Newspapers in Science Communication: A Content Analysis on Science and Technology News

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Abstract

Science communication describes the connection between science and society in various ways. Written media and media tools contribute to strengthening science communication. The aim of this research was to examine the science and technology news in daily newspapers published in Turkey. Three newspapers in Turkey (Hürriyet, Sabah, and Posta), and their publications between August 28th and September 21st, 2019, were selected in this study. Some reviews have been made into how often these newspapers include science and technology events occurring in Turkey and around the world, what type of scientific news there is, and in what way the socio-scientific contents are presented in newspapers. The content analysis method was used in the study and the news items were presented in categories. As a result of the research, it was observed that science and technology news is given little space in these newspapers and is generally presented in the small columns on the last pages. It was seen that newspapers are an important tool in presenting scientific content and socio-scientific issues to society, but these depictions made are in certain patterns.

Keywords: Science Communication, Newspapers, Media, Socio-scientific Issues, Content Analysis

Bilim İletişiminde Gazeteler: Bilim ve Teknoloji Haberleri Üzerine Bir İçerik Analizi

Öz

Bilim iletişimi, bilimin toplumla çeşitli yollarla bağlantısı olarak tanımlanmaktadır. Yazılı basın ve medya araçları bilim iletişimini güçlendirmede katkı sunabilir. Araştırmanın amacı Türkiye'de yayınlanan günlük basılı gazetelerdeki bilim ve teknoloji haberlerine ne kadar ve nasıl yer verildiğinin incelenmesidir. Araştırmada incelenmek üzere 28.08.2019-21.09.2019 tarihleri arasında Türkiye'de yayınlanan üç gazete (Hürriyet, Sabah ve Posta) seçilmiştir. Araştırma kapsamında incelenen gazetelerin, Türkiye'de ve Dünya'da geçen olaylara konu olmuş bilim ve teknoloji haberlerine hangi sıklıkla yer verdikleri, en sık hangi tür bilim haberlerine yer verdikleri, sosyo-bilimsel içeriklerin ne şekilde sunulduğu incelenmiştir. Araştırmada içerik analizi yöntemi kullanılmıştır ve tespit edilen haberler kategoriler halinde sunulmuştur.

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Araştırma sonucunda, gazetelerde bilim ve teknoloji haberlerine çok az yer verildiği genellikle son sayfalarda küçük sütunlarda sunulduğu görülmüştür. Teknoloji haberleri ise nispeten iç sayfalarda daha (bilim haberlerine göre) büyük bölümlerinde yer verildiği görülmüştür. Gazetelerin bilimsel içerikleri ve sosyo bilimsel konuların topluma sunulmasında önemli bir araç olduğu ancak yapılan tasvirlerin belirli kalıplarda olduğu görülmüştür.

Anahtar Kelimeler: Bilim İletişimi, Gazeteler, Medya, Sosyo-bilimsel Konular, İçerik Analizi

Introduction

Science communication receives significant attention from policymakers, research institutions, practitioners, and academics (Bubela et al., 2009). As a result of advanced communication tools and technology, individuals can access information whenever they want to. Information is in the hands of individuals, which has made it easier for us to access information, but it has become difficult to find accurate and reliable information (Sevgi & Şahin, 2017). Mass media, especially newspapers, are important social institutions in a link with the country's cultural, economic, and political state. Gathering and evaluating information about these institutions, integrating them into theoretical structures, and understanding the nature of these institutions through theoretical explanations are very important in academic terms (Erdoğan, 2007). Over the years, it has been observed that science and scientific research have an increasing impact, both directly and indirectly, on public life. As a result, we can see that the general public is increasingly getting interested in science and science policies. Nunn (1979) stated that newspaper viewers, especially young adults, have a great interest in science news. Science communication defines the connection between scientists and the rest of society or the public through various means. Due to the gradual institutionalization of science in the 20th century, the distance between scientists and the public has gradually widened (Utma, 2017). During the last 20 years, Turkey has shown significant growth in science communication activities. Currently, there are many channels that are used to transmit science in the region. Scientific journals, popular science journals, science museums, newspapers, and television programs are some examples of the most used channels in science communication. It is seen that there has not been enough research done yet in terms of how much space newspapers include and why they are involved in scientific communication, how they provide the service, whether there is a science supplement or not, the reasons for this, how they decide on the science news, or the topics emphasized in science communication and the sources of news. In this research, a study was conducted on the representation of science and technology news in newspapers, which is one of the science communication tools.

Literature Review

Science Communication

Making informed decisions about complex issues, such as climate change, vaccines, genetically modified foods, nanotechnology, etc., requires an understanding of the science involved, particularly as it relates to the potential consequences of current courses of action. Science communication has an important role in understanding science (Bruin & Bostrom, 2013). Science communication helps the public to understand science as part of their real life and not only see the importance of science and the source of

pleasure and curiosity, but also help citizens, policy makers, funders, etc. It helps to educate citizens who are concerned about the threats facing our planet; thus, better shaping the direction of politics and policy decisions (Jucan & Jucan, 2014). Therefore, the problem of presenting science with books, newspapers, educational films, and radio and television programs that will bridge the distance between the world of ordinary people and the world of scientists, and facilitate the access of science to the general public or the public, that is, the popularization of science, as an important issue, is an important issue in the public policies of developed countries and the future (Dursun, 2018). Science journalism and journalism practices, are the practical realization grounds of science communication and examining how science is presented in the media.

Newspapers and Science Literacy

It is known that journals and newspapers published in the 20th century have a very important role in increasing the scientific literacy of people and popularizing science (Babaii, Atai, & Saidi, 2017). Newspapers are a resource that can be used for all teaching areas and all levels. Newspapers contain interesting information that can appeal to every individual in a society. Therefore, the use of newspapers can attract students' interest and increase their motivation. Newspapers include different sections, such as sports news, comics, and current events. In this way, new stories are discovered every day and that is why newspapers can be used in a classroom environment (Manning, 2001).

Journalism, when examined within the scope of communication science, has an interdisciplinary feature, despite the fact that it is a unique discipline. Journalism is a social system that transcends cultural boundaries and falls within the scope of globalized media communication. Newspapers both produce content and ideas and convey thematic information in the process of reporting an event, phenomenon, or information (Saray, 2018). Science news is both news of action and discourse in the context of innovation and timeliness. Technology is utilized while reporting the actions such as lunar eclipses or launching a space shuttle or the discourses such as scientific conferences, symposiums, meetings, and press releases (Girgin, 1998). Kahan (2014) put forth a definition of science journalism in a paper named ''Defining Science Journalism'': 1) it gives the necessary information about science and science literacy and provides citizens with the information that they need to make decisions in their daily lives; 2) it focuses on the context and pays attention to the needs and situations of the audience; 3) it focuses on the idea of a broad palette of information in which scientists and non-scientists have equal input; and 4) it focuses on the processes behind science and involves the multi-stakeholder perspective and engages the audience in pluralistic discussions.

