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POPULARIZATION OF THE HISTORY OF SCIENCE IN EDUCATION: MUSEUMS AND SCIENCE CENTERS

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ABSTRACT

The history of science is an essential field for understanding the development of knowledge and its relationship to societal contexts. Despite its importance, current education systems often address the history of science in a narrow scope, neglecting to effectively convey its social and historical dimensions to students. This limited approach perpetuates the perception of the history of science as an abstract and detached subject, making it difficult to integrate meaningfully into classroom practices. Museums and science centers provide a significant opportunity to bridge this gap by offering tangible and interactive ways to present the history of science. These institutions have the potential to enhance learning by contextualizing scientific advancements and their impact on society. This research investigates how museums and science centers can play a pivotal role in popularizing the history of science within educational settings. Using a qualitative methodology, the study reviews existing literature and examines contemporary practices in science centers. Examples from both Turkey and the global context are analyzed, including institutions such as the Konya Science Center, Islamic Science and Technology History Museum, Deutsches Museum, and Exploratorium. These cases highlight the effectiveness of museums and science centers in bringing the history of science to life, fostering greater social awareness and engagement. The findings reveal that history of science-themed activities in these institutions enhance students' critical thinking, problem-solving, and historical analysis skills. Furthermore, advancements in digitalization and the rise of virtual science centers offer unprecedented opportunities to make the history of science accessible to broader audiences. The study emphasizes the need to integrate the history of science into educational curricula, develop interactive materials, and launch public awareness campaigns to maximize its societal impact. By leveraging the unique capabilities of museums and science centers, the history of science can be effectively popularized and connected to the wider community.

Keywords: History of science, science centers, history of science teaching.

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INTRODUCTION

Science has played a fundamental role in the transformation of societies in every period of human history and has been a critical factor in shaping the future with its accumulation of knowledge. However, it is essential to understand science as a historical process, not just a set of results, in order to comprehend its social and cultural contexts. Today's education systems often focus on science through its modern achievements, which prevents an adequate understanding of the historical background of scientific developments. The history of science has the potential to provide students with the skills of critical thinking, problem solving and analyzing in a historical context while bringing together the scientific accumulation of the past with the present. However, it is seen that this potential is limited in classroom environments, the history of science is perceived as an abstract subject and cannot be fully integrated into the learning process. Museums and science centers come to the forefront as areas that both enrich learning processes and create scientific awareness by embodying the historical adventure of science. The limited number of museum and science center applications focused on the history of science, especially in Turkey, creates a need for research on this subject. Therefore, this study aims to examine the role of museums and science centers in bringing the history of science to a wider audience in education, as well as contributing to the deficiencies in the integration of this field into the education system.

The history of science is an important discipline in understanding the accumulation of knowledge in human history and how this accumulation has been shaped. The history of science, which examines the origins of scientific developments, how these developments have evolved in the historical process and their effects on societies, is a field that should be popularized not only in academic circles but also among the general public (Fazlıoğlu, 2004, p. 11). In this context, the integration of the history of science into education plays a critical role in enabling individuals to better understand the nature of science and develop their scientific thinking skills. An education limited to the classroom environment is insufficient to convey the historical context of science to students. The use of alternative learning environments such as museums and science centers has great potential for the history of science to appeal to a wider audience (Danilov, 2010, p. 5). This research aims to make significant contributions to the popularization of the history of science in education through museums and science centers. By analyzing the current situation in the integration of history of science into education, the study will enable the development of new strategies in this field. It also aims to reveal how interactive learning experiences offered by museums and science centers develop students' scientific thinking skills.

While research in this field provides important information on the history of science, museums and science centers, it also points to important gaps in the intersection of these fields. First of all, studies on how history of science can be used more effectively in education through museums and science centers are limited. The existing literature mostly focuses on classroom teaching or the general educational functions of museums and does not focus enough on the integration of these two fields. Moreover, empirical studies on museum and science center practices focusing on the history of science in the Turkish context are noteworthy. In particular, research on the educational impact of pioneering examples such as the Konya Science Center and the Museum of the History of

Islamic Science and Technology is insufficient. Similarly, the lack of studies on the digitalization processes of science centers and their contribution to the teaching of history of science is another gap in the literature. In this context, it is necessary to increase the number of studies that adopt an interdisciplinary approach to the popularization of the history of science in education through museums and science centers. Such studies can make important contributions both in terms of bringing the historical context of science to a wider audience and developing new methods in education. The importance of the research can be summarized in three main points:

-Filling the Literature Gap: Considering the scarcity of studies on the history of science, museums and science centers, this study will fill an important gap in the literature.

