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TURKEY

From the Ottoman Empire to the Republic

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1. Historical development of science communication in Turkey: Summarising crucial milestones

The scientific and industrial revolutions that emerged from the mid-18th century onwards divided countries into two streams: the developed and the less developed. Science communication became a key feature of developed countries. Partly due to other priorities, Turkey joined this trend rather late. This section presents the history of science communication in Turkey by dealing separately with the Ottoman Empire and the entity that succeeded it, the Republic of Turkey. The main focus will be on the Republic, which began in 1923.

In the Ottoman Empire's policies, applied sciences (engineering, medicine) were given priority in order to meet military, medical and agricultural needs, followed by physical sciences (chemistry, physics, astronomy, etc.) and mathematics to support the applied sciences (Dursun, 2009). The social sciences had a later stage of development than the applied and physical sciences (Dursun, 2009).

The Empire period spanned more than 600 years starting in 1299 as a multinational reign including *millets*,[1] like Muslim, Armenian, Syriac and Roman. During the reign, especially in the early establishment years, studies

1 In the Ottoman Empire, a *millet* was an independent court of law pertaining to 'personal law' under which a confessional community (a group abiding by the laws of Muslim Sharia, Christian Cannon law or Jewish Halakha) was allowed to rule itself under its own laws.

of science were encouraged. Istanbul Observatory (1557–60) and nearly 300 *medreses* (learning centres) were established and welcomed students from all over the world to study and conduct research in mathematics, astronomy, philosophy and religious sciences (Ihsanoglu, 2007). The first higher education institute, Mühendishane-i Bahri Hümayun, was established in 1773 to train engineers and soldiers.

From the 17th century onward, the Ottoman Empire began to lose its power. In an attempt to regain this power, a modernisation project with a European influence was put into practice: Tanzimat (1839–76). In the Tanzimat period (meaning reorganisation) many social, military, political, economic and educational reforms similar to those in the West were promulgated. Examples of social and educational ones are as follows: the first public education system, the first modern university (Darülfünun), establishment of a private press sector, the first telegraph. From the beginning of 1800s to the 1900s there was a remarkable investment in scholarships program that sent students to Europe for education (Gencoglu, 2008; Sisman, 2004). Most of these students, especially those sent in Tanzimat period, were studying basic science.

Despite all these efforts at reform and modernisation, the Ottoman Empire came to an end after World War I, when it was replaced by the Republic of Turkey in 1923. The new state, formed according to the nation-state model, would build new institutions and renovate old ones. The new government, under the presidency of Mustafa Kemal Atatürk—a towering figure of the 20th century—carried out crucial reforms in different spheres, including science. In the field of education, many reforms were introduced to inform the public in various fields and to teach them to read and write. These include alphabet reform, secular education, women's rights, village institutes and *millet mektepleri* (society schools). The new era with Atatürk began with high hopes for modernisation, a society with a strong science-based foundation, and a science-literate community. He fought to build a democratic, strong and modern state based on science: 'Science is the most reliable guide for civilisation, for life, for success in the world. Searching a guide other than science means carelessness, ignorance and heresy' (from Atatürk's speech to teachers in Samsun in 1924) (Atatürk Research Center, 2019).

In these early years of the Republic, educational reforms were made so that science and technology could develop. Reforms in industry and the economy followed education.

The first systematic movement in education was the Maarif Kongresi (Congress of Education) in 1921. The aim of this congress was giving 'a national direction to education' (Akyuz, 1983). The second step was Tevhid-i Tedrisat Kanunu (Law on Unification of Education). By means of the law, in 1924, all institutions (e.g. religious, secular, foreign) were gathered under the umbrella of the Ministry of National Education. In these times, the economy was mostly based on agriculture. The steps to be taken for the purpose of development were determined in 1923 at the first economic congress in Izmir. In this congress, Atatürk and deputy minister of economy Esat Bozkurt underlined the necessity of economic development and growing the national economy. In a public speech in Alaşehir in 1923, soon after the Izmir Economy Congress, Atatürk said:

> Following the military triumph we accomplished by bayonets, weapons and blood, we shall strive to win victories in such fields as culture, scholarship, science, and economics … the enduring benefits of victories depend only on the existence of an army of education. (Atatürk Research Center, 2019)

In parallel with these thoughts, in the early years of the Republic, there was an emphasis on the principles of science and technological transformation as never before seen in the history of Turkey (Bahadir, 2001; Inonu, 1999). By means of technology transfer, sugar and cement factories were built. In 1924 the High School of Mining Engineering in Zonguldak was established. Due to the worldwide 1929 economic crisis, the Second Economy Congress convened in 1930 adopted a statist model (where the state has substantial centralised control over social and economic affairs). Despite the worsening economy in the crisis, in the 1930s Turkey sent students (mainly engineering students and technical personnel) to Europe for education, to train them to work in industry.

