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International Journal of Curriculum and Instruction 17(3) (2025) 762–771

IJCI
International Journal of Curriculum and Instruction

Investigating the Effect of Science Shows on Middle School Students' Curiosity Levels Toward Science

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Abstract

The prominence of scientific literacy as a fundamental skill in the 21st century has increased the importance of learning environments that will equip students with scientific thinking skills and guide them toward engaging with scientific processes. In particular, the development of students' curiosity toward science plays a critical role in terms of both their individual learning motivation and their tendencies for lifelong learning. In this respect, science shows have the potential to foster curiosity in students by evoking surprise, interest, and excitement. For this reason, this study examined the effect of science shows conducted with middle school students on their curiosity levels toward science. A single-group experimental method based on a pre-test–post-test design was used in the study. The sample of the research consisted of 96 middle school students from different grade levels studying at a public school in Ankara. During the implementation process, science shows on physics, chemistry, and biology topics within the scope of the science curriculum were performed for the students. In selecting the science shows, criteria such as the potential to arouse curiosity, safety considerations, and feasibility were taken into account. The implementation was carried out interactively with students over 8 weeks, one class hour per week. As a data collection tool, the *Science Curiosity Scale Toward Science* developed by the researcher, consisting of three sub-dimensions and 21 items in a five-point Likert type (Cronbach's alpha = .92), was used. Data were analyzed using the t-test. According to the analysis results, a significant increase was found in the post-implementation scores of the science curiosity scale compared to the pre-implementation scores ($p < .05$). These results reveal that science shows positively influence students' tendencies toward scientific curiosity.

Keywords: Science shows, science education, scientific curiosity, middle school students

This study was produced from the first author's doctoral dissertation.

1. Introduction

The rapid developments in science and technology in the 21st century have made it a fundamental requirement for individuals to be scientifically literate. Scientific literacy is

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the ability of individuals to understand scientific processes and transfer these processes to their daily lives (Bybee, 2013; OECD, 2018). In this context, it is expected that students will not only acquire knowledge in science lessons but also use this knowledge critically and creatively, develop scientific thinking skills, and gain intrinsic motivation toward learning (National Research Council, 2012; Osborne, 2014). Curiosity, a fundamental cognitive and affective element in achieving these goals, is considered both the initiator and the sustainer of learning (Hidi & Renninger, 2006; Engel, 2011). Curiosity triggers the desire in individuals to explore the unknown, providing a powerful source of motivation for learning. Especially for middle school students, curiosity is one of the key variables that determine their relationship with science (Jirout & Klahr, 2012; Kang & Kim, 2023). Indeed, research has revealed that students whose curiosity is stimulated in science classes demonstrate higher motivation and learn concepts more deeply (Litman, 2005; Ceylan et al., 2015).

Current educational approaches, based on constructivist learning theory, encourage students to construct knowledge through their own experiences. In this approach, learning occurs through active participation, inquiry, discovery, and experience (Piaget, 1977; Driver & Oldham, 1986). The *Century of Türkiye Education Model*, implemented in Türkiye in 2024, is also based on this understanding, emphasizing interdisciplinary, experiential, and holistic learning (Ministry of National Education [MEB], 2023). In this context, instructional strategies that will trigger students' curiosity and make them active participants are of great importance. Science shows have become one of the notable practices in science education in recent years. Science shows are interactive presentations combining surprising experiments, visual elements, and humor that capture students' attention and make them think while entertaining them (Boone & Roth, 1992; Braghini, 2017). Such shows allow students to learn scientific concepts in an enjoyable and engaging way while simultaneously stimulating their scientific curiosity (Shakhashiri, 1985; Walker, 2012). Especially in learning environments, the triggering of emotions such as surprise and admiration increases students' mental arousal levels, contributing to permanent learning (Limon, 2001; McKee, Williamson, & Ruebush, 2007).

Studies on the educational potential of science shows have also demonstrated that these shows increase students' levels of attention, interest, motivation, and scientific understanding (Garrett & Roberts, 1982; Polat, 2014). For example, Boone & Roth (1992) reported in their study that science shows provided more intrinsic motivation compared to traditional laboratory activities. Science shows not only promote knowledge acquisition but also support higher-order cognitive skills such as observation, prediction, and inquiry (Falk & Dierking, 2010; Laurent, 2011).

In Türkiye, science festivals and shows are widely organized by various educational institutions to encourage scientific curiosity in students. However, studies that experimentally examine the effect of science shows on students' curiosity toward science are limited. Yet, the literature indicates that even a single science show can significantly

influence students' sense of curiosity in science lessons (Bultitude, McDonald, & Custead, 2011).

