy from a functional citizenship perspective; they support students' reasoning, justification and ethical evaluation skills. Within this framework, the higher post-test mean observed in the study suggests that the science festival may have provided students with a more visible, concrete, and experiential encounter with socio-scientific issues.

When the sub-dimensions of the scale used in the study are considered, it is evident that the science festival did not affect all attitude components to the same extent. Upon examining the findings regarding the sub-dimensions, no significant difference was found in the Personal Relevance dimension or the School-Relatedness sub-dimension. The fact that no difference was found in the Personal Relevance dimension indicates that the science festival did not create a

noticeable change in the short term regarding the extent to which students relate socio-scientific issues to their own lives. Personal Relevance is related to the student perceiving a issue as connected to their own life, preferences, family, immediate surroundings and future expectations. The formation of such a connection is often possible through the subject being repeatedly linked to the student's life experiences. Similarly, the absence of a significant difference in the Relevance to School sub-dimension indicates that the level to which the science festival is directly linked to students' school learning remains limited. It is known that events such as science festivals foster curiosity, interest and awareness in students (Başar et al., 2018; Gao et al., 2026). However, if these experiences are not linked to science curriculum outcomes and are of short duration, students perceive the event as an activity that is independent of school learning, a one-off and experiential activity. Similarly, Bevan and colleagues (2021) note that the impact of science activities in out-of-school learning environments cannot be limited to a single experience, and that achieving lasting learning transformation becomes difficult when these experiences are not linked to curriculum outcomes.

In the analyses of the other sub-dimensions, increases were observed in the Positive Feelings, Concern, Collective Efficacy and Dependency on Others dimensions in the post-test. When evaluating the findings related to the sub-dimensions, the results should be interpreted cautiously because separate independent samples t-tests were conducted following the MANOVA for the six sub-dimensions of the scale. Therefore, these findings should not be considered as definitive evidence of individual-level change, but rather as indicators of group-level differences between the pre-test and post-test measurement sets. However, rather than conclusively demonstrating that the science festival experience brought about changes in certain affective and social dimensions of students' attitudes towards socio-scientific issues, these findings should be interpreted as indicating a trend towards positive change in these dimensions. The finding of a significant difference in favour of the post-test in the Positive Feelings sub-dimension indicates that the science festival supported students' affective orientations towards socio-scientific issues. It is thought that students' active participation in scientific processes during the activities, their interaction with various materials, their communication with experts, and their experience of scientific issues in the context of everyday life contribute to the development of positive feelings. Science festivals transform encounters with science into a more concrete, enjoyable and social experience, particularly for primary school pupils (Peterman et al., 2020). Canovan's (2019) study on science festivals also demonstrates that such events can influence families' and young people's perceptions of science, particularly fostering positive shifts in perception among groups who view science as distant and difficult. In their work, Ramsey and Boyette (2021) note that informal learning environments such as science festivals facilitate students' deeper engagement with scientific concepts by providing opportunities for adult support and learning alongside peers. Science festival environments not only provide students with opportunities for individual observation and experimentation but also enable them to collaborate with peers, seek support from experts, and develop joint products or ideas. This may explain the higher post-test mean observed in the Collective Efficacy sub-dimension. Collective efficacy is related to students' belief that individuals, groups, society or institutions can be effective by acting together to solve socio-scientific problems. In such activities, students experience 'learning by doing together' as they participate in scientific processes alongside their peers, families, teachers, and scientists. This experience fosters the belief that a problem an individual cannot solve alone can be resolved through the joint efforts of a group or society. It is known that teaching based on socio-scientific issues positively influences students' beliefs in collective efficacy (Klaver et al., 2024). It is assessed that this social experience may also lay the groundwork for a collective belief that individuals can be effective by acting together. The positive attitudes towards collective trust and cooperation observed in students are thought to have increased the need for expert opinion and external support; in other words, the tendency to rely on others. The reason for this view has been identified as an increase in scores on the Dependency on Others dimension. For Year 4 pupils, large-scale problems such as climate change, environmental pollution, health issues or