-Presenting New Perspectives in Education: It will contribute to the development of innovative approaches to the integration of history of science into the education system.

-Raising Scientific Awareness: It will provide concrete suggestions for increasing scientific thinking skills and awareness in different segments of society.

The main purpose of this study is to analyze how the history of science can be popularized through museums and science centers. The study is designed to emphasize the role of history of science in education and to examine the effects of such education on society. The main problem of the research can be expressed as follows:

How can the history of science be popularized more effectively in education through museums and science centers?

MUSEUMS AND HISTORY OF SCIENCES

Bridge from and the Past to the Future: Museums

In ancient Greek civilization, “Mouseion” was used to mean the name of the building on the hill reserved for the nine muses (Lalliope, Euterpe, Klio, Terpsikhore, Klio, Urania, Thalia, Erato, Melpomene), the guardians of fine arts (Şapolyo, 1936 as cited in Ata, 2015). According to the Turkish Language Association, a museum is defined as “a place where works of art and science or objects useful for art and science are kept and exhibited for public display” (TDK, 2024). According to Ata (2002), museums are “permanent organizations that obtain, exhibit, research and transfer the material evidence of humanity and their environment for the purposes of study, education and entertainment in the service of society and its development and are open to the public for profit.” Museums have gone far beyond the function of merely preserving objects from the past. They are gaining different functions according to the needs of an ever-changing and developing society and are also used for educational purposes. In 2022, the International Council of Museums (ICOM) defined a new definition of a museum as a result of needs and current problems. According to ICOM (2022), *“A museum is a non-profit, permanent institution in the service of society. It researches, collects, preserves, interprets and exhibits tangible and intangible heritage. It is public, accessible and inclusive, promoting diversity and sustainability. The museum*

works with communities in an ethical and professional manner, offering a variety of experiences for education, entertainment, reflection and knowledge sharing." It is defined as such. This definition puts the function of museums in a broader perspective than just being a place where artifacts are exhibited.

The museum is positioned as a "place of memory" that documents the past, makes sense of the present and sheds light on the future. It also emphasizes that, as a non-profit institution, it should operate ethically and inclusively in the service of society. This definition shows that museums have a responsibility to create an educational and thought-provoking space in interaction with society, prioritizing the values of diversity and sustainability. By addressing conflicts and challenges, museums build community trust, preserve heritage and provide equal access. They aim to contribute to human dignity, social justice, global equality and prosperity through their non-profit, participatory and transparent structures (Kesebilir, 2021). In addition to the basic duties of museums such as collection building, conservation, documentation, exhibition and education, museums need to assume broader responsibilities to serve society (ICOM, 2004). These responsibilities identified by ICOM (2004) are listed as follows:

-Museums are institutions that preserve, scientifically analyze and promote the cultural and natural heritage of humanity.

-Museums are institutions that offer their existing collections for social development and public service.

-Museums are spaces that verify and develop knowledge and host objects that represent this knowledge.

-Museums are responsible for understanding, preserving and valorizing natural and cultural heritage.

-Museums should cooperate with other social institutions and organizations and make their collections accessible to them.

-Museums are a hub, providing objects and resources that other institutions and organizations can use in their activities.

-Museums operate in accordance with their own regulations and are obliged to comply with legal procedures.

-Museums should be managed by teams of specialized professionals.