The scientific perspective that constitutes the source of basic knowledge of science for the vast majority of adults in the media is represented as follows (Pellechia, 1997): 1) Medicine and health: there is some research news as to the health-related areas in this category. Some examples of products in this category include research on new drugs, surgical procedures, and diseases, as well as research on health, nutrition, and fitness. If there were available results of scientific research carried out by a researcher affiliated with a hospital or university, some articles on psychology could also be included; 2) Technology: this category includes the stories focusing on the developments in engineering and applied sciences. The stories included in this category include the researches on the space program, computer technology, and superconductor; and 3) Natural and physical sciences: this category includes theoretical stories from the fields of astronomy, physics, chemistry, biology, zoology, marine biology, and environmental science. The Ministry of National Education (MoNE) in Turkey (2005, 2008) gives more importance to science literacy among the other science education programs.

Therefore, it is thought that newspapers can be used as an important tool in bringing science literacy to students and society. There is, however, a general agreement that science education or as many others say ''Science, Technology, and Society education'', should provide students with the necessary skills of being scientifically literate citizens. DeBoer (2000, p. 592) identifies nine objectives proposed for science education, all of which contribute to the greater goal of scientific literacy. One of them can be summarized as ''understanding the science news and discussions in popular media'' (DeBoer, 2000). In their study ''Science and technology literacy and informal science education: The potential role of newspapers'', Kavak, Tufan, Demirelli (2006) focused on the side effects of science and technology on the environment rather than the news about science and technology in the newspapers. This news stated that there is no sufficient information about the nature of science and scientific process skills. According to Öztekin and Şahin (2020), a good roadmap is needed in science journalism, as exaggerated inflated claims, scientific abuses, ethical violations, conflicts of interest can destroy scientific realities. Erdoğan's (2007) study also reveals that there are hardly any professional science reporters in the media. Therefore, it has recently emerged that an increasing portion of science news published in Switzerland is based on press releases provided by the university (Vogler and Schäfer, 2020). For this reason, professionals should support the creation of science news.

In the 21st century, digital news sites and short videos are increasingly replacing text-based news as a source of information, and media companies appear to be an important area for investment in video content (Salzmann et al., 2021). Digital newspaper publishing is taking firm steps towards becoming the journalism type of the future, with features such as speed and freedom, as well as the interactive opportunities it offers (Kılıç and Övür, 2019). Newspapers have embraced online platforms and continue to play a role as a consistent source of health and science information (Brossard & Scheufele, 2013). On the other hand, Ayhan, Baloğlu, and Livberber (2018) determined that the subject content of science and technology news in digital media is mostly technology companies, blockchain and developments related to medicine. Therefore, considering that the subjects that affect human life at a significant level are frequently included, the value of being scientifically literate individuals who have a critical and questioning perspective about the source, accuracy and reliability of information about science news in the media emerges (Elmalı, 2019).

Socio-scientific Issues

Socio-scientific issues are of great importance in science literacy, sustainable development, and citizenship. Socio-scientific issues (SBI) represent the social dilemmas with different perspectives, which are based on the application of scientific principles and are complex and controversial, and also have multiple solutions and different perspectives (Sadler and Fowler, 2006). The study of sociological subjects focuses on improving students' thinking skills. While doing this, the focus is on what affects science, the physical and social environment, and moral decisions (Zeidler, Sadler, Simmons & Howes, 2005).

It is thought that sociological issues in society will increase in number because of the rapid progress of science and technology makes it difficult for that society to understand this information. In addition, these issues may become even more complex day by day. Therefore, it may be difficult for every individual in society to understand these issues. Individuals should be able to discuss these issues with limited scientific knowledge. In this context, sociological issues should be included in educational programs and students should be given the opportunity to discuss these issues. Students' decision-

making on sociological issues is closely related to their knowledge of how to use scientific evidence and how to participate in a discussion. (Maloney and Simon, 2006).

For this reason, today's society faces many dilemmas. Societies should make their own decisions in issues such as genetically modified organisms, nuclear energy, and global warming and they should have an idea about these events. It is not easy for individuals to decide on these issues. When deciding, one should consider all criteria and address the positive and negative aspects of the situation (Dawson and Venville, 2009: 1422). Although newspapers, magazines, the internet, and other popular media are seen as important sources for non-scientists to learn about scientific research and their effects on scientific literacy are known, there are limited studies in this area (Norris, Phillips, & Korpan, 2003).

As scientific fields have become more complex, the public has struggled to understand the exponentially increasing pace of science, leading to low scientific literacy, misinformation (inadvertently false), disinformation (intentionally false), and loss of trust (Peretti-Watel et al., 2015). Science journalism, as an important branch of journalism, does not receive the necessary attention in Turkey (Koloğlu, 1997: 87). For this reason, the issue of how and to what extent the media fulfill the mediating role between the publics and the scientific world is a problem in itself (Dursun, 2018). One of the most important problems in the way science and technology is reported is that science journalists do not have a good grasp of the concepts and jargon in this field (Dursun, 2018). For example, Özkan (2018) stated that the headlines of science and technology news in newspapers are usually prepared in an interesting and intriguing manner, but the contents of the news are mostly not reflected in accordance with the scientific approach, and the source definition is not clear and unambiguous in some news. Although there are many studies on the subject in the relevant literature, it was seen that there is no direct research on the representation of science and technology news.

Importance of Study

Societies have begun to attach more and more importance to academic activities, not only in science and technology, but also in how to popularize science and how to debate with the public (Utma, 2017). For this reason, science communication has gained importance in our age. The media's news about science can mislead society, and false news can be delivered to the public. To prevent this, scientists have to pay special attention to their interactions with the media (Utma, 2017). Which news, as this has an important place among the mass media, does or does not give, and how it gives the news is an issue that needs to be emphasized and examined (Seyhan & Temiztürk, 2014). Although there are studies examining the integration of newspapers into education, as well as studies revealing the inadequacy of the news about education by the newspapers, there are no studies based on the examination of science and technology news. For this reason, it is thought that the number of science and technology news reports in the newspapers, the representation of these news reports, and the determination of the categories of these news reports will fill the gap in the literature.