One can say that few nations in the world have ever experienced the massive changes that Atatürk triggered in Turkey in such a short period of time. The Atatürk era began with high hopes for science and a science-literate community. However, these attempts were not enough to match modern Western science and other issues and turbulent times pushed science off the national agenda. The young state of Turkey had to focus on the need to build itself quickly. During the Republic's early years, science and technology transfer was seen as an easy and practical way to help achieve this aim. Yet, unfortunately, the importance and meaning of technological production based on science was not sufficiently comprehended even in the 21st century. Science was generally a low priority and despite the good intentions contained in many five-year development plans, national investment in

science has continued to be low. It was not until 1963 that a national agency TUBITAK (the Scientific and Technological Research Council of Turkey) with a responsibility for science and science communication was created. Science coverage in the media has been weak and there are only few programs to train science journalists and science communicators. Nonetheless, there are promising developments: the number of science centres has increased rapidly over the years, and research in science communication is a new but active field. In the following sections, these issues will be discussed in detail.

1.1. Science policies and funding bodies in science communication

In order to talk about the emergence of science communication in the Republic of Turkey (after 1923), one might begin a chain with the establishment of the first university. The University Reform Act in 1933 can be considered the first link. After this Act, science in Turkey flourished (Inonu, 1999). In the same year, Istanbul University (formerly Darülfünun) was established. These were the first steps in the institutionalisation of science. Following Istanbul University, Gazi University (formerly Gazi Teacher Training Institute) (1926) and Ankara University (1946) were founded as initiatives of Atatürk. Education was considered important as a transformation agent to develop Turkey into a 'modern' society.

With the 1946 law on universities, administrative autonomy and legal status were given to universities and their duties were documented. This documentation gave a framework to the universities in their responsibilities for communicating science. At this time, Turkey was lagging behind many other Western countries in its institutionalisation of science. The institutionalisation of science in Turkey was clearly established with the formation of TUBITAK in 1963. This was the second link. In this manner, science was coordinated by a structure separate from universities. For Türkcan (2001), the establishment of TUBITAK is the start of science policy in Turkey. The purpose of TUBITAK was described as follows:

> In Turkey, to develop science-based research and development activities according to the priorities of the country's development, to encourage, organise and coordinate the activities and to access the available scientific and technical information and ensure availability (Official Gazette, 1963, p. 7).

Another important link in the chain of science policy in Turkey was the OECD Science and Development: Pilot Teams Project. The aim of this project was to highlight scientific activities as an important factor in economic growth and promote the idea that these activities should be the subject of a planned

policy at the national level (OECD, 1967). Historical and economic analysis indicated that Turkey needed to formulate research facilities to manage the dynamics between science, technology, manufacture and development, with important implications for communication.

1.2. Media and science journalism

The first newspapers of the republican era, *Emel* (published in Amasya in 1920), *İntibah* (published in Bursa in 1921), and *Küçük Mecmua* (published in Diyarbakir in 1922), mainly covered political news rather than science. When science journalism of the Republic of Turkey is considered, given the decrease that occurred in the number of pages in newspapers in the 1930s, it appears that science news was mostly affected negatively (Kologlu, 1997). In 1945, with the transition to multi-party life on the political scene, science and technology news was neglected (Kologlu, 1997). In any case, the media is not designed to build public engagement in science.