In Turkey, museology is a process that started during the Ottoman Empire and gained its modern meaning in the Republican era. The need to preserve, exhibit and transfer historical artifacts to the future has shaped museum studies since the Ottoman period (Özrili, 2023; Keçeli, 2024). The Republican era was a period in which museums ceased to be mere exhibition spaces and became important tools in the construction of national identity. The understanding of museology in the Ottoman Empire began to take shape in the 19th century under the influence

of the West. In this process, regulations made to prevent the smuggling of historical artifacts abroad were an important step. The first museum in the Ottoman Empire was the Tarih-i Tabii Museum (Zoology Museum) opened by Austrian Ambroise Bernard at the Galatasaray Mekteb-i Tıbbiye-i Fünun-i Şahane in 1839. In 1846, Fethi Ahmet Pasha, the Minister of War, laid the foundations of both a military museum and an archaeology museum. While the Museums Act was published in England in 1845, authorizing municipalities to build art and science museums, the Ottoman Empire enacted the Âsâr-ı Atîka Regulation in 1874. With Osman Hamdi Bey's appointment as director of the Museum-i Hümayun in 1881, Ottoman museology entered a new era (Ata, 2015). During the Republican period, museology was developed as part of Turkey's efforts to protect its cultural heritage and build its national identity. Under Atatürk's directives, Topkapı Palace was opened to the public as a museum in 1924. Founded in 1925, the Museum of Anatolian Civilizations in Ankara has an important place as a museum exhibiting Anatolian civilizations from prehistory to the Ottoman period (Keçeli, 2024). During the Republican era, museology was an important part of Turkey's efforts to preserve its cultural heritage and build its national identity. Under Atatürk's leadership, museums were shaped as centers of education and culture. In this context, the opening of Topkapı Palace to the public as a museum in 1924, Konya Mevlâna Museum (1927), and Istanbul State Museum of Painting and Sculpture (1937) were important steps in the preservation and exhibition of historical buildings inherited from the Ottoman period (Özrili, 2023, p. 19). In 1925, the Museum of Anatolian Civilizations was established in Ankara, which became one of the first comprehensive museums to exhibit Anatolian civilizations from prehistory to the Ottoman period. In the 1930s, in line with the Republic's nation-building policies, new museums were established and legal arrangements were made to improve existing museums (Keçeli, 2024, p. 3).

Since the early years of the Republic, museology and art activities have been treated as a priority area and important steps have been taken to develop these activities. Turkey's accession to UNESCO in 1945 and later to ICOM paved the way for the establishment of an institutional structure in the field of museology. In the following periods, development in this field continued and made it possible for modern museums to become widespread in public or private museums (Bilir, 2023).

Museums are institutions established to preserve, exhibit and support learning about human history and culture. Although their definitions and functions vary across cultures, they are generally accepted as centers of education and learning on subjects such as history, art, science and nature. Museums concretize learning and increase its permanence by providing students with visual and auditory experiences (Bilir, 2023). Museums have an important place in the learning and experiencing processes of individuals in the modern world thanks to their conservation and educational functions as well as their structures developed with technological innovations.

Museums can be classified according to their collections, the institutions they are affiliated with, their service areas, the place where they exhibit the collection, and their functions (Özkan, 2010; Sezgin & Karaman, 2009). According to the collection, museums are museums classified according to the type, period and thematic scope of the objects they exhibit. These museums are organized according to the interests and needs of the society by

focusing on a specific subject. These can be exemplified as general museums, archaeology museums, art museums, ethnography museums, industrial museums, history museums, science and technology museums, natural history and science museums. According to their affiliation, museums can be classified according to their administrative structure and affiliated institutions. This classification is an important element that affects the management of the resources of museums, the preservation of collections and their access to the public. These include municipal museums, state museums, private museums, city museums, foundation museums, military museums, and museums affiliated to educational institutions. According to their service areas, museums are classified as institutions that serve a specific region or community geographically or thematically. These can be exemplified as regional museums, folk museums, eco museums (Sezgin & Karaman, 2009). According to the places where they exhibit their collections, museums can be classified according to the physical characteristics and display methods of the places where they exhibit their collections. These can be exemplified as open-air museums, monumental museums and museum houses. According to their functions, different museums can be exemplified as one-person or one-object museums, Atatürk (museum houses), revolution museums and virtual museums. Other museums are specialized museums (museums gathered around a certain subject, toy museum, kite museum, etc.), children's museum, submarine museum and sports museum (Sezgin & Karaman, 2009).