sustainability may be perceived as beyond individual capacity. Therefore, pupils turning to the idea that "others are also part of this solution process" is a developmentally appropriate situation. This situation also explains the significant increase in the Concern dimension. Socio-scientific issues often involve complex issues such as environmental problems, climate change, health risks, technology use, bioethical debates, energy sources and sustainable living. Consequently, students' exposure to these issues may not only evoke positive emotions but also heighten anxiety rooted in awareness. This anxiety can be seen as the student beginning to recognise the importance, seriousness and societal implications of the issue. It is not desirable for students to perceive socio-scientific problems solely as threatening, intractable, or untackled individually. This situation can also be interpreted as students grasping the multidimensional nature of socio-scientific issues and accepting that such problems cannot be resolved without scientists and other societal stakeholders. Consequently, the increase in anxiety becomes more meaningful when considered alongside collective efficacy and action-oriented learning processes. Furthermore, it can be said that students are beginning to internalise the role of the scientific community, which is one of the fundamental elements of scientific literacy (Klaver & Walma van der Molen, 2021). In other words, whilst seeing themselves as part of the solution supports their self-confidence, their understanding of the value of collaboration and expert knowledge has also contributed to the development of a positive attitude. This balance is a desirable outcome in the teaching of socio-scientific issues and can be regarded as a reflection of the aim of socio-scientific education to foster conscious and collaborative citizens (Beniermann et al., 2021).

When the research findings are evaluated holistically, it can be said that the post-test scores were generally higher than the pre-test scores, particularly in the affective and social dimensions of attitudes toward socio-scientific issues. The absence of a significant change in the dimensions of personal relevance and school-relatedness suggests that students have not yet strongly integrated their science festival experience with their own lives and school learning. Conversely, the higher post-test scores observed in the dimensions of positive feelings, concern, collective efficacy, and dependency on others suggest that the science festival may have supported students' awareness, sensitivity, and perceptions of social solutions regarding socio-scientific issues. This finding suggests that science festivals provide a valuable starting point for socio-scientific awareness and scientific literacy, particularly at an early age; however, they may not be sufficient on their own to bring about lasting changes in attitudes (Osborne & Dillon, 2008). The findings of the study also indicate that, from the perspective of science education, science festivals should be regarded not only as events that bring students into contact with scientific knowledge but also as learning environments that support students in developing a scientific perspective on social issues. Socio-scientific issues provide powerful contexts that support students in thinking based on scientific knowledge, evaluating evidence, understanding different perspectives, and taking responsibility in problem-solving processes (Sadler, 2004; Zeidler et al., 2005). Therefore, linking the activities in science festivals to socio-scientific issues is consistent with the contemporary objectives of science education. In particular, activities related to sustainability, environmental issues, health, energy, technology and social life can help students view science not merely as curriculum content, but as a tool for making sense of life and generating solutions to social problems. Based on the findings of this study, it can be argued that, when appropriately planned and subsequently supported from a pedagogical perspective, science festivals may serve as a valuable educational component for supporting students' scientific and social awareness and attitudes.

A methodological limitation of this study is that the pre-test and post-test forms could not be matched at the individual student level. Therefore, although data were collected before and after the science festival, the analyses were conducted by treating the pre-test and post-test scores as independent measurement sets. For this reason, the findings should be interpreted as group-level differences rather than individual-level developmental changes. Future studies should use participant codes or matched data collection procedures to allow paired-sample analyses or repeated-measures designs.