Aim

Since newspapers, one of the means of mass communication, are cheap and easily accessible, they are preferred in daily life as a means of accessing news about politics, magazines, sports, science, technology, etc. Therefore, mass media is perceived as an effective tool in providing individuals with scientific literacy skills in terms of science and technology. The aim of this research was to examine the scientific and technological

contents of mass media, and analyze the news in terms of socio-scientific content. The questions to be answered within the scope of this study were as follows:

a) How often do newspapers in the research sample include science and technology news?

b) What is the frequency of the newspapers in the research sample to include science and technology news when compared to the total news?

c) What content is used in the science and technology news of the newspapers in the research sample?

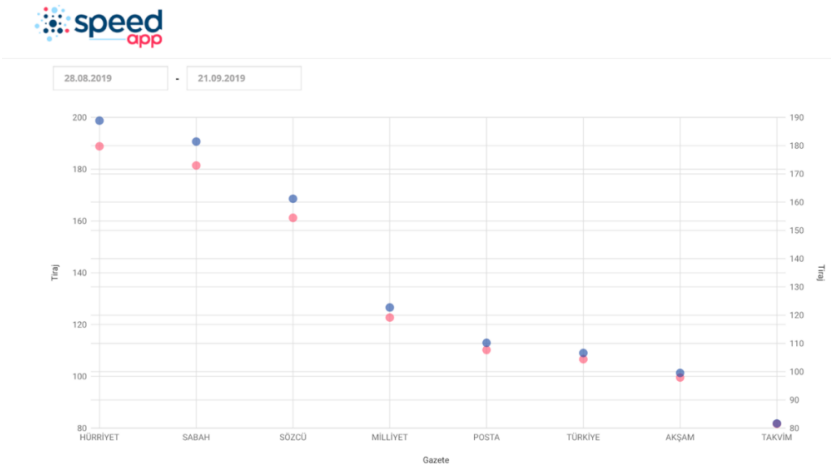
d) At what level are socio-scientific issues included in the science and technology news of the newspapers in the research sample?

Method

The aim of this research was to examine how often the science and technology events in Turkey are included in the newspapers and in which way they are presented. For this purpose, quantitative methods were used to digitize the news, and qualitative data collection tools were used to classify the news. "Media content analysis is a special sub-branch of content analysis, which is a deep-rooted research methodology" (Macnamara, 2005). Büyüköztürk, Kılıç Çakmak, Akgün, Karadeniz, and Demirel (2012) defined content analysis as a systematic technique in which the document is categorized with rules-based coding in order to determine the existence of certain words or concepts within the text or texts. The content analysis technique can also be used for newspapers. The daily printed issues of the newspapers were obtained and the science and technology news in the world was analyzed. The content analysis method was used in the research.

Data Analyses

In determining the sample of this study, criterion sampling method, one of the purposeful sampling methods, was used. The criterion sampling method provides researchers with the opportunity to review and examine all cases that meet certain predetermined criteria (Patton, 2002). (a) In newspaper selection: Circulation. (b) In the selection of numbers: Printed (c) In the selection of the sample; Criteria such as representative of the sample to represent the universe were determined. It was deemed sufficient to reach a one-month issue with the start date of the research. In similar studies, it has been found sufficient to examine the number of monthly newspapers (Öztekin and Şahin, 2020; Dursun, 2018). In the study, three newspapers in Turkey, Hurriyet, Sabah, and Posta, were analyzed. The newspapers with the highest circulation on the specified dates were Sabah, Hürriyet, and Sözcü. It was determined that Sözcü was not delivered on some days in the region where the research was conducted on the relevant dates. For this reason, a newspaper named Posta was added to the research.



Gazete	Tiraj
SABAH	263.664
SÖZCÜ	260.514
HÜRRİYET	216.743
POSTA	165.738
TÜRKİYE	128.505
MİLLİYET	125.488

Figure 1. Newspapers used in the research and their circulation.

According to Speedapp (http://app.speedmedya.com/), the newspaper circulation of Sabah (263,664), Hürriyet (216,743), and Posta (165,738) on the relevant dates are given in Figure 1. The newspapers were analyzed because they were distributed in an important and widespread manner at a national level and their circulation is much greater than the other newspapers. All copies of these newspapers published between August 28th and September 21st, 2019, were examined. Only newspapers from Sabah, dated August 29th, and Hürriyet, dated August 30th, that could not be obtained and included in the study. Each published newspaper supplement was included in this study. As a matter of fact, Hürriyet, one of the newspapers used in the sample, has a science and/or health column in its Tuesday edition. Thus, one week for each of the three newspapers and one day for each of the three time periods were analyzed. Thus, reviewed were 23 issues of Hürriyet, 23 issues of Sabah, and 23 Posta. These 69 newspapers were examined and 304 science and technology news articles were identified. It was within the scope of internal validity to determine whether the terms specified in the research examined were appropriate for the content and whether the findings obtained were consistent with the content presented (Maxwell, 1992). In this context, in order to provide internal validity, the data obtained from the newspapers were revealed and interpretations of them were made. Glesne (2006) stated that sharing qualitative studies with people who are experts in this field and getting feedback from them will increase the reliability of the research. In order to ensure the reliability of the research, the findings were sent to an independent researcher specialized in qualitative research, and feedback was received. The data obtained were subjected to Miles and Huberman compatibility tests. In comparison to the numbers of consensus and disagreement the reliability of studies was calculated by using Miles and Huberman formula (reliability = consensus /

consensus + disagreement) (Miles & Huberman, 1994). According to the compatibility test, the compatibility of the data was calculated as 91%.

Within the scope of this research, an answer was sought to the questions "What is the frequency of the newspapers in the research sample to include science and technology news?" and ''What kind of scientific content is the subject of newspaper news?". After reviewing the newspapers included in the study group, the identified news items were categorized. While determining the categories, the science news items were analyzed in-depth, as Elliot (2006) stated. In this respect, it was aimed to find an answer to the following concepts and questions: Title: Does it persuade you to read the rest of the article? Reportability: This is a combination of factors that determine whether an article should be printed or not. Source: Is it possible for the original source of the story to be identified? Scientific content: Does the story make any assumptions about the reader's previous knowledge? Does it explain the scientific background of the story? Scientists: How are the scientists involved in the story portrayed? Drawings: If there is, what elements from the images are used? Balance and bias: Is it possible to detect any prejudice in the story? What is the status of the quoted persons and does the author express his/her views? Editor's comment: Is the story cited elsewhere in the newspaper by the editor or the editor-in-chief? If so, what is the nature of this interpretation and does it show any balance or bias?