Ten months after the announcement of the Republic in 1923, *Muallimler Mecmuasi* was the only scientific journal (Bahadir, 2001). The contents included subjects such as atoms, heat and mechanics. Over the next few years of the Republic, between 1923 and 1928, six science journals were published: *Muallimler Mecmuasi*, *Darülfünun Fen Fakültesi Mecmuasi*, *Mühendis Mektebi Mecmuasi*, *Kimya ve Sanayi Mecmuasi*, *Fen Alemi Dergisi* and *Tabiat Alemi Dergisi*. *Darülfünun Fen Fakültesi Mecmuasi* was the first new scientific journal of the Republican era. Among these journals, *Fen Alemi Dergisi* (January 1925 – December 1926) was the first popular science journal in Turkey. Subjects covered in the first issue of this journal included airways, electricity in the houses, white coal and new style ships. In the same year, 1925, a second popular science journal was published in Turkey: *Tabiat Alemi Dergisi*. In the following decades there were no other popular science journals besides these two until the TUBITAK publication *Bilim Teknik* [Science Technology] started in 1967. Today, TUBITAK, with four high-circulation popular science journals, continues its successful dissemination activities.

Media tools are important in communicating science. Radio broadcasting began in 1921 and TV was introduced to Turkey in 1952. The first broadcasts were basically culture and art programs. In the following years, with an increasing number of channels, science news—mostly translated from international news agencies—appeared on TV. When it comes to science communication in the media, there are now many popular science journals (for example, *Herkese Bilim ve Teknoloji*, *Bilim ve Teknik*, *Bilim Çocuk*, *Merakli Minik*, *Bilim ve Ütopya*, *Bilim ve Gelecek, Eğlenceli Bilim Dergisi*) and also science, technology and innovation news in newspapers, but most

newspapers do not have separate section for science. Dursun, Becerikli and Dursun (2010) investigated the visibility and representation of science news in printed media in Turkey between 1993 and 2008. They analysed a total of 4,568 science news items in three high-circulation Turkish newspapers. According to the results, science news in the newspapers mainly covered medicine, biotechnology and health issues followed by astronomy, technology and nutrition news. Besides traditional media, another important initiative in social media channels is the 'Science Communication Platform of Turkey' and on the internet, bilimiletisimi.com.

1.3. Universities and public talks

When it comes to academic studies, there are not any specific departments to train professional science journalists (Becerikli, 2013), nor a national association for science journalists, nor a science news agency. There is not a specific department called 'science communication' in universities. However, there are some master's and PhD programs on issues related to science communication such as Science and Technology Policy Studies in the Middle East Technical University (METU), and a non-thesis program at Ankara University, called Science and Society Studies. The mission of the Science and Technology Policy Studies PhD program is explained in the following way on the department webpage (METU, 2018):

> PhD Program in Science and Technology Policy Studies is supported by various disciplines such as economics, administrative sciences, engineering, sociology, history, philosophy, communication and cultural studies … Recent developments in the knowledge-intensity of economic activity and rapid technological advancement have significant socio-economic repercussions at the level of nation states, regions, industries, markets, and firms. In this context the program aims to confront the challenges by providing several concentration areas for policy making.

The first international science communication conference in Turkey, the 14th Conference of the Network for the Public Communication of Science and Technology (PCST), co-chaired by Prof. Dr Gultekin Cakmakci and Brian Trench, was hosted in 2016 in Istanbul, Turkey. More than 400 international science communication scholars, researchers and practitioners participated in the conference. This was a unique experience for the host country and an important initiative to increase the awareness of science communication in Turkey. Prof. Dr Erkan Yuksel, Anadolu University, with his research team have been running an annual Health Communication Symposium[2] since 2015; however, there is not yet a national conference on science communication.

2 saglik-iletisimi.org.

Lastly, there are the Cafe Scientifique talks, first conducted by TUBITAK in 2014, which focus on young people at school-level. These activities—where expert speakers give information and are then asked questions by the participants—include elements of both the 'dialogue' and the 'deficit' models (Trench, 2008); nonetheless, elements of the 'participation' model also need to be considered in public engagement initiatives in Turkey.

2. Science communication policies and funding bodies in science communication

Turkey's longstanding aim, as articulated by Atatürk, has been 'to reach the level of contemporary civilisation'. In order to accomplish this aim, science and technology is important, as well as a science-aware community. The importance of the development in science and technology is appreciated and valued in Turkey; nonetheless, the importance of science communication in this process needs greater recognition (Bursali, 2000). Turkey has made plans for science (and, by implication, for science communication) but it has lacked the political will and the resources to carry out these plans effectively.