Use of Museums in Education

Museums are institutions that provide people with the opportunity to learn about the world they live in and function to educate society by housing objects from the natural world and the past. Since the 20th century, developments in education have encouraged museums to use their collections for educational purposes and to make arrangements for visitors to actively participate in exhibitions. For this reason, museums today consider developing programs for children, students and educational institutions as one of their main duties (Filiz, 2010; Onur, 2003; Hooper-Greenhill, 1999).

Museum pedagogy, which consists of the relationship between education and museums, aims to evaluate museums as an effective learning environment in basic education processes and lifelong learning experiences of individuals (Adıgüzel, 2002). Museum pedagogy aims to support individuals to produce knowledge by interacting with objects, to organize the museum environment in accordance with needs and expectations, and to create active learning environments. Achieving these goals requires designing museums in an education-oriented manner, cooperating with schools and other educational institutions, and making effective use of information technologies (Paykoç & Baykal, 2000).

Museums are not only places where historical artifacts are preserved and exhibited, but also educational centers where individuals increase their knowledge through learning and cultural interaction. In contemporary educational approaches, museums are environments that take learning outside the classroom environment and enable individuals to learn through observation, analysis and experience (Nacar, 2019). By assuming an innovative role in education, museums enable individuals not only to acquire knowledge but also to understand

this knowledge in depth. Educational activities in museums allow individuals to gain awareness of history, art and culture and develop a broader worldview. In this context, the use of museums in education should be recognized as an important tool that enriches learning processes. Museums, which allow objects to be examined from various perspectives with different teaching methods, can be used repeatedly as an educational environment. In this direction, the education offered by each museum has a character specific to its own context. The interaction of individuals with objects in museums allows learning to support intellectual development from concrete to abstract, from observation to generalization. In addition, museums not only provide opportunities for learning by having fun, but also contribute to the development of individuals' aesthetic sensitivity and imagination (Onur, 2003).

Museums are institutions that stand out with their potential to provide an effective educational environment and operate in this direction in many countries. While one of the main goals of formal education is to prepare children for the future by starting education at an early age, children play an important role in the role of museums in education. Museums enable children to see and recognize artistic elements by using their different senses and information acquisition channels, and contribute to the development of abstract thinking skills. In addition, the fact that museums exhibit the common heritage of society is of great importance in terms of strengthening children's ties with society. Museum education is a contemporary approach that supports students' participation in active learning processes based on research, observation and experimentation, which makes it possible to examine artifacts and the messages they convey (Turanlı, 2012). The use of museums in education makes many contributions to individuals' learning processes. By providing a highly interactive environment, it allows students to develop creative thinking, problem solving and critical analysis skills. By arousing students' curiosity about historical and cultural issues, it enables them to participate more actively in the learning process. Exhibiting works from various cultures not only supports individuals in understanding cultural diversity and fostering empathy (Nacar, 2019) but also encourages these outcomes through the same means (Uçar, 2014). Beyond the aforementioned benefits of utilizing museums in education, İlhan and Okvuran (2001) outline the fundamental contributions of museum visits for children as follows:

-Museum education enhances the active participation of attendees, particularly children, by enabling them to gain experience through seeing, touching, smelling, and using tools.

-Children can work more independently in museums compared to traditional school environments.

-It facilitates the concretization of abstract knowledge.

-Museums maintain the relevance of history and the past, fostering a connection between the past and the present and providing a deeper insight into history.

-They offer an enjoyable and engaging learning environment for both children and adults.

Museums in the Perspective of the History of Science

The history of science is a discipline that examines the processes through which knowledge has evolved into what is now referred to as scientific knowledge, the contributions made to science during different periods and their contexts, as well as the methods, tools, and works employed by scientists during these advancements (Tekeli et al., 2021). The history of science can be regarded as a field that examines the definition, origins, and developmental processes of science; the biographies of individuals who contributed to science; scientific institutions and instruments; the relationship between science and economic, political, religious, and social contexts; and the transmission of scientific knowledge across different cultures (Fazlıoğlu, 2004, p. 11). Individuals who study the history of science recognize its dynamic, continuously evolving, and progressive nature, which enables them to understand the role of science in human life (Şimşek & Şimşek, 2010). Education in the history of science provides individuals with a holistic perspective on the progression of scientific advancements and technological innovations from the past to the present. A study incorporating various examples from the history of science can offer significant insights into the functioning of science and even how it can be made more effective (Maienschein, 2000). Museums, particularly history of science museums, play an active role in conveying these critical insights by presenting a comprehensive view of the evolution and development of science through time (Şimşek & Şimşek, 2010). History of science museums are spaces that bear the traces of humanity's journey of scientific discovery, transporting curious minds to the past while offering perspectives on the future. The instruments, experimental setups, and documents exhibited in these museums illustrate how scientific thought has evolved and shaped human life. Such museums serve as essential tools for understanding the historical context of scientific discoveries and the societal impacts of science. They approach science not merely as a domain of knowledge but as a process that has significantly influenced the transformation of societies throughout history. Educational activities conducted in history of science museums contribute to teaching scientific events and discoveries from a historical perspective, while also fostering critical thinking and problem-solving skills in individuals.