While analyzing socio-scientific issues, the analysis created by Ekborg, Ideland & Malmberg, (2009) was used. Starting point: Socio-scientific issues are real situations in real life and are often reported by the media (Ratcliffe & Grace, 2003). The starting points maybe both fictional and non-fictional. The starting points maybe both fictional and non-fictional (Ekborg, Ideland & Malmberg, 2009). Characteristics of scientific evidence: This component is based on various scientific evidence. Ratcliffe and Grace (2003) state that sociological issues are characteristic, and they are not "correct answers''. However, there are different reasons for the dispute in the interpretation of science content, values or financial reasons etc. Social content: Today, science provides integrity with politics, economics, ethics, and so on in a complex way (Nowotny, Scott & Gibbons, 2002). However, the studies show that school science is generally preparation for studies in science and not for the use of science in society (Aikenhead, 2006). The use of scientific knowledge: Jensen and Schnack (1997) argued that the objectives of education should be to enable students to achieve their ability and willingness to act according to their decisions. Level of conflict of interest: Subjects defined as sociological issues are complex and contain conflicts of interest (Jensen and Schnack, 1997); this means that people will discuss, make decisions, and act according to different interests and different knowledge bases.

Findings

3.1. Findings of the first subproblem: "What is the frequency of the newspapers in the research sample to include science and technology news?"

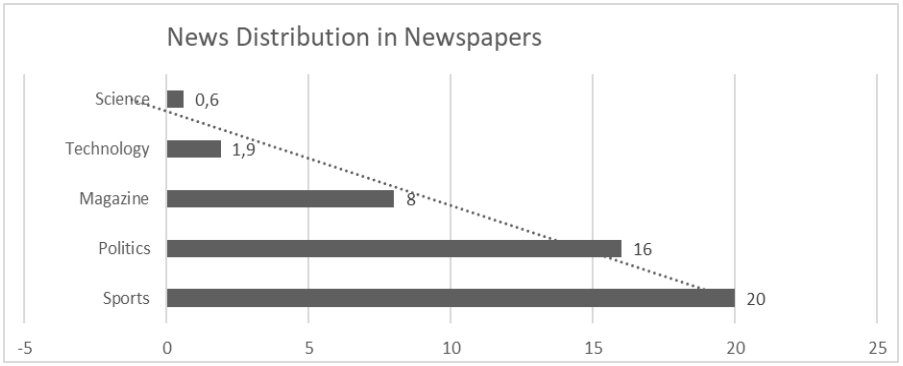


Figure 2. Distributions (%) of the news published between August 28th and September 21st.

Figure 2 shows the ratio of science and technology to total news. Between August 28th and September 21st, a total of 9125 news articles (f = 125 (0.6%)) (politics, current, sports, science, technology, etc.) were published in the three newspapers. On the other hand, it is seen that the number of sports news articles was f = 1825 (20%), political news articles was f = 1460 (16%), and magazine news articles was f = 730 (8%). It was observed that science news was usually on the last pages and technology news was on the inner pages. Science news was observed to be presented usually in small boxes, while technology news was in larger columns.

Table 1. Ratio of science and technology news to total news.

Total	Science		Technology		Politics		Sports		Magazine	
f	f	%	f	%	f	%	f	%	f	%
9125	125	0,6	179	1,9	1460	16	1825	20	730	8

3.2. Findings of the second subproblem: "What is the frequency of the newspapers in the research sample to include science and technology news compared to the total news?"

Table 2. Frequency and percentage values of science and technology news.

		Science		Technology				Science		Technology	
Date	Newsp.	f	%	f	%	Date	Newsp.	f	%	f	%
August 28th	Hürriyet	1	0.08	3	0.16	September 9th	Hürriyet	-	-	1	0.05
	Posta	1	0.08	-	-		Posta	2	0.16	2	0.11
	Sabah	1	0.08	-	-		Sabah	1	0.08	3	0.16
August 29th	Hürriyet	2	0.16	2	0.11	September 10th	Hürriyet	3	0.24	1	0.05
	Posta	1	0.08	2	0.11		Posta	2	0.16	-	-
	Sabah*	-	-	-	-		Sabah	2	0.16	1	0.05
August 30th	Hürriyet*	-	-	-	-	September 11th	Hürriyet	6	0.48	2	0.11
	Posta	-	-	-	-		Posta	1	0.08	3	0.16
	Sabah	1	0.08	-	-		Sabah	1	0.08	1	0.05
	Hürriyet	2	0.16	2	0.11		Hürriyet	3	0.24	2	0.11
	Posta	-	-	2	0.11		Posta	-	-	-	-

August 31st	Sabah	1	0.08	2	0.11	September 12th	Sabah	2	0.16	2	0.11
September 1st	Hürriyet	1	0.08	1	0.05	September 13th	Hürriyet	2	0.16	1	0.05
	Posta	1	0.08	1	0.05		Posta	3	0.24	-	-
	Sabah	1	0.08	1	0.05		Sabah	2	0.16	5	0.27
September 2nd	Hürriyet	3	0.24	1	0.05	September 14th	Hürriyet	2	0.16	4	0.22
	Posta	1	0.08	1	0.05		Posta	-	-	3	0.16
	Sabah	-	-	3	0.16		Sabah	4	0.32	10	0.55
September 3rd	Hürriyet	4	0.32	3	0.16	September 15th	Hürriyet	1	0.08	5	0.27
	Posta	1	0.08	-	-		Posta	2	0.16	2	0.11
	Sabah	2	0.16	-	-		Sabah	2	0.16	3	0.16
September 4th	Hürriyet	1	0.08	2	0.11	September 16th	Hürriyet	3	0.24	2	0.11
	Posta	1	0.08	3	0.16		Posta	2	0.16	2	0.11
	Sabah	1	0.08	3	0.16		Sabah	-	-	5	0.27
September 5th	Hürriyet	4	0.32	-	-	September 17th	Hürriyet	2	0.16	1	0.05
	Posta	3	0.24	-	-		Posta	3	0.24	-	-
	Sabah	-	-	1	0.05		Sabah	2	0.16	5	0.27
September 6th	Hürriyet	2	0.16	1	0.05	September 18th	Hürriyet	3	0.24	4	0.22
	Posta	1	0.08	2	0.11		Posta	2	0.16	4	0.22
	Sabah	2	0.16	4	0.22		Sabah	-	-	3	0.16
September 7th	Hürriyet	2	0.16	3	0.16	September 19th	Hürriyet	4	0.32	10	0.55
	Posta	3	0.24	2	0.11		Posta	4	0.32	3	0.16
	Sabah	-	-	-	-		Sabah	1	0.08	4	0.22
September 8th	Hürriyet	3	0.24	9	0.05	September 20th	Hürriyet	1	0.08	5	0.27
	Posta	1	0.08	3	0.16		Posta	2	0.16	2	0.11
	Sabah	-	-	9	0.50		Sabah	2	0.16	3	0.16
						September 21st	Hürriyet	3	0.24	2	0.11
							Posta	2	0.16	2	0.11
							Sabah	-	-	5	0.27