In the 1960s, science and technology policies were added to the agenda for economic and social development during the second Five-Year Development Plan period (1968–72) (State Personnel Presidency, 1969). The establishment of TUBITAK in 1963 was an important step toward the institutionalisation of science and technology. TUBITAK is an advisory agency to the government and responsible for science and technology policymaking together with the Supreme Council for Science and Technology. Its missions and responsibilities are:

1. to advance science and technology
2. conduct research and support Turkish researchers
3. promote, develop, organise, conduct and coordinate research and development in line with national targets and priorities (TUBITAK, 2018).

With the Division of Science and Society in TUBITAK, the following activities are coordinated:

1. to promote scientific literacy among the public
2. to raise awareness of science
3. to instil a culture of science, technology, and innovation (TUBITAK, 2018).

To this end, TUBITAK organises and supports activities by governmental institutions and universities that will engage the public with science. The other activity field of the Science and Society Division is popular science publications, as stated earlier.

Development plans including national and international goals and objectives are important in the history of Turkey. From the third Five-Year Development Plan (State Personnel Presidency, 1972) onward, the emphasis on technology is of note. In the fifth Five-Year Development Plan (State Personnel Presidency, 1984), 'keeping up with the developments in science and technology to mirror the rapid changes occurring in the world' (p. 15) is included. TUBITAK and universities were made responsible for achieving this aim.

In 1983, the Supreme Council for Science and Technology was established. The role of the council has an implied responsibility for science communication, which was explained in the following way:

> [the council] is the highest-ranking Science and Technology and Innovation policy-making body in Turkey with decision-making power and the role of identifying, monitoring and coordinating policies in Science and Technology areas in accordance with national goals for economic and social development and national security (TUBITAK 2010, p. 6).

The Supreme Council did not achieve its expected outcome. Minister of state Dr Nimet Ozdas (2000, p. 40) explained its lack of effectiveness:

> It was expected that this system would gain momentum as Science and Technology would enter the political agenda of the country with the effective operation of such a board. Unfortunately, this board held its first meeting in 1989, six years after its establishment. Thus, in Turkey is considered spent in vain one of the world's most precious resources in terms of both science and technology: time.

The first official policy document on science, the Turkish Science Policy 1983–2003 (TUBITAK, 1983), is a well-prepared and important document with the participation of various stakeholders. But the committee organised by the Turkish Supreme Council for Science and Technology to implement the policy efficiently failed to meet for many years and the report has never, in fact, been applied thoroughly. This negative situation regarding implementation can be blamed on reasons such as the failure of stakeholders to carry out their roles properly, different government priorities and problems in political stability, media indifference (as the main topic of those years was elections) and limited dissemination. Over the years, the various plans proposed a combination of deficit and dialogue model approaches.

During the 30-year period from 1963 to 1993, Turkey lacked an active, efficient and systematic science and technology policy (Yalcin and Yalova, 2005). In 1960s and 1970s, the science and technology policy in Turkey was mainly based on the promotion of research in the natural sciences (Saritas, Taymaz and Tumer, 2006).

To overcome these problems regarding the implementation of the plan, the Supreme Council for Science and Technology decided to prepare a project called Vision 2023 Technology Foresight. The project began by examining education, and the education system in Turkey was put under the spotlight in terms of quality and quantity (TUBITAK, 2005b). The report highlighted educational issues and also considered extending the involvement of the wider society and sectors in the economy, the level of political support, the integration of science and technology policies and other sectoral policies (Saritas, Taymaz and Tumer, 2006).

Like the *Turkish Science and Technology Policy 1993–2003* report (TUBITAK, 1993), the 1983 plans functioned to a limited extent. The stated aim in the 1993–2003 report is to catch up with world technology. In order to achieve this aim:

> the full and special production factors in the country should be made available to the educational system, and the scientific and technological research-development system should be improved with the most efficient use of country resources (TUBITAK, 1983, p. 8).

In terms of the emphasis on education, it is possible to trace the 'deficit model' effect and education orientation in the report. In the 'deficit model', education is considered the most fundamental way to eliminate the lack of knowledge. Besides education, the report also emphasises the importance of research and development facilities.

In 2004, TUBITAK published another document, *Vision 2023: Science and Technology Policy*. In this report, public awareness and public participation were given official emphasis: 'In every segment of society, awareness-raising … should be coordinated, and systems should be established to ensure wide participation in such activities' (TUBITAK, 2004, p. 32). Within this aim, attention is drawn to the mission of education. Therefore, the report has signs of the 'deficit model' and 'dialogue model' as discussed by Bucchi (2009) and Trench (2008).