History of science museums aim to foster an understanding of the historical context of scientific thought, discoveries, and technologies, as well as to demonstrate how science has shaped and transformed societies throughout history. By elucidating the historical background of scientific advancements, these museums enable visitors to comprehend the impacts of scientific discoveries within their historical trajectories. An exemplary institution in Turkey is the Museum of the History of Islamic Science and Technology, established by Prof. Dr. Fuat Sezgin, a globally renowned historian of science. Nearly all of the approximately 700 artifacts housed in the museum were acquired through Fuat Sezgin's efforts and donations. Currently located within Gülhane Park in one of the historic auxiliary buildings of Topkapı Palace, the museum offers a comprehensive perspective on the inventions and discoveries made by Muslim scientists over centuries, highlighting the development of various branches of science. This unique feature positions it as a pioneering initiative worldwide. A study conducted by İnce (2021) identified the Museum of the History of Islamic Science and Technology as a significant institution for introducing young generations to the history of Islamic science. The study also revealed that museum visits

by students enhanced their knowledge of history and geography, fostered scientific and historical awareness related to geography, facilitated the development of social relationships during the visit, and increased their awareness of the historical and cultural features of their city. From this perspective, educational activities and visits to history of science museums are invaluable for explaining the historical context of scientific advancements. Instructional approaches based on the history of science are engaging and enjoyable, while also positively contributing to the development of scientific skills and supporting the cognitive and affective domains of learning (Koştur, 2016). Alongside history of science museums, science and technology museums also provide educational environments, especially for children and young people, by enhancing their understanding of scientific concepts and technological innovations, as well as sparking curiosity about scientific and technical knowledge. Science and technology museums are dedicated to teaching modern science and technology, explaining scientific theories and principles, and showcasing technological advancements. These museums, often featuring interactive exhibits, experimental zones, and hands-on activities, promote learning in a dynamic and engaging manner.

In the contemporary era of rapidly advancing science and technology, the significance of science and technology museums has grown immensely. Beyond exhibiting the technologies developed by humanity, these museums enable visitors to conduct informative experiments related to these technologies. Their interactive nature, allowing visitors to engage directly with the displayed objects rather than merely observing them, distinguishes science and technology museums from other types of museums (Bozdoğan, 2007). In Turkey, prominent examples include the METU Science and Technology Museum, Rahmi M. Koç Museum of Industry, Merinos Energy Museum, and M.S.Ö. Aviation and Space Museum. These institutions stand out as venues that address science and technology from both historical and contemporary perspectives. Their objectives encompass introducing scientific and technological concepts to society, fostering scientific awareness, and inspiring curiosity, particularly among younger generations. Through methods such as interactive exhibits, educational workshops, and guided tours, they encourage active visitor participation in the learning process. Additionally, these museums illuminate significant discoveries and processes in the history of science and technology, providing society with insights into the historical context of scientific achievements. With diverse collections focused on various themes, they span a wide range of artifacts, from historical objects to modern technologies. Far beyond being mere exhibition spaces, science and technology museums serve as educational centers that support science-based learning, nurturing skills such as observation, analysis, and critical thinking. In this context, science and technology museums play a pivotal role in disseminating a societal culture of science and making scientific knowledge more accessible.