5. Recommendations

The findings of this study indicate that the science festival experience has a multifaceted impact on students' attitudes towards socio-scientific issues. In this regard, the following recommendations may be developed:

- To ensure that the impact of out-of-school and informal learning experiences, such as science festivals, is sustained, such activities should not be limited to the day of the event alone. Following the festival, in-class reflection sessions, structured discussion activities, concept mapping exercises and small-scale project applications could be organised.
- The research findings indicate that the science festival experience has a more limited impact on certain dimensions of attitude. Therefore, the activities should be more explicitly linked to students' everyday life experiences, school learning and the real-world problems they encounter in their environment.
- To assess changes in attitudes in a more robust and sustainable manner, longer-term, repeated and phased science festival models could be developed rather than one-off applications. In this way, the continuity of changes in students' attitudes towards socio-scientific issues can be monitored more effectively.
- As the study was limited to a short-term pre-test–post-test design, follow-up studies are needed to reveal the long-term effects of the science festival. It could be investigated whether students' attitudes towards socio-scientific issues are maintained several weeks or months later.
- The extent to which classroom discussions, reflective journals, group work and project-based activities conducted following the science festival contribute to the sustainability of changes in students' attitudes could be investigated.
- To gain a deeper understanding of the affective changes observed in students, future research could utilise qualitative data collection methods such as interviews, focus group discussions, student diaries, open-ended questions, observation, and student work.
- The impact of the science festival experience on attitudes towards socio-scientific issues may vary across different age groups and developmental levels. For this reason, comparative studies could be conducted at pre-school, primary, secondary and sixth-form levels.
- In future studies, the ways in which different socio-scientific themes such as environmental issues, climate change, energy use, health, sustainable living, biotechnology and artificial intelligence affect students' attitudinal dimensions could be examined comparatively.
- It can be determined which types of activities such as workshops, practical experiments, drama activities, STEM/STEAM-based design tasks, argumentation activities and virtual reality applications are more effective in influencing which dimensions of attitude.
- The link between science festival activities and the learning outcomes of science lessons must be clearly established. In this way, students can relate the experiences they gain at the festival to the scientific concepts they learn at school and evaluate socio-scientific issues in a more meaningful way.

References

Alkış Küçükaydın, M., Gökbulut, Y., & Şahinpınar, D. (2021). Validity and reliability study of the attitude scale toward socioscientific issues for children. *OPUS International Journal of Society Researches, 18(Education Sciences Special Issue), 4935–4956*. https://doi.org/10.26466/opus.932976

Avan, Ç., Gülgün, C., Yılmaz, A., & Doğanay, K. (2019). Out-of-school learning environment in STEM education: Kastamonu Science Camp. *Journal of STEAM Education, 2*(1), 39-51. https://doi.org/10.14527/9786052419700.03

Başar, M., Doğan, C., Şener, N., & Doğan, Z. G. (2018). Examining science festival activities according to the views of students, parents, and teachers. *Uşak University Journal of Social Sciences, 11*(2), 132–147. https://doi.org/10.29217/uujss.243

Başkan Takaoğlu, Z. (2023). A systematic analysis of graduate theses on socioscientific issues. *Millî Eğitim, 52*(237), 547–576. https://doi.org/10.37669/milliegitim.1075185

Beniermann, A., Mecklenburg, L., & Upmeier zu Belzen, A. (2021). Reasoning on controversial science issues in science education and science communication. *Education Sciences, 11*(9), Article 522. https://doi.org/10.3390/educsci11090522

Bevan, B., Dierking, L. D., Staus, N., Benne, M., & Storksdieck, M. (2021). Measuring the long-term effects of informal science education experiences: Challenges and potential solutions. *Disciplinary and Interdisciplinary Science Education Research, 3*(1), 10. https://doi.org/10.1186/s43031-021-0003

Bozkurt, B., & Şensoy, Ö. (2025). The effect of science festivals organized for lower secondary schools on students' attitudes towards science festivals. *Journal of Eurasian Education and Culture, 10*(29), 67-84. http://dx.doi.org/10.35826/ijoecc.2862

Canovan, C. (2019). "Going to these events truly opens your eyes". Perceptions of science and science careers following a family visit to a science festival. *Journal of Science Communication, 18*(02), A01. https://doi.org/10.22323/2.18020201

Cohen, J. (1988). *Statistical power analysis for the behavioral sciences* (2nd ed.). Lawrence Erlbaum Associates.