In 2005, TUBITAK published its *Science and Technology Policies Implementation Plan*. In this plan, some actions are identified as being of considerable importance in developing an awareness of science and technology and 'encouraging the active participation of social actors in decision-making processes' (p. 5). This kind of active participation might be evidence of the 'dialogue model'.

One of the most recent plans, TUBITAK's *2018–2022 Strategic Plan* (2018), highlights the importance of expanding the culture of science, technology and innovation in society and increasing awareness. Not surprisingly, it is possible to see traces of common elements in science/technology policy and education policy. For instance, it is noteworthy that in the Ministry of National Education *2015–2019 Strategic Plan* (2015), the idea of forming science classes and organising science fairs so that students will be able to evaluate events and facts from a scientific point of view shares common ground with the public focus in recent national science and technology plans and reports.

In today's Turkey, there is no report that specifically uses the terminology of 'science communication'. Instead, we can trace science communication as 'science and society' in the policy documents. Although there are some awards for science writing (for example, the Sedat Simavi Award) and funding bodies like foundations and associations, government and public support for science communication is limited. Nevertheless, TUBITAK encourages scientific publications and research with a program initiated in 1993 (Arioglu and Girgin, 2003), and Bilim Akademisi (Academy of Science) and TUBA (the Turkish Academy of Sciences) have awards, grants and projects. TUBA defines part of its mission as:

> to give direction to the science policies of our country, to give all stakeholders science-based consultancy service, to encourage science and scientists, to make people adopt scientific thinking, to work for making 'Turkish' a science language, and to fortify international scientific collaboration representing our country internationally.[3]

3. Science communication in informal environments

3.1. Science centres

Science and technology centres were included in development plans in 2001, with the eighth Five-Year Development Plan (State Personnel Presidency, 2001). The following statement from the plan was important in explaining public engagement in science: 'Interactive Science and Technology Centers will be established and developed in such a way as to support formal education, in order to make science, technology, and society come closer together.'

Looking at the nature of museums in Turkey, there has been a wide variety of museums in different fields, but the first science centre, Feza Gürsey Science Center, was established in 1993 in Ankara. This science centre was established and run by

3 See www.tuba.gov.tr/tr.

Ankara Municipality. Partly based on this successful initiative, other municipalities in different cities and towns started to do public engagement activities in science and technology. Table 37.1 shows the science museums, science centres, observatories and planetariums established thereafter in different cities.

Table 37.1. Main science centres in Turkey.

Name	Established	City	Mainly funded/run by
Feza Gürsey Science Center	1993	Ankara	Ankara Municipality
Deneme Science Center	1998	Istanbul	Science Center Foundation / Istanbul Technical University
Bekirpaşa Municipality Science Center	2008	Kocaeli	Bekirpaşa Municipality
Istanbul Museum of the History of Science and Technology in Islam	2008	Istanbul	Ministry of Culture and Tourism, Turkish Academy of Science (TUBA), TUBITAK
Karşiyaka Municipality Science Museum	2009	Izmir	Karşiyaka Municipality
Gaziantep Planetarium and Science Center	2010	Gaziantep	Gaziantep Municipality
Ödemiş Municipality Science Center	2011	Izmir	Ödemiş Municipality
Eskişehir Science Experiment Center	2012	Eskişehir	Eskişehir Municipality
Bursa Science and Technology Center	2012	Bursa	TUBITAK and Bursa Municipality
Karaman Municipality Science Center	2012	Karaman	Karaman Municipality
Avcilar Science Center	2013	Istanbul	Avcilar Municipality
Sancaktepe Science Center, Observatory and Planetarium	2014	Istanbul	Sancaktepe District Governorate, Sancaktepe Municipality and Istanbul Development Agency
Konya Science Center	2014	Konya	TUBITAK and Konya Municipality
Kocaeli Science Center	2014	Kocaeli	TUBITAK and Kocaeli Municipality
Elaziğ Science Center	2015	Elaziğ	TUBITAK and Elaziğ Municipality
Kayseri Science Center	2017	Kayseri	TUBITAK and Kayseri Municipality
Üsküdar Science Center	2018	Istanbul	TUBITAK, Üsküdar Municipality, Turkish Technology Team Foundation