SCIENCE CENTERS AND THE HISTORY OF SCIENCE

The Primary Objectives and Functions of Science Centers

Science centers are specialized institutions that aim to make science accessible to a broad segment of society and to promote the popularization of scientific knowledge. By facilitating the understanding of scientific

advancements within a historical context, these centers also contribute to education through interactive learning methods. This study examines the primary objectives and functions of science centers from the perspective of the history of science.

The Historical Context of Science Centers

In ancient The modern formation of science centers dates back to the early 20th century. Among the first examples is the Chicago Museum of Science and Industry (1933) in the United States, which, with its interactive exhibits, became one of the cornerstones of science centers (Danilov, 2010, pp. 3–4). In Turkey, the first science center was established on April 23, 1993, in Ankara with the support of the Ankara Metropolitan Municipality. Named after the world-renowned Turkish physicist and mathematician Feza Gürsey, the Feza Gürsey Science Center served as Turkey's sole science center for nearly a decade. Since 2005, the number of science centers has increased rapidly with the support of various institutions, including universities, municipalities, foundations, and associations (Öner & Öztürk, 2019, p. 3).

The Industrial Revolution played a crucial role in making science and technology accessible to the general public. During this period, science and technology museums became widespread, disseminating scientific knowledge to society through interactive exhibits and educational activities. Institutions such as the Franklin Institute and the Deutsches Museum emerged as pioneers in this domain (Danilov, 2010, pp. 7–9).

Core Objectives

Scientific Awareness and Public Engagement

The primary goal of science centers is to cultivate scientific awareness among individuals and make science comprehensible to everyone. Events and programs held at these centers help the public better understand scientific concepts. For instance, student programs organized by the Konya Science Center exemplify this objective (Koyuncu et al., 2016, p. 72).

Interactive Learning Experiences

One of the most distinctive features of science centers is their ability to allow visitors to learn by experiencing scientific processes firsthand. For instance, interactive exhibits and simulations make complex scientific concepts more tangible, thereby facilitating the learning process (Danilov, 2010, pp. 5–6).

Introducing the Perspective of the History of Science

Science centers provide visitors with a perspective on the history of science by enabling them to understand past scientific achievements and processes. This plays a crucial role in comprehending the social context of science (Fazlıoğlu, 2004, pp. 10–12).

Functions

Education and Training

Science centers serve as effective learning environments that support school curricula, particularly in science education and STEM fields. Hands-on and experiential learning methods form the foundation of the experiences offered by these centers. For instance, the Student Visit and Education Program (ÖZEP) conducted at the Konya Science Center enabled students to better understand scientific concepts and positively influenced their attitudes toward science (Koyuncu et al., 2016). Similarly, interactive exhibits and experimental kits utilized in such centers make significant contributions to concretizing abstract concepts (Çığrık, 2016, pp. 82–84).

Bringing Science to Society

Science centers organize large-scale events to make science accessible to all segments of society. In Turkey, TÜBİTAK-supported projects have played a crucial role in establishing and enhancing the functionality of science centers. For example, the Konya Science Center, established with TÜBİTAK's support, facilitates society's engagement with science through interactive exhibits and science festivals. These activities have significantly contributed to increasing scientific awareness and fostering public interest in science (Koyuncu et al., 2016, p. 72; Konya Science Center, 2024). When designed with consideration for age-appropriate features, these centers aim to inspire a love for science in young individuals and promote scientific thinking across society (Bozdoğan, 2008, p. 20).

A Culturel and Historical Bridge

Science centers play a vital role in connecting past scientific achievements with the present and fostering an understanding of the historical context of science. They highlight the scientific advancements that followed the Industrial Revolution and the societal impacts of these processes. Davidsson and Jakobsson (2012) emphasize that such centers are valuable resources for helping visitors understand the historical and cultural dimensions of science (pp. 3–4). Similarly, Danilov (2010) notes that these centers make science accessible to the public rather than restricting it to a domain of expertise, thus contributing to the popularization of scientific knowledge (pp. 4–5).