Çepni, Z., & Geçit, Y. (2020). Preservice social studies teachers' attitudes and opinions toward socioscientific issues. *International Journal of Geography and Geography Education, 42*, 133–154. https://doi.org/10.32003/igge.732782

Dauer, J. M., Sorensen, A. E., & Wilson, J. (2021). Students' civic engagement self-efficacy varies across socioscientific issues contexts. *Frontiers in Education, 6*, Article 628784. https://doi.org/10.3389/feduc.2021.628784

Durmaz, H., Oğuzhan Dinçer, E., & Osmanoğlu, A. (2017). The effect of a science festival on preservice teachers' science teaching and students' attitudes toward science. *Trakya Journal of Education, 7*(2), 364–378. https://doi.org/10.24315/trkefd.296520

Erkol, M., & Gül, Ş. (2020). Preservice science teachers' attitudes toward socioscientific issues. *PESA Uluslararası Sosyal Araştırmalar Dergisi, 6*(1), 9–21. https://doi.org/10.25272/j.2149-8385.2020.6.1.02

Field, A. (2018). *Discovering statistics using IBM SPSS statistics* (5th ed.). SAGE Publications.

Gao, S., Jahani, S., Long, H., & Besley, N. (2026). What science fairs reveal about STEM learning. *Education Sciences, 16*(3), 482. https://doi.org/10.3390/educsci16030482

Gülgün, C., Yılmaz, A., Avan, Ç., Akyol, B. E., & Doğanay, K. (2019). Determining the views of primary and middle school students and workshop leaders regarding TÜBİTAK-supported science festivals (4007). *Journal of STEAM Education, 2*(1), 52–67.

Hair, J. F., Black, W. C., Babin, B. J., & Anderson, R. E. (2014). *Multivariate data analysis* (7th ed.). Pearson Education Limited.

Hughes, G. (2000). Marginalization of socioscientific material in science-technology-society science curricula: Some implications for gender inclusivity and curriculum reform. *Journal of Research in Science Teaching, 37*(5), 426–440. https://doi.org/10.1002/(sici)1098-2736(200005)37:5<426::aid-tea3>3.0.co;2-u

Jekel Könnel, E., Geuer, L., Schlindwein, A., Perret, S., & Ulber, R. (2025). The effects of an outdoor learning program,'gewässercampus', in the context of environmental education. *Education Sciences, 15*(5), 550. https://doi.org/10.3390/educsci15050550

Klaver, L. T., & Walma van der Molen, J. H. (2021). Measuring pupils' attitudes towards socioscientific issues: Development and validation of a questionnaire. *Science & Education, 30*, 317–344. https://doi.org/10.1007/s11191-020-00174-y

Klaver, L. T., Guérin, L. J. F., Sins, P. H. M., & Walma van der Molen, J. H. (2024). Effects of socioscientific issues-based teaching on attitudes: Students' resources as moderator. *The Journal of Educational Research, 117*(4), 169-184. https://doi.org/10.1080/00220671.2024.2362159

Küçük, A. (2021). Investigation of the change towards scientific attitudes of students with out-of-school learning experience. *OPUS–International Journal of Society Studies, 18*(44), 7552–7580. https://doi.org/10.26466/opus.933305

Lakens, D. (2013). Calculating and reporting effect sizes to facilitate cumulative science: A practical primer for *t*-tests and ANOVAs. *Frontiers in Psychology, 4*, 863. https://doi.org/10.3389/fpsyg.2013.00863

Lin, P. Y., & Schunn, C. D. (2016). The dimensions and impact of informal science learning experiences on middle schoolers' attitudes and abilities in science. *International Journal of Science Education, 38*(17), 2551–2572. https://doi.org/10.1080/09500693.2016.1251631