The Turkish Supreme Council for Science and Technology (SCST) plays a critical role in setting the agenda and policies in science and technology. At its 23rd meeting on 27 December 2011, the SCST set a roadmap to promote science and technology among the public (SCST, 2011). In this meeting, TUBITAK, in cooperation with local authorities, was given the main role to establish science centres around the country to enhance children's interest and curiosity towards science and technology. TUBITAK aimed to complete a science centre in all 16 metropolitan cities by 2016, and in all 81 cities by 2023. This target was subsequently modified and rescheduled. Bursa Science and Technology Center, Konya Science Center, Kocaeli Science Center, Elaziğ Science Center, Kayseri Science Center and Üsküdar Science Center were funded by TUBITAK and their respective local municipalities. The local municipality is mainly responsible for the establishment of the science centre and TUBITAK is mainly responsible for the development of exhibitions, training of explainers and providing academic consultancy. Afterwards, the local municipality runs the centre. Kalkan and Turk (2017) argue that this model of partnership has some problems—for example, the municipality sees the science centre as a division of their municipality and political arena. Thus, the quality and quantity of explainers and administrators could be an issue. Rather than hiring staff and experts in different areas, the municipality may prefer to select staff locally, leading to a possible lack of quality and diversity.

3.2. Science and art centres

The first science and art centre in Turkey, Yasemin Karakaya, was opened in Ankara in 1995. Partly due to high demand from the public and national priority policies of the SCST, currently there are 124 science and art centres in 81 cities with a population above 25,000 students (SCST, 2011). These centres are designated for gifted and talented students. There is a huge demand for these centres; therefore, through an examination, primary school students (up to Grade 4) are placed in three fields (music; a 'general talent' field including science history, geography, etc.; and visual art) according to their talent. The nature of diagnostic tests for the selection of students has been criticised, as has the fact that these centres are only for gifted and talented students. There have been public demands for science and art centres for all children no matter what interests and abilities they have.

These centres are run by the Ministry of Education and are free of charge for students who pass the entrance exam. These students can attend their centres until they graduate from high school. They take courses and extra-curricular activities and projects at the centre for around eight hours per week during school terms. They attend the centre at weekends or weekdays based on their school timetable.

3.3. Science festivals and STEM enrichment programs

The 24th meeting of the SCST on 7 August 2012 focused on the dissemination of a science culture, spirit of research and research skills among students through science fairs. TUBITAK Science and Society Division is responsible for coordinating the public engagement initiatives.[4] TUBITAK gives funds to primary and secondary schools to run science fairs. Funding for each school is around US$1,000 and almost all applicant schools are successful. Although the funding is quite modest, the impact can be immense (Sontay et al., 2019). In particular, it has enhanced collaboration among schools, universities and industry, and it has also created social inclusion in science education. TUBITAK Science and Society Division also has other funding (around US$20,000 per event) for organising large-scale science festivals. These science festivals have attracted children to participate in many hands-on science activities.

There are non-profit initiatives in this field. The Turkish Technology Team Foundation,[5] Turkish STEM Alliance,[6] STEM & Makers Fest/Expo[7] and Maker Faire[8] are among them. The Turkish Technology Team (T3) Foundation, founded by several entrepreneurs, supports educational projects and technology start-ups. They organise science engagement activities for primary and high school students and provide several support programs for university students and grants for young tech start-ups. The T3 Foundation aims to support 1001 Technology Teams and 1001 Technology Ventures by 2023. On 20–23 September 2018, the T3 Foundation organised the biggest tech festival at new Istanbul Airport.[9] The Teknofest Istanbul Aerospace and Technology Festival aimed to showcase Turkey's technological advancement and promote cutting-edge technological products. The festival received good publicity in the media and had a great impact on the public's awareness about technological innovations in Turkey.[10]

The Turkish STEM Alliance (founded in 2015), a member of the EU STEM Coalition, is an independent body of networks for promoting public engagement with STEM. It unites STEM practitioners, researchers, policymakers and the public to enhance the quality of STEM education and broaden participation in

4 See www.tubitak.gov.tr/tr/destekler/bilim-ve-toplum/ulusal-destek-programlari.
5 See turkiyeteknolojitakimi.org/en.
6 See www.stemalliance.center.
7 See www.stemandmakers.org.
8 See turkiye.makerfaire.com.
9 See www.teknofestistanbul.org.
10 See www.bilimgenc.tubitak.gov.tr/makale/teknofest-istanbul-havacilik-uzay-ve-teknoloji-festivali-icin-geri-sayim-basladi.