Science centers hold a critical role in bridging science and society, enhancing individuals' scientific thinking skills, and popularizing scientific knowledge. Through activities catering to different age groups and interactive learning environments, they contribute to both individual education and the promotion of scientific awareness within society. Furthermore, by connecting past scientific achievements with the present, they provide valuable insights into the historical role of science. To create more effective science centers, it is recommended that they be more closely integrated with school curricula, increase the availability of interactive materials, and organize more workshops and activities for the public

Science History-Focused Activities in Science Centers

Science centers play a significant role in bridging science with society and fostering an understanding of the history of science. These centers present the historical development of science through interactive and experiential methods, enabling visitors to comprehend abstract concepts in a more tangible way (Çığrık, 2016). Science history-focused activities are an integral part of this process, emphasizing the impact of science from past to present.

Such activities aim not only to teach the historical progression of science but also to highlight the challenges faced by scientists and how they overcame these obstacles. These events have the potential to inspire young individuals by drawing lessons from the lives of scientists, encouraging them to pursue an interest in science (Unat, 2017, p. 14).

Types and Contributions of Science History-Focused Activities

Exhibitions Based on Historical Figures

Interactive historical experience zones allow visitors to reenact past scientific processes. For example, centers like the Chicago Museum of Science and Industry, Konya Science Center, and Ankara Feza Gürsey Science Center combine historical experiences with modern technology, making the history of science both engaging and educational (Danilov, 2010, pp. 3–4).

Workshops and Seminars

Science centers offer science history-focused workshops and seminars, providing unique learning opportunities for both students and teachers. Such activities enable participants to experience the historical development of science while enhancing their scientific thinking skills (Danilov, 2010, p. 5). In Turkey, science centers also organize workshops emphasizing the progression of science from past to present. For example, the educational programs at the Konya Science Center aim to provide students with a historical perspective by enriching science history education with hands-on activities (Çolakoğlu, 2017, p. 2). Another significant aspect of these activities is related to teacher education. Seminars designed for teachers at science centers offer guidance on integrating science history themes into lessons and provide opportunities to enhance teaching methods (Çığrık, 2016). Additionally, digital platforms such as virtual science centers enable these activities to reach a wider audience (Tan & Subramaniam, 2005).

The impact of science history-focused activities on individuals and society is substantial. Understanding the historical role of science contributes to the development of critical thinking skills in individuals (Yıldırım, 1974, p. 5). Moreover, the stories of past scientists inspire young people to pursue careers in science (Unat, 2017, p. 14). Science centers are indispensable spaces for teaching and popularizing the history of science. From exhibitions based on historical figures to interactive experience zones, these activities enhance the societal impact of

science. Therefore, it is recommended to further integrate science center programs into educational curricula and to increase the use of digital technologies in such activities.

Examples of Scıence Centers: From Turkey and Around the World

Examples from Turkey

-**Konya Science Center** opened in 2014, the Konya Science Center is Turkey's first TÜBİTAK-supported science center. It stands out with its interactive exhibits and educational programs, offering visitors the opportunity to learn scientific concepts through hands-on experiences (Koyuncu et al., 2016, p. 71).

-**Feza Gürsey Science Center** located in Ankara, the Feza Gürsey Science Center is a significant milestone in the history of science centers in Turkey. The experimental kits and activities offered here are designed to contribute to the understanding of scientific principles (Bozdoğan, 2008, p. 20).

-**Kayseri Science Center** established through collaboration between TÜBİTAK and local authorities, the Kayseri Science Center organizes large-scale events to promote science to all segments of society. Through workshops, scientific demonstrations, and traveling science exhibits, this center provides an educational environment for both children and adults (Çolakoğlu, 2017, p. 3).

In addition to these, numerous other science centers have been established across Turkey, many through municipal initiatives and some with university support. Notable examples include: Kocaeli Science Center, Bursa Science Center, Elâzığ Science Center, Üsküdar Science Center, Antalya Science Center, Trabzon Özdemir Bayraktar Science Center, İTÜ Science Center, Gaziantep Science Center, METU Science and Technology Museum, Ödemiş Trial and Science Center, Şişli Municipality Science Center (TÜBİTAK, 2024).

Examples from Around the World

-**Exploratorium (San Francisco, USA)** The Exploratorium is a pioneering science center renowned for its interactive science exhibits. Established in 1969 by Frank Oppenheimer, the center aims to present scientific experiences in an engaging and educational manner. Its exhibits, which allow visitors to conduct experiments, have served as a model for many future science centers across the United States (Danilov, 2010, p. 4).