Macalalag, A. Z., Johnson, J., & Lai, M. (2020). How do we do this: Learning how to teach socioscientific issues. *Cultural Studies of Science Education, 15*, 389–413. https://doi.org/10.1007/s11422-019-09944-9

Ministry of National Education. (2018). *Science course curriculum (Primary and middle school grades 3, 4, 5, 6, 7, and 8)*. https://mufredat.meb.gov.tr/Dosyalar/201812312311937-FEN%20B%C4%B0L%C4%B0MLER%C4%B0%20%C3%96%C4%9ERET%C4%B0M%20PROGRAMI2018.pdf

National Research Council. (2009). *Learning science in informal environments: People, places, and pursuits*. National Academies Press. https://doi.org/10.17226/12190

Osborne, J., & Dillon, J. (2008). *Science education in Europe: Critical reflections*. The Nuffield Foundation. https://www.nuffieldfoundation.org/about/publications/science-education-in-europe-critical-reflections

Özcan, C., & Gücüm, B. (2021). An ethical examination of decision-making skills regarding socioscientific issues: Electronic waste. *Mustafa Kemal University Journal of the Faculty of Education, 5*(7), 224–239. https://izlik.org/JA49WM38RK

Özcan, C., & Kaptan, F. (2020). Investigation of the studies on socioscientific issues between 2008–2017. *Journal of Muallim Rıfat Faculty of Education, 2*(1), 16–36. https://izlik.org/JA69RB47BF

Peterman, K., Verbeke, M., & Nielsen, K. (2020). Looking back to think ahead: Reflections on science festival evaluation and research. *Visitor Studies, 23*(2), 205-217. https://doi.org/10.1080/10645578.2020.1773709

Ramsey, J. R., & Boyette, T. (2021). "Science Festival" may not mean what we think it means: an analysis of how researchers and practitioners use this term. *Journal of Science Communication, 20*(7), A01. https://doi.org/10.22323/2.20070201

Sadler, T. D. (2004). Informal reasoning regarding socioscientific issues: A critical review of research. *Journal of Research in Science Teaching, 41*(5), 513–536. https://doi.org/10.1002/tea.20009

Salmi, H., & Thuneberg, H. (2019). The role of self-determination in informal and formal science learning contexts. *Learning Environments Research, 22*(1), 43–63. https://doi.org/10.1007/s10984-018-9266-0

Tabachnick, B. G., & Fidell, L. S. (2019). *Using multivariate statistics* (7th ed.). Pearson.

Yıldırım, H. İ. (2020). The effect of using out-of-school learning environments in science teaching on motivation for learning science. *Participatory Educational Research, 7*(1), 143–161. https://doi.org/10.17275/per.20.9.7.1

Yılmaz İnce, E., Kabul, A., & Diler, İ. (2022). The effect of science festival on participants' attitudes towards science. *Journal of STEAM Education, 5*(1), 88–99. https://izlik.org/JA49PU98KG

Yurtbakan, E., & Batmaz, O. (2024). Primary school 4th-grade students' attitudes toward socioscientific issues and question asking: Philosophy for children. *Science Education International, 35*(3), 219–228. https://doi.org/10.33828/sei.v35.i3.5

Zeidler, D. L., & Nichols, B. H. (2009). Socioscientific issues: Theory and practice. *Journal of Elementary Science Education, 21*(2), 49–58. https://doi.org/10.1007/BF03173684

Zeidler, D. L., Sadler, T. D., Simmons, M. L., & Howes, E. V. (2005). Beyond STS: A research-based framework for socioscientific issues education. *Science Education, 89*(3), 357–377. https://doi.org/10.1002/sce.20048

Author Contributions

All authors contributed equally to the conception, design, data collection, analysis, and writing of the manuscript.

Conflict of Interest Statement

The authors declare that they have no known personal or financial relationships that could have appeared to influence the work reported in this paper, and thus no conflict of interest exists.

Funding and Acknowledgements

This study was carried out within the scope of the project numbered 126B672, which was supported by the TÜBİTAK 4007 Science Festivals Support Program.