Necmettin Erbakan Üniversitesi *Ereğli Eğitim Fakültesi Dergisi* 5/2 *(2023), 443-468 | Araştırma Makalesi*

Fen Bilimleri ve Sınıf Öğretmenlerinin Popüler Bilime İlişkin Bakış Açıları

Ersin KARADEMİR [1], Songül UÇAR [2]

[1] Eskişehir Osmangazi Üniversitesi,Fen Bilgisi Eğitimi Anabilim Dalı, Eskişehir, Türkiye, eekarademir@gmail.com , 0000-0002-8519-622X

[2] Milli Eğitim Bakanlığı, İstanbul, Türkiye, snglucr6@gmail.com , 0000-0003-0047-5025

Öz

Fen öğretiminde farklı ve yenilikçi yaklaşımlar kullanmak oldukça önemlidir. Bilimsel içeriklerin aktarımının daha anlaşılır olması, öğrencilerin bilim konusunda daha meraklı olmasını sağlamaktadır. Popüler bilim içerikler de bu aktarım yöntemlerinden biridir. Popüler bilim dergileri, kitapları, videolar, belgeseller vb. birçok materyal bilimin anlaşılmasında önemli bir rol oynar. Bu açıdan bakıldığında fen derslerinde popüler bilim içeriklerini kullanmak öğretmenlere avantaj sunmaktadır. Bu çalışmada fen bilimleri ve sınıf öğretmenlerinin popüler bilime yönelik bakış açıları ve tutumlarını incelemek amaçlanmıştır. Bu amaç doğrultusunda nitel ve nicel verilerin birlikte ele alındığı karma desen tercih edilmiştir. Nitel kısımda 7 sınıf öğretmeni ve 7 fen bilimleri öğretmeni ile açık uçlu görüşmeler gerçekleştirilmiştir. Nicel kısmında ise Uçar ve Karademir (2020) tarafından geliştirilen Popüler Bilime Yönelik tutum ölçeği ile 175 fen bilimleri ve 298 sınıf öğretmeninden veri toplanmıştır. Verilerden elde edilen bulgulara göre popüler bilim içeriklerini fen bilimleri öğretmenlerinin sınıf öğretmenlerinden daha fazla ve çeşitli olarak kullandığı tespit edilmiştir. Tutum ölçeğinden elde edilen bulgulara göre yeni göreve başlayanların popüler bilime yönelik tutumlarının çok yıllık kıdeme sahip öğretmenlerden daha yüksek olduğu tespit edilmiştir.

Anahtar Kelimeler

Popüler Bilim, Bakış Açıları, Tutum, Bilim Eğitimi, Bilim

Atıf Bilgisi

Karademir, E. & Uçar, S. (2023). Fen Bilimleri ve Sınıf Öğretmenlerinin Popüler Bilime İlişkin Bakış Açıları. *Necmettin Erbakan Üniversitesi Ereğli Eğitim Fakültesi Dergisi, 5*(2), 443-468. https://doi.org/ 10.51119/ereegf.2023.64

Geliş Tarihi	15.08.2023
Kabul Tarihi	04.12.2023
Yayım Tarihi	31.12.2023
Etik Beyan	Bu çalışmanın hazırlanma sürecinde bilimsel ve etik ilkelere uyulduğu ve yararlanılan tüm çalışmaların kaynakçada belirtildiği beyan olunur.
Bilgilendirme	Bu çalışma Doç. Dr. Ersin KARADEMİR danışmanlığında 2021 yılında tamamlanan yüksek lisans tezi esas alınarak hazırlanmıştır.
Benzerlik Taraması	Yapıldı – Turnitin
Etik Bildirim	eekarademir@gmail.com
Çıkar Çatışması	Çıkar çatışması beyan edilmemiştir.
Yazar Katkı Oranı	Yazar Katkıları: Yazar 1: %50-Araştırma tasarımı, literatür tarama, yöntem, analiz, bulgu ve sonuçlar, Yazar 2: %50-Araştırma tasarımı, literatür tarama, yöntem, analiz, bulgu ve sonuçlar.
Finansman	Bu araştırmayı desteklemek için dış fon kullanılmamıştır.
Telif Hakkı & Lisans	Dergide yayımlanan çalışmaların telif hakkı Necmettin Erbakan Üniversitesi Ereğli Eğitim Fakültesi Dergisi'ne aittir ve çalışmalar CC BY-NC 4.0 lisansı altında yayımlanmaktadır.

Science and Primary School Teachers' Perspectives on Popular Science

Ersin KARADEMİR [1], Songül UÇAR [2]

[1] Eskişehir Osmangazi University, Department of Science Education, Eskişehir, Türkiye, eekarademir@gmail.com , 0000-0002-8519-622X

[2] Ministry of National Education, İstanbul, Türkiye, snglucr6@gmail.com , 0000-0003-0047-5025

Abstract

It is very important to use different and innovative approaches in science teaching. The fact that the transfer of scientific content is more understandable makes students more curious about science. Popular science content is one of these transfer methods. Popular science magazines, books, videos, documentaries, etc. Many materials play an important role in understanding science. From this point of view, using popular science content in science lessons offers teachers an advantage. In this study, it is aimed to examine the perspectives and attitudes of science and primary school teachers towards popular science. For this purpose, mixed design, in which qualitative and quantitative data are handled together, was preferred. In the qualitative part, open-ended interviews were conducted with 7 primary school teachers and 7 science teachers. In the quantitative part, data were collected from 175 science and 298 primary school teachers with the attitude scale towards Popular Science developed by Uçar and Karademir (2020). According to the findings obtained from the data, it has been determined that science teachers use popular science content more and more diversely than primary school teachers. According to the findings obtained from the attitude scale, it has been determined that the attitudes of the new recruits towards popular science are higher than the teachers with many years of seniority.