For this reason, this study aims to reveal the effect of science shows conducted with middle school students on their curiosity toward science. The findings obtained are important in this respect.

2. Method

2.1. Research Design

This study was carried out using a single-group pre-test–post-test experimental design to examine the effect of science shows on middle school students' curiosity levels toward science. This design is based on measuring the same group before and after the experimental intervention to evaluate its effect (Creswell, 2012). Such designs are frequently preferred in educational research for directly observing the impact of an intervention process.

2.2. Study Group

The study group consisted of 96 middle school students (45 male and 51 female) studying at a public school in Ankara, Türkiye. The participants voluntarily took part in the study with the consent of the school administration and parents. Students were selected from the 5th, 6th, and 7th grade levels. In determining the sample group, students were stratified according to their grade levels, and a certain number of students from each grade level were randomly selected. Accordingly, a stratified random sampling method was used in the study. This method ensures that the subgroups in the population are represented in the sample in a balanced way with high representational power (Creswell, 2012; Karasar, 2016).

2.3. Data Collection Tool

To collect data in the study, the *Science Curiosity Scale Toward Science* (Gök & Doğan, 2025) was used. The Cronbach's alpha reliability coefficient of this five-point Likert-type scale was calculated as .92. It consists of three sub-dimensions: *Curiosity for Exploring Scientific Knowledge*, *Curiosity for Applying Science in Daily Life*, and *Experience-Based Scientific Curiosity*. The minimum score a participant can obtain from the scale is 21, and the maximum score is 105. The scale was administered to the same students both before (pre-test) and after (post-test) the science show intervention.

2.4. Implementation Process

During the implementation process, within the scope of the science course, one class hour per week over an 8-week period, eight science shows titled "Cool Flames," "Traffic Light," "Shape Memory Alloys," "Colorful Flames," "Chemist's Matchstick," "Extinguishing a Candle Without Blowing," "Shapes of Sound," and "Magic or Science?" were performed with the students in the classroom environment (Moore, Stanitski, & Jurs, 2009; Otsuka

& Ren, 2005; Lagoudas, 2008; Royal Society of Chemistry, 2023; American Chemical Society, 2023; Szydłowska-Czerniak & Tułodziecka, 2021).

For science shows to be effective, the implementation process was designed to remove students from a passive environment where they only remain as observers and to allow them to actively participate. In these processes, it was important for students to directly observe the shows, notice the differences between their predictions and the actual outcomes, and experience cognitive conflict through these contradictions. Thus, students had the opportunity to question and reconstruct their prior knowledge, paving the way for deep learning (Baessa, Chesterfield, & Ramos, 2002). Especially unusual events or unexpected show results draw students' attention while also triggering individual learning. Within the framework of Limon's (2001) cognitive conflict approach, such situations enable students to construct new conceptual structures through data that contradict their existing schemas.

To ensure that science shows were conducted safely and effectively, approximately half an hour of preliminary preparation was carried out by the teacher before presenting them, including procuring materials, taking safety precautions, and rehearsing the show steps in advance. The presentation time of a prepared science show ranged from a minimum of 15 seconds to a maximum of 3 minutes.

To ensure students' active participation in the science shows, questions such as "What happened?" and "How did it happen?" were asked, encouraging them to engage in inquiry during the process. Science shows, as systematically defined by Shakhashiri (1985), were implemented by considering the following characteristics:

- ◊ Producing results in a short time to maintain students' attention
- ◊ Being designed according to the target audience's age and learning level
- ◊ Being staged in a way that can be easily observed by the entire class
- ◊ Being prepared with simple and safe materials
- ◊ Taking necessary safety precautions
- ◊ Encouraging interaction between teacher and students and creating a discussion environment
- ◊ Being rehearsed in advance to ensure good timing
- ◊ Being repeatable if necessary
- ◊ Having a structured, clear, and simple format

2.5. Data Analysis

The data obtained were analyzed using a paired samples t-test. IBM SPSS 26.0 statistical software was used for the analyses. Pre-test and post-test scores were compared to test whether the science shows created a significant change in students' curiosity levels

toward science. The significance level was set at .05 (Büyüköztürk, 2007; Yıldırım & Şimşek, 2018).

3. Results

The results obtained from the *Science Curiosity Scale Toward Science*, which was administered to determine the effect of science shows on middle school students' curiosity toward science, are presented in Table 1.