Table 2 shows the frequency and percentage values of science and technology news (including health and medicine) published between August 28th and September 21st. There were 125 news in science and 179 news in technology. The newspapers, Sabah dated August 29th, and Hürriyet, dated August 30th, could not be obtained. Daily science news articles generally varied between f = 1 (0.08%) and f = 6 (0.48%). Most of the science news articles were in the newspaper Hürriyet (f = 55) and the least were in Sabah (f = 22). On some days, no science news articles were found (e.g., Posta dated August 30th, Sabah dated September 5th, and Hürriyet dated September 9th). Technology news articles generally varied daily between f = 1 (0.08%) and f = 10 (0.55%). Most of the technology news articles were in Sabah (f = 80) and the least were in Posta (f = 32). On some days, no technology news articles were found (e.g., Posta dated August 28th, Sabah dated September 3rdand Hürriyet September 5th).

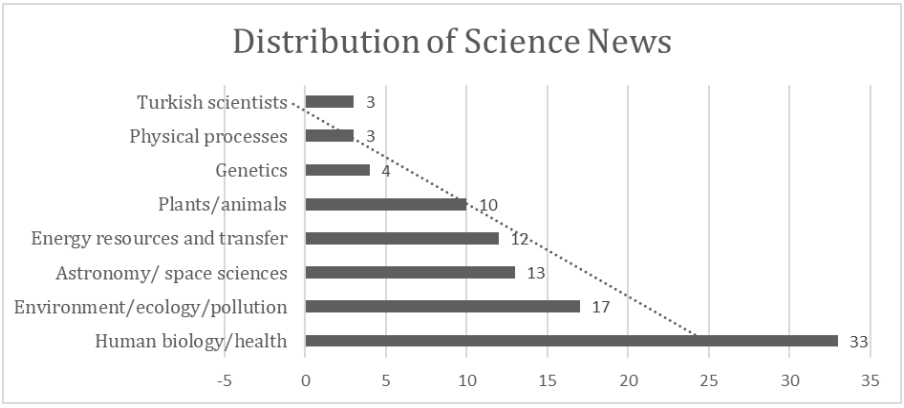


Figure 3. Percentage (%) of scientific news published between August 28th and September 21st.

Figure 3 shows the frequency and percentage of the science news published between August 28th and September 21st. The distributions were listed as human biology/health f = 42 (33%), environment/ecology/pollution f = 22 (17%), astronomy/space sciences f = 17 (13%), energy sources and transfer f = 15 (12%), plants/animals f = 13 (10%), genetic f = 6 (4%), physical processes f = 5 (3%), and Turkish scientists f = 5 (3%).

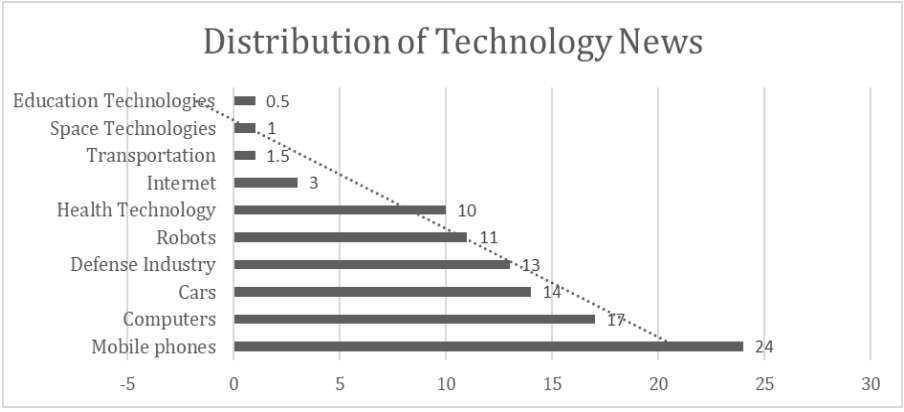


Figure 4. Percentage of the technology news published between August 28th and September 21st.

Figure 4 shows the frequency and percentage of the technology news published between August 28th and September 21st. The distributions were listed as mobile phone news f = 44 (24%), computer news f = 32 (17%), car technologies f = 26 (13%), defense industry f = 25 (13%), robots f = 21 (11%), health technology f = 19 (10%), internet f = 6 (3%), transportation f = 3 (1.5%), space technologies f = 2 (1%), and educational technologies f = 1 (0.5%).

3.3. Findings of the third subproblem: "What content is used in the science news of the newspapers in the research sample?"

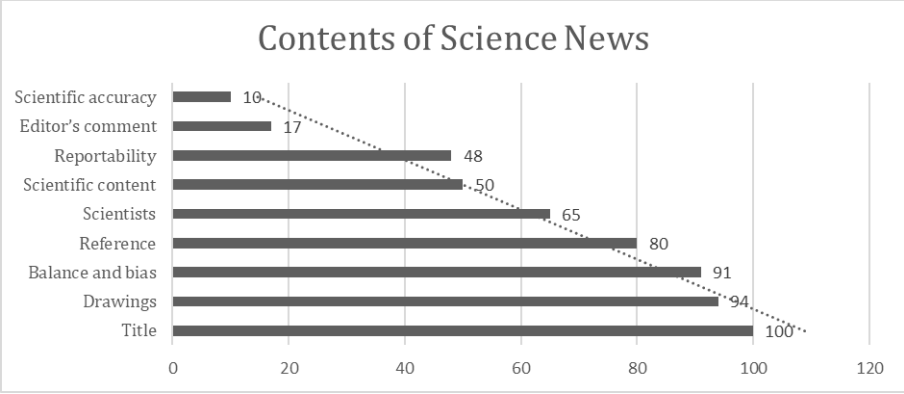


Figure 5. Percentage of the content (%) of the scientific news published between August 28th and September 21st.

Figure 5 shows the percentages of the scientific news content published between August 28th and September 21st, and the frequency, percentage, and content signs are shown in Table 3. A title can be seen in 100% (f = 129) of the news items, the reportability in 48% (f = 60), the source in 80% (f = 103), the scientific content in 50% (f = 64), scientific accuracy in 10% (f = 13), scientists in 65% (f = 83), drawings in 94% (f = 121), balance and prejudice in 91% (f = 117), and the editor's comment in 17% (f = 21).