-**Heureka Science Center (Finland)** Heureka focuses on increasing young people's interest in science through various activities. The center's programs encourage family participation, aiming to enhance scientific awareness across society. Heureka is recognized for its innovative approaches, which integrate physical and virtual learning environments (Salmi, 2003, p. 327).

-**Deutsches Museum (Munich, Germany)** The Deutsches Museum, founded in 1903 by Oskar von Miller and opened to the public in 1906, is acknowledged as the world's first interactive science and technology museum showcasing the historical development of science and technology. Miller envisioned making science and technology accessible to all segments of society while enabling visitors to engage directly with the exhibited devices. The museum's historical artifacts, working models, and hands-on demonstrations contribute to visitors' understanding of fundamental scientific principles (Danilov, 2010, p. 8).

-**Ontario Science Centre (Toronto, Canada)** Another influential science center is the Ontario Science Centre, which opened in 1969 in Toronto. Like the Exploratorium, it introduced a new tradition of interactivity. Visitor engagement and participation are central to its concept. With over 50,000 square meters of indoor space and 13,000 square meters of exhibition area, the center features more than 800 exhibit units (TÜBİTAK, 2024).

Science centers are vital institutions that facilitate public access to scientific knowledge and enable individuals to engage with science. Examples from Turkey and around the world demonstrate that these centers contribute significantly across a broad spectrum, from education to fostering societal awareness. Ensuring the sustainability of these centers and supporting innovative approaches such as virtual science centers will enable them to reach even wider audiences in the future.

CONCLUSION

History of science is a critical discipline not only for understanding scientific discoveries of the past, but also for grasping the role of science in social transformations. However, current practices in this field do not reach a wide enough audience and remain limited, especially in education systems. Museums and science centers offer unique learning environments that can fill this gap by embodying the historical journey of science. In this context, the research sheds light on the educational and social effects of these areas by addressing the popularization of the history of science in education through museums and science centers.

The history of science not only teaches students scientific concepts, but also enables them to understand the historical processes of science, its impact on societies and its cultural contexts. However, educational curricula often ignore this dimension and treat the history of science as an abstract subject. This makes it difficult to grasp the dynamic nature of science and limits the broad perspective that history of science offers to students. Museums and science centers are unique learning environments that can present the history of science in a more accessible and effective way. The research shows that the interactive structure of these centers facilitates learning by making abstract scientific concepts concrete. Examples such as Konya Science Center and the Museum of the History of Islamic Science and Technology are concrete indicators of the potential in this area. However, it is also among the findings that the history of science-themed content of these centers should be increased.

Studies on the history of science, museums and science centers mostly focus on these fields separately. This does not provide enough information on the integration and interaction of these three fields. The limited number of studies on museum and science center practices with a focus on the history of science in the Turkish context creates an important gap, especially in the integration of these centers into education.

Science centers and museums have the potential to raise scientific awareness in different segments of society. However, innovative methods are needed for these centers to reach large segments of society. Digitalization and virtual science centers offer an important opportunity in this context. Especially for individuals in rural areas, virtual environments can increase access to the history of science. Integration into Educational Curricula: The history of science should become an integral part of educational curricula. Science and social studies courses should be restructured to include the history of science. This integration would help students understand that science is not merely a collection of technical knowledge but also shaped by societal and cultural contexts. Effective Use of Science Centers and Museums: Science centers and museums should enrich their content with a focus on the history of science and organize activities emphasizing this field. For instance, presenting the life stories and works of past scientists through interactive exhibits could increase visitors' interest in science. Centers such as the Konya Science Center in Turkey should expand such content to appeal to a broader audience. Digitization and Virtual Science Centers: Science centers need to adapt more to the process of digitization. Virtual science centers can provide an alternative learning environment for individuals without access to physical centers and help convey the historical development of science to a wider audience. Technologies like augmented reality (AR) and virtual reality (VR) can be used effectively in this context. The findings of this study indicate that the history of science can be used more effectively in education through science centers and museums. However, realizing this potential fully requires innovative approaches in areas such as curriculum integration, digitization, teacher training, and societal awareness. By following these recommendations, the history of science could reach a wider audience at both individual and societal levels, amplifying the impact of science on society.

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