Test Type	n	M	SD	t	df	p
Pre-Test	96	62,45	8,32			
Post-Test	96	78,12	7,95	–15,27	95	.000*

* $p < .05$

Table 1. t-test Results of the Scale

As seen in Table 1, the mean curiosity score of students toward science was 62.45 before the science show intervention, whereas it increased to 78.12 after the intervention. According to the t-test results, the post-test mean score was significantly higher than the pre-test mean score $t(95) = -15.27$, $p < .001$.

4. Discussion

The findings in Table 1 show that there was a statistically significant difference between students' curiosity levels toward science before and after the intervention. This indicates that science shows significantly increased middle school students' curiosity toward science (Silvia, 2006; Loewenstein, 1994; Engel, 2011; Walker, 2012; Sadler, 2004; McCrory, 2010).

Science shows arouse curiosity in students, particularly through strong pedagogical mechanisms such as "capturing attention" and "creating conceptual conflict" during the learning process (Baessa, Chesterfield, & Ramos, 2002; Chin, 1992). When students' prior knowledge is challenged by the surprising phenomena they observe in the shows, a contradiction arises, initiating a cognitive process of questioning and investigation. This creates a strong learning cycle that stimulates both conceptual understanding and scientific curiosity (Limón, 2001; McCrory, 2010). Especially surprising and unpredictable shows help sustain student interest while allowing a deeper understanding of the subject (Kang & Kim, 2023).

The effect of science shows on student curiosity is remarkable when compared with other active learning approaches in the science education literature. For example, while inquiry-based learning environments enhance students' scientific process skills and curiosity levels, they are often time-consuming to implement and require greater teacher control (Chin & Osborne, 2008). In contrast, science shows can be conducted within a short time in classroom settings and still generate high levels of attention and impact. By offering students the opportunity to simultaneously experience both the cause and effect of a scientific phenomenon with rich visual and sensory input, they actively engage in the

cognitive process (Sadler, 2004; Walker, 2012). In this respect, science shows have a pedagogical effect similar to STEM education, project-based learning, and inquiry-based laboratory practices; however, unlike these, the theatrical narration and element of surprise in science shows can trigger situational curiosity more effectively (Litman, 2005; Hidi & Renninger, 2006). Research on the impact of demonstration-based activities has also shown that such practices significantly increase students' willingness to learn and their interest in scientific concepts (Çavuş & Balçın, 2017; Sari, Yağbasan, & Dönmez, 2024).

Moreover, the student-centered nature of science shows supports the transition of students from passive observers to active participants in the learning process. Such activities not only encourage students to observe but also to make predictions, establish cause–effect relationships, and generate questions. In this way, science shows provide students with a holistic learning experience that is both epistemic and emotional, creating a positive emotional state toward learning and supporting permanent learning (Silvia & Kashdan, 2009; Ainley, Hidi, & Berndorff, 2002).

Additionally, in the literature, Ceylan et al. (2016) found that students with high curiosity toward science also had higher science achievement. Similarly, Gürel (2016) noted that scientific demonstrations for primary school students positively affected their curiosity. In the study by Çavuş and Balçın (2017), it was found that scientific demonstration experiments increased attention, curiosity, and retention in students, and that they developed greater interest in scientific explanations. These studies clearly demonstrate that using science shows in science education increases students' scientific curiosity.

5. Conclusions

In this study, it was determined that interactive science shows implemented with middle school students provided a significant increase in their curiosity levels toward science. The data obtained indicate that students' interest in exploring scientific knowledge, relating science to daily life, and experience-based learning increased through science shows. At the same time, the findings show that science shows increased students' interest and desire to explore (Hidi & Renninger, 2006; Engel, 2011). The fact that these shows are visually and auditorily rich increases students' desire to learn science concepts (Kurnaz & Tan, 2016; Koçak, 2021). Science shows stimulated students' curiosity toward science (Engel, 2011; Loewenstein, 1994). In an environment where curiosity is stimulated, students not only access knowledge but also actively participate in processes of meaning-making, questioning, and reconstruction (Hidi & Renninger, 2006). In this respect, learning experiences that are attention-grabbing and rich in affective engagement, such as science shows, can not only activate curiosity—the driving force of learning—but also increase students' intrinsic motivation toward learning.

Based on the results of the study, it can be stated that the systematic use of science shows as a teaching strategy in science lessons may contribute to increasing students'

scientific curiosity and achievement (Bybee, 2013; Walker, 2012; McCrory, 2010; Sadler, 2004). In conclusion, science shows can be used as supplementary instructional practices that support students' curiosity toward science, trigger their intrinsic motivation to learn, and make science education more meaningful.

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