Table 3. Frequency and percentage values of the scientific news published between August 28th and September 21st.

Code	Content	f	%
a	Title	129	100
b	Reportability	60	48
c	Reference	103	80
d	Scientific content	64	50
e	Scientific accuracy	13	10
f	Scientists	83	65
g	Drawings	121	94
h	Balance and bias	117	91
i	Editor's comment	21	17

Hürriyet, dated August 28th, ''END OF SNORING WITH JAW IMPLANT (a)'' Image is available (g). Belgian scientists have promised to treat sleep apnea after a 15-minute operation with jaw implants which they have developed (b). A thumb-sized chin implant developed by a Belgian firm has become a beacon of hope for the permanent solution of sleep apnea. The "U implant shaped implant can be placed under the chin within a 15-minute operation (d). The implant's stimulation of the tongue muscles and glands prevents the tongue from closing the air gap where fresh air circulation takes place. The implant is placed under local anesthesia

so that it is not felt by the user, which makes this device problem-free (h). The manufacturer will publish the results obtained from the implantation of the device within this year (i).

Sabah dated August 28th: "THREE OTHER PLANETS DISCOVERED (a)" [No image]: Astronomers have discovered 3 other planets, which are at nearly the same size as the Earth and 12 light years away. According to the news on the Science Alert (c) website, researchers have discovered three rocky other-planets, which are 1.4 to 1.8 times more than the Earth's mass, using a 3.6-meter telescope (d) located at the European Southern Observatory (ESO) in La Silla, Chile. It has been stated in the research that these other planets, which are 12 light years away from Earth and located on the orbit of a lightweight dwarf star, complete their rotation in 3 to 13 days' time (h).

Posta dated September 11st "HYDROGEL SLOWING CANCER FROM A TURKISH DOCTOR (A)" Image is available (g). Dr. Rahmi Öklü (f), working in the famous Mayo Clinic medical center in the United States, has developed a cancer treatment that stops the growth of the tumor. Accordingly, hydrogel injected in the vessels reduces blood flow that feeds cancerous tumors (d, e). The study has been published in a scientific journal named Advanced Materials (c)… The method developed by Öklü is expected to have a Golden Standard (i).

3.4. Findings of the fourth subproblem: "What is the level of socio-scientific issues in the science and technology news of the newspapers in the research sample?"

Table 4. Socio-scientific content of science and technology news in newspapers.

Component	**Radioactive water in Pacific** (September 11th, Hürriyet)	**Plastic Age** (September 7th, Posta)	**Water found in Super World** (September 13th, Sabah)	**Paralysis risk of one-way diet** (September 6th, Posta)	**Hope for Stem Cell** (September 11th, Posta)
Sciences content	Chemistry, Geology	Chemistry, Technology	Physics, Technology	Biology, Chemistry	Biology, Chemistry, Technology
Characteristics of scientific evidence	The information everybody knows is misleading and science is used in an incorrect way.	Well-known and scientific content is generally presented in a true way. It is difficult to judge.	There is no agreement.	It is difficult to judge.	Well-known and scientific content is generally presented in a true way. It is difficult to judge.
Social content	Media literacy, Economy, Morality	Social life Economy Media literacy	Social life Economy	Social life Economy	Social life Economy Politics Morality
Use of scientific knowledge	Decision-making	Investigation and explanation	Decision making Cost-benefit Risk assessment Review the information Critical thinking	Take action for a change	Decision-making
Conflict level	Individual Social	Individual Social	Individual Social Structural	Individual Social	Individual Social Structural

Table 4 shows the coverage level of the socio-scientific issues in the science and technology news of the newspapers. The included contents were evaluated through the content analysis with which they are related (Ekborg, Ideland & Malmberg, 2009). The news investigated and examined included radioactive water in Pasific (September 11th, Hürriyet), plastic age (September 7th, Posta), water found in the super world (13rd September, Sabah), risk of paralysis in one-way diet (September 6th, Posta), and stem cell

hope (September 11th, Posta). In this news, the contents of the science articles were generally dominated by the fields of chemistry and technology. As for the scientific evidence, it is clear that the contents were presented appropriately or scientifically, but they were difficult to judge. Social content generally includes social life and economy. The use of scientific information in the news appeals to the decision-making and explanation skills of the reader. Thus, the conflict level of the news is explained individually and socially.

Discussion and Conclusions

The presentation of science and technology in the media gives information about the events in that society and reflects society's view of science and technology. In this study, how often and in what way the fields of science and technology are included in the daily printed newspapers published in Turkey was examined, and it was found that there was little space for science and technology news in the newspapers. On the other hand, it was observed that news, such as politics, magazines, and sports, is given a lot of space in the newspapers. There was no science and technology news given on the first pages. Science news was often found on the internal pages of newspapers in small columns. On the other hand, there was more political news in the headlines and in the middle sections of the newspapers. It was observed that the magazine news appeared on the second or third pages. Öztekin and Şahin (2020) revealed that science in Turkey is not newsworthy in terms of print media. They stated that newspapers are weak in terms of science journalism, not only in terms of quantity, but also in terms of quality. These findings seem to coincide with the research findings. It was stated that the development of science and technology is due to a better understanding of these fields by societies (Felt & Davies, 2020). However, it is obvious that they are not reflected enough in the press. For this reason, there should be some pages in the newspapers that are especially in the name of ''science and technology''.

Considering the dates examined, it was seen that the total daily number of science news articles was the highest in Hürriyet and the lowest in Sabah. On some days, there were no science and technology news articles in the newspapers. The total number of technology news articles was the highest in Sabah and the lowest in Posta. The reason why there were a lot of technology news articles in Sabah was that there was a separate page that specifically for technology news on some days. For this reason, the creation of some pages in the name of science and technology in the newspapers helps science communication to better understand science and technology and this derives more attention from the public. Among the most important reasons for Nelkin's (2004, 16–17) science journalism not being in the place it deserves are the competition between institutions and organizations that are news sources, the priority of other fields in the choice of the reader's news reading, and the confusion between reality and fantasy.