STEM. The Turkish STEM Alliance consists of members from science centres, science museums, professional development centres, NGOs, STEM centres, companies, research centres and public organisations. It has organised STEM & Makers Fest/Expos[11] in different cities, such as Ankara, Kocaeli, Konya, Antalya, Gaziantep, Diyarbakir, Malatya, Adiyaman and Mersin since 2015. In 2020, Van, Kastamonu and Bolu were added to these cities for STEM & Makers Fest/Expos. With these cities, more than 200,000 participants have engaged with STEM & Makers activities. STEM & Makers Fest/Expo, a member of the European Science Engagement Association, has been organised in collaboration with universities, schools, local authorities and industry. Makers Faire is also quite popular in Turkey and attracts many young people.

4. Science communication in non-formal environments

Science communication in non-formal environments such as the media need significant improvements, (Becerikli, 2013; Cakmakci and Yalaki, 2012, 2018; Trench et al., 2014). Although there are several newspapers in Turkey, most of them do not have a science section, and news related to science is not reported by science reporters but rather by generalist journalists. Nonetheless, there are a few science reporters, such as Esra Oz. She covers news and articles on health-related issues on CNN Turk.[12] She also has books on informed decision-making about health issues (Oz, 2018).

Becerikli's 2013 study with 73 journalists revealed that most have limited knowledge and expertise in stories on science and technology (Becerikli, 2013; Erdogan, 2007). Environmental issues, ecology, historical texture and heritage, archaeology and evolution theory were among the areas they found difficult (Becerikli, 2013). Many public and private universities have faculties of communication but none has a science communication division. There are pioneering scholars who offer courses on science communication for students, scientists and journalists: Irfan Erdogan (Erdogan, 2007), Erkan Yuksel (Yuksel et al., 2014), Ciler Dursun (Dursun, 2010) and Ahmet K. Suerdem (Veltri and Suerdem, 2013).

The SCST plays an important role in science communication in non-formal environments, with TUBITAK responsible for promoting, funding and carrying out cutting-edge scientific research and making the findings available.

11 See www.stemandmakers.org.

12 See www.cnnturk.com/yazarlar/guncel/esra-oz.

It publishes popular science books as well as science magazines for children and the public. TUBITAK has three popular science magazines: *Curious Puppy* targets pre-school children, *Science and Children* targets primary school students (ages 7–14) and *Science and Technology Magazine* targets high school students. TUBITAK has an online science news platform, *Bilim Genç*,[13] for youth and the public. Besides these there is an independent news aggregator, bilimiletisimi.com (in Turkish, 'science communication'), which aggregates science, technology, health, education and business news content from a variety of sources (e.g. online newspapers and popular magazines).

5. Research in science communication

Although science communication activities are carried out in Turkey, studies on science communication as a discipline are limited (Gelmez-Burakgazi, 2017; Veltri and Suerdem, 2013). Research on science communication in the national context could be categorised under three main headings: descriptive studies, science journalism and media, and interdisciplinary studies (science education, public relations). There are some dissertations and theses (Arca 2004; Arslanoglu, 2014; Erdem, 2011; Gelmez-Burakgazi, 2012; Guzeloglu, 2012; Utma, 2015); journal articles (Becerikli, 2013; Dursun, 2010; Gelmez-Burakgazi, 2017; Gelmez-Burakgazi and Yildirim, 2014); and books/book chapters (Erdoğan 2007; Utma, 2017) in the field.

Most studies conducted on science communication in Turkey concern science journalism and the media. In her thesis, Arca (2004) examines the contribution of popular science magazines and scientific journalism in Turkey. Similarly, Erdogan (2007) explores the organisational and contextual structure of scientific journalism in Turkey through science communication. This study is pioneering as it is the first science communication study supported by TUBITAK. Other studies are concerned with nationalist discourse in science news (Erdem, 2011); scientific journalism and the profile of science journalists (Becerikli, 2013); science journalists' views on science news (Arslanoglu, 2014); and the process of scientific journalism and analysis of science news in a university newspaper (Utma, 2015). The common result of these studies is to say that the importance of science, technology and innovation news and science journalism is ignored, and that most science news is not produced by professional science journalists.