If society can understand the news of the day about science, such as genetic engineering, and it is taken into consideration and processed in a meaningful context, then we can attain scientifically literacy (Jarman and McClune, 2007, p. 5). When science news in the newspapers was examined, it became clear that the news published includes human biology/health, environment/ecology/pollution, astronomy/space sciences, energy sources and transfer, plants/animals, genetics, physical processes, and Turkish scientists. It was seen that the news published specifically focused on humans, biology, and health. Pellechia (1997) described health as a part of science news, which is why he focused on studying news about health-related areas, such as new drugs, surgical procedures, and diseases, as well as health, nutrition, and fitness. Journalists are seen as a problem with regard to the lack of sufficient information flow about news sources, especially in the

production of the environment, health, and science journalism, which is the subject of the region they are in (Becerikli, 2013). The obtained data and discussions suggest that studies on science and technology education should be included in their reports. The reason for this is that when the news is about health, useful plants, medicines, and health problems, it might be of more interest to society. It was seen that environmental problems concerning all of whole society were at the center. The results of this research were similar to that of Kavak, Tufan, and Demirelli (2006); the news about science and technology especially includes the side effects of science and technology on the environment. It was observed that Turkish scientists, although in small number, have been included in the news. It is thought that this is an important step in strengthening the nature of science and the image of scientists. It is important to include such news more often and it emphasizes that Turkey is involved in culturally scientific literacy studies.

When news articles about technology are used correctly and analyzed correctly, it was seen that they were effective tools in teaching the nature of technology or in raising awareness about the nature of technology (Aydın & Karaçam, 2015). When technology news was analyzed, it was observed that there was news about mobile phone technologies, computer news, car technologies, defense industry, robots, health technology, internet, transportation, space technologies, and educational technologies. In technology news, social media content that surrounds our daily lives was more prevalent. For this reason, it was seen that mobile phone and computer news were given more space. The other result was the use of national weapons and products in the defense industry. Technology news should enable people to recognize technology, and understand and question the nature of technology. However, when the news was examined, it was understood that it was shown as a tool for technology consumption.

The percentages of the contents of the scientific news, the titles of the news, the reportability, the source, the scientific content, the scientific accuracy, the scientists, the drawings, the balance and the bias, and the editor's comment are all given. Rather than the content, the interesting aspects of science were emphasized. It was seen that there was no reference in some of the news. However, when presenting scientific contents, providing a reference was important for the validity of the news. This makes it difficult to distinguish the most accurate and reliable among the reader's constantly growing knowledge (Sevgi & Şahin, 2017). It was observed that while the scientific content was impartially presented, there was no assumption made about the previous knowledge of the reader and it was insufficient to explain the scientific background of the story. In some of the news, it was clear that the scientists were included, and they were generally depicted as those with gowns and wearing glasses. Socio-scientific issues are of great importance in science literacy, sustainable development, and citizenship. Socio-scientific issues represent social dilemmas with different perspectives, complex and controversial structures, and multiple solutions, based on the application of scientific principles (Sadler and Fowler, 2006).

It was found that the scientific news published in the newspapers did not give enough attention to socio-scientific issues. In this news, it was seen that the contents of the science articles were generally dominated by chemistry and technology. As for the scientific evidence, the contents were presented correctly or scientifically, but it was difficult to make a judgment of them. Social content was generally seen to be based on social life and the economy. It was seen that the use of scientific information in the news appealed to the decision-making and explanation skills of the reader. It was seen that the conflict level of the news was explained individually and socially. Socio-scientific topics should be included in the curriculum and students should be given the opportunity to discuss these issues. Students' ability to make a decision on sociological issues is closely related to their knowledge of how to use scientific evidence and to deal with the process

of participating in a discussion. (Maloney and Simon, 2006). Accordingly, as Ratcliffe and Grace (2003) suggested, it is appropriate to think that presenting sociological issues may be important in terms of both the students and the whole society. It is not easy for individuals to make any decision on such issues. Media tools should present the contents very carefully. As Dawson and Venville stated (2009, p.1422), one should take into consideration all of the criteria and the positive and negative aspects of a situation while making a decision. However, presenting socio-scientific issues with a negative perspective in newspapers will cause readers to have some negative attitudes about science. In science communication, newspapers appear to be effective in focusing on science and science literacy and they provide citizens with the information they need to make decisions in their daily lives (Kahan, 2014; DeBoer, 2000). On the other hand, it is obvious that the information in the news should be satisfying in terms of quantity and accuracy. The aim is to focus on the idea of a broad palette of information in which scientists and non-scientists have equal input, to follow the processes behind science, to involve the multi-stakeholder perspective, and to engage the audience in pluralistic discussions. Scientific and technological advances in our age and their results affect society closely. The media has a great role in delivering scientific and technical advances to the masses. An important function of newspapers is to ensure that scientific events and news are conveyed to the society correctly, without distorting them. Journalism should contribute to the scientific thinking of society and an understanding of the nature of technology. For this reason, it is important for students and teachers to gain awareness about socio-scientific issues in society by connecting with daily life, and make a final decision by correctly understanding, interpreting, and evaluating different perspectives of media tools (newspaper, magazine, internet, etc.) which are indispensable elements of our daily lives. (Öztürk, & Erabdan, 2018).

Our lifestyles, business lives, family lives, and in short, almost every area of our social lives is being reshaped with the positive or negative effect of science and technology. Societies need science communication and science journalists more than ever. This is because science is disconnected with society due to its complex structure, which cannot be understood by people on the street. From this point of view, a science journalist performs the duty of bridging the gap between the scientific world and the public (Utma, 2017). In this respect, it is recommended that academicians and science journalists work together for the effective development of science communication. In line with the results of the research, it is suggested that researchers should investigate the contents of the description of scientific news in developed and undeveloped countries. Similarly, in the literature, it was emphasized that the presence of news related to science in newspapers attracts the attention of the students, and also brings newspapers into the classroom, which will facilitate the connection between science and daily life (Shibley, 2003). It may be suggested that newspapers should conduct studies for the use of science and technology in teaching environments.

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Özet

Günümüzde gelişen iletişim araçları ve teknoloji sayesinde birey istediği zaman istediği bilgiye ulaşabilir durumdadır. Kitle iletişim araçlarından gazeteler, ülkelerin kültür, ekonomi ve siyasal hayatıyla ilgili aktarmada önemli araçlardır. Bu araçlar, ilgili bilgilerin toplanması, bunların değerlendirilmesi, kuramsal yapılara bunların bütünleştirilmesi ve böylece kuramsal açıklamalarla bu kurumların belli koşullardaki doğasının anlaşılması akademik bağlamda oldukça önemlidir. Son 20 yılda, Türkiye bilim iletişimi faaliyetlerinde önemli bir büyüme göstermekle beraber halen bilimi iletmek, yaygınlaştırmak için birçok kanal kullanılmaktadır. Bu kanallardan en yaygın olanları bilimsel dergiler, popüler bilim dergileri, bilim müzeleri, gazeteler, televizyon programları örnek verilebilir. Kitle iletişim araçlarından bir olan gazeteler ucuz ve kolay ulaşılabilir olması nedeniyle günlük hayatta siyasi, magazin, spor, bilim ve teknoloji vb. haberlere ulaşmada önemli bir araç olarak tercih edilmektedir. Gazetelerde bilim ve teknolojik haber içeriklerin incelenmesi, bu haberlerin sosyo-bilimsel açısından içerik analizinin yapılması bu araştırmanın amacı olarak görülmektedir. Bu amaç kapsamında nitel araştırma yöntemi benimsenmiştir. Medya içerik analizi, bir araştırma metodolojisi olan içerik analizinin özel bir alt alanıdır (Macnamara, 2005). İçerik analizini, metin veya metinlerdeki belirli kelime veya kavramların varlığını belirlemek için belgenin kurallara dayalı kodlama ile kategorilere ayrıldığı sistematik bir teknik olarak tanımlarlar (Büyüköztürk, Kılıç Çakmak, Akgün, Karadeniz ve Demirel, 2012). Araştırmada Türkiye'de yayımlanan Hürriyet, Sabah ve Posta gazetelerinde yer alan bilim ve teknoloji haberlerinin temsili analiz edilmiştir. Gazetelerin 28 Ağustos- 21 Eylül 2019

tarihleri arasında yayınlanan tüm kopyaları incelenmiştir. Bu kapsamda 69 sayı incelenmiş ve 304 bilim ve teknoloji haberi tespit edilmiştir.

Türkiye'de yayınlanan günlük basılı gazetelerdeki bilim ve teknolojinin ne kadar ve nasıl yer aldığının incelendiği bu çalışmada, bilim ve teknoloji haberlerine diğer haberlere göre az yer verildiği sonucuna ulaşılmıştır. Buna karşın gazetelerde politika, magazin, spor gibi haberlere daha çok yer verildiği görülmüştür. Bilim haberlerinin genellikle küçük alanlarda gazetelerin arka sayfalarında yer aldığı görülmüştür. Buna karşın siyaset haberlerinin manşetlerde, gazetenin orta bölümünde daha çok yer kapladığı görülmüştür.

İncelenen tarihler arasında günlük olarak bilim haberlerinin en fazla Hürriyet gazetesinde, en az haber ise Sabah gazetesinde yer aldığı görülmektedir. Bazı günler ise hiçbir bilim ve teknoloji haberine rastlanmamıştır. Teknoloji haberleri incelendiğinde cep telefonu teknolojileri, bilgisayar haberleri, araba teknolojileri, savunma sanayi, robotlar, sağlık teknolojisi, internet, ulaşım, uzay teknolojileri ve eğitim teknolojileri ile ilgili haberlerin olduğu görülmüştür. En çok teknoloji haberinin Sabah gazetesinde, en az teknoloji haberinin Posta gazetesinde yer aldığı görülmektedir. Sabah gazetesinde teknoloji haberlerinin fazla olmasının nedeni haftanın bazı günleri teknoloji haberlerini içeren özel bir sayfanın yer almasıdır. Bu nedenle gazetelerde bilim ve teknoloji adı alında sayfalar oluşturulmasının bilim ve teknolojinin daha iyi anlaşılmasına ve daha çok dikkat çekeceği düşünülmektedir. Teknolojiyle ilgili haberler doğru kullanıldığında, teknolojinin doğasını öğretmede veya teknolojinin doğası hakkında farkındalık yaratmada etkili araçlar oldukları görülmektedir.

Bilimsel haberlerin içeriklerinde haber başlık, haber verilebilirlik, kaynak, bilimsel içerik, bilimsel doğruluk, bilim insanları, çizimler, denge/önyargı ve editörün yorumlarının yer aldığı görülmektedir. Bilimsel içeriklere yer vermekten çok ilgi çekici yanlarına vurgu yapılmaktadır. Haberlerin bir bölümünde kaynak gösterilmediği görülmektedir. Oysa bilimsel içerikler sunulurken bilimin kaynağı haberin güvenirliği için önemli bir göstergedir.

Bilim okuryazarlığı, sürdürülebilir gelişim ve toplumda sosyo-bilimsel konuların anlaşılması büyük bir öneme sahiptir. Sosyo-bilimsel konular bilimsel ilkelerin uygulamalarına dayanarak karmaşık ve tartışmalı, birden fazla çözümü olan, farklı bakış açılarını içeren sosyal ikilemleri temsil eder. Gazetelerde yer alan bilimsel haberlerde sosyo-bilimsel konulara yeteri kadar yer verilmediği görülmüştür. Bu haberlerde sosyo-bilimsel içeriklerin genellikle kimya- teknoloji ağırlıklı olduğu görülmektedir.

Medyanın, bilimsel ve teknik ilerlemelerin kitlelere ulaştırılmasında büyük rolü vardır. Gazetelerin önemli bir işlevi, bilimsel olayların ve haberlerin çarpıtılmadan topluma doğru bir şekilde aktarılmasını sağlamaktır. Gazetecilik, toplumun bilimsel anlayışın gelişimine ve teknolojinin doğası anlayışına katkıda bulunmalıdır. Yaşam tarzımız, iş hayatımız, aile hayatımız kısacası sosyal hayatımızın hemen her alanında bilim ve teknolojinin olumlu ya da olumsuz etkisi ile yeniden şekillenmektedir. Çünkü bilim, toplumdaki her sosyo-ekonomik kademeden anlaşılamayan karmaşık yapısı nedeniyle kopukluk yaşamaktadır. Bu açıdan bilim iletişimcileri, bilim dünyası ile halk arasında köprü görevi görmektedir. Bu bağlamda bilim iletişiminin etkin bir şekilde kullanımı için bilim iletişimcilerinin ve bilim-teknoloji yazarlarının birlikte çalışmaları önerilmektedir.

Araştırma sonuçları doğrultusunda araştırmacılara gelişmiş, gelişmekte olan ve gelişmemiş ülkelerde bilimsel-teknoloji haberlerinin tasvirinin nasıl yapıldığına ilişkin içeriklerin araştırması önerilebilir. Literatürde de benzer biçimde gazetelerde yer alan bilim ile ilgili haberlerin varlığı öğrencinin ilgisini çekmekte ve gazetelerin sınıf ortamına getirilmesi ve kullanılmasının bilim ile günlük yaşam arasında bir bağ kurabilme anlamında kolaylık sağlayacağı vurgusu yapılabilir. Gazetelerin bilimin ve teknolojinin doğasının öğretiminde kullanılmasına yönelik araştırmalar yapması önerilebilir.