13 See www.bilimgenc.tubitak.gov.tr.

Elsewhere, Dursun (2010) portrays the development of science communication and different approaches, and comparing these with other developed countries. Guzeloglu (2012) conducts an interdisciplinary study investigating the role of public relations in creating awareness of the consumption of the products of nanotechnology. Another interdisciplinary study was conducted by Gelmez-Burakgazi (2012, 2013). She examines how fourth- and fifth-grade students use science information and the effective uses of sources and processes in communicating science to students, with a major focus on bridging science education and science communication.

Science communication is a fertile field of study in Turkey. Compared to other countries, science communication research and practices are conducted in a limited range of places (science centres, universities, etc.) by a limited number of science communicators and researchers. Nevertheless, we believe that, in time, with the initiatives of these communicators and researchers the visibility and importance of the field will develop. We need to emphasise that well-structured policies and investment on science and technology and on science communication will catalyse development of the field.

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Timeline

Event	Name	Date	Comment
First interactive science centre established.	Feza Gürsey Science Center	1993–95	See www.fezagurseybilimmerkezi.com
First national (or large regional) science festival.	Science festivals promoted by TUBITAK	1990s	2018: The Teknofest Istanbul Aerospace and Technology Festival www.teknofest.org
An association of science writers or journalists or communicators established.	Türkiye Gazeteciler Cemiyeti [Turkish Journalists' Society]	1946	See www.tgc.org.tr
First university courses to train science communicators.	First field study on science communication and science journalism (Prof. Dr Ciler Dursun, Ankara University; funded by TUBITAK)	2008–10	2011–13: Second field study was in science journalism in Turkey, Prof. Dr Ciler Dursun, Ankara University, funded by TUBITAK) 2010: Science, Technology and Health Communication, Prof. Dr Erkan Yüksel, Anadolu University 2010: Science Communication, Dr Hacer Erar, Atilim University
First master's students in science communication graduate.	Science Journalism, Ankara University	2004	Supervised by Prof. Dr Ciler Dursun
First national conference in science communication.	Health Communication Symposium	2015	Organised by Prof. Dr Erkan Yuksel, Anadolu University, www.saglik-iletisimi.org
National government program to support science communication established.	The Scientific and Technological Research Council of Turkey (TUBITAK)	1963	See www.tubitak.gov.tr/en

Event	Name	Date	Comment
First significant initiative or report on science communication.	First field study	2010	Prof. Dr Ciler Dursun, Ankara University
National Science Week founded.		1970s	See www.bilimgenc.tubitak.gov.tr/makale/bilim-ve-teknoloji-haftasi-etkinlikleri-turkiyenin-dort-bir-yaninda
A journal completely or substantially devoted to science communication established.	*Bilim ve Teknik,* TÜBİTAK science and technology magazine	1967 2007	See www.bilimteknik.tubitak.gov.tr/dergimiz/hakkimizda
First significant radio programs on science.	Programs featuring Prof. Dr Celal Sengor	2010s	Professor Sengor of the Istanbul Technical University was a guest speaker for different radio channels
First significant TV programs on science.	Programs featuring Prof. Dr Celal Sengor	2010s	Professor Sengor of the Istanbul Technical University was a guest speaker for different TV channels
First awards for scientists or journalists or others for science communication.	Awards administered by the Turkish Academy of Science (TUBA)	1993	See www.tuba.gov.tr/en
Date hosted a PCST conference.	PCST-14 in Istanbul	2016	
Other significant events.	*Fen Alemi Dergisi*, first popular science magazine	1925	2010: A second magazine *Eğlenceli Bilim Dergisi*, editor Dr Hacer Erar www.atilim.edu.tr/tr/eglencelibilim/page/2942/eglenceli-bilim-dergisi
	Most influential books on science communication	2007	*Journalism in Turkey and science communication*, by Prof. Irfan Erdoğan
		2011	*Understanding communication*, by Prof Irfan Erdoğan
		2009	Senturk, E. (2009). The effect of science centres on students' attitudes towards science. Middle East Technical University, Ankara
		2012	Gelmez-Burakgazi, S. (2012) 'Connecting science communication to science education: A phenomenological inquiry'. Middle East Technical University, Ankara
		2012	Cakmakci, G. and Yalaki, Y. (2012). *Promoting student teachers' ideas about nature of science through popular media*. Trondheim, Norway: S-TEAM/NTNU

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