Keywords

Popular Science, Perspectives, Attitude, Science Education, Science

Citation

Karademir, E. & Uçar, S. (2023). Science and Primary School Teachers' Perspectives on Popular Science, *Journal of Necmettin Erbakan University Ereğli Faculty of Education, 5*(2), 443 - 468. https://doi.org/10.51119/ereegf.2023.64

Date of Submission	15.08.2023
Date of Acceptance	04.12.2023
Date of Publication	31.12.2023
Ethical Statement	It is declared that scientific and ethical principles have been followed while carrying out and writing this study and that all the sources used have been properly cited.
Acknowledgements	This study was conducted by Assoc. Dr. It was prepared based on the master's degree completed in 2021 under the supervision of Ersin KARADEMİR.
Plagiarism Checks	Yes - Turnitin
Conflicts of Interest	The author(s) has no conflict of interest to declare.
Author Contributions	Author Contributions: Author 1: 50%-Research design, literature review, method, analysis, findings, and results, Author 2: 50%-Literature review, research design, and method, analysis, findings, and results.
Complaints	eekarademir@gmail.com
Grant Support	The author(s) acknowledge that they received no external funding in support of this research.
Copyright & License	The copyright of the studies published in the journal belongs to Journal of Necmettin Erbakan University Ereğli Faculty of Education and the studies are published under the CC BY-NC 4.0 license.

Introduction

Today, countries adopt an understanding of education according to the needs of the age in order to raise this level and prepare for life in the best way. Education achieves its aims only through education programs. It is aimed that the prepared program will bring the desired skills, values and habits in society (Karademir, 2017). In recent years, especially starting from the development of science and technology, raising individuals with 21st century skills has become the main purpose of education and training. In the acquisition of these skills, the sciences, which inherently contain many disciplines, play a major role (Karamustafaoğlu, 2018). In this respect, it is extremely important to learn science from a young age, to know the concepts related to science and to use them in daily life, in short, to be trained as science-literate (Çepni, 2019). Science literacy is a concept that emerged in the second half of the 1950s (Belhan & Şimşek, 2012). The most important task in raising science literate individuals falls on the education system and curriculum. The subject in the curriculum necessitates the use of alternative and innovative teaching methods and techniques in the acquisition of concepts and both cognitive and non-cognitive high-level skills. Because it is a difficult process for students to learn some subjects and concepts in the changing science curriculum and to acquire high-level skills. The reason for this is that some science subjects and concepts remain abstract for students, students cannot connect the new information given about the concepts with the old ones, they are insufficient in understanding what they read, interpreting logical and mathematical operations, graphics and figures (Ucer, 2019). In addition, students cannot establish a context between previous learning and new ones and have problems in associating with daily life. Therefore, the science curriculum shows that it is not sufficient to teach traditional methods only in classrooms.

Teachers' use of scientific books, journals and popular science content to gain complex subjects, concepts and high-level skills in science lessons can play an important role in achieving the goal of raising science literacy. Because popular science content establishes a bond between science and individuals, gives the individual the opportunity to gain reading skills and the ability to understand the essence of events, and to associate information with daily life (Kıyıcı et al., 2012). In addition, popular science content has an interesting and intriguing effect on people and students, making complex scientific topics and concepts easy to understand. For this reason, popular science content (books, magazines, documentaries/series, science-related films, activities, etc.) should help students learn reading skills, logical and mathematical interpretation, explaining events scientifically, designing and evaluating scientific research, interpreting and proving data, critical thinking, It can be used as an alternative

and innovative method in gaining high-level skills such as making inferences. Students' interest in science comes from how these topics will affect their lives rather than from the content of the subject. Popular science contents, which form a bridge between science and life, describe the nature of science and its relationship with life, and appeal to large audiences with its simple language. Popular science content that develops a sense of curiosity in students creates positive effects on learning and motivation, making learning permanent (Eroğlu & Sağlam, 2020). The simple language of popular science content makes it difficult to understand content and scientific subjects easier to understand in science lessons. This increases the student's self-confidence and improves the sense of achievement (Pelger & Nilsson, 2016).

Science is not only about physics, chemistry, biology and human behavior, but also about humanities such as literature, music, art and history (O'Connor, 2009). The concept of science and its content go through a process of constant restructuring and reuse. Therefore, our whole life is constantly changing by the progress and results of science, technology, medicine and health practices (Ridder, 2014). Since science is gradually divided into many different branches, it becomes difficult to follow the developments in science, whether it is a scientist or a public person. For this reason, popular science builds a bridge between society and science, increasing scientific literacy in the society and facilitating the follow-up of developments in this field. (Akoglu, 2005). Popular science changes as society's view of science changes. In today's science-society relationship, society is not only the recipient of information; it is the party that requests information and evaluates it as a service of the scientific world towards itself (Kılıç, 2009). Popular science works not as a one-way knowledge transfer process, but as heterogeneous cultural exchanges and feedback loops between different social groups. With the understanding of bringing science to people in modern societies, science books, periodicals, conferences, guided tours, shows, demonstrations and many other social and commercial areas have become popular. Popular science is a way for the public to follow scientific developments and for society to form sound views on these developments. In addition, it is the structure in which scientific knowledge and the components of scientific literacy are formed in a way that people from all walks of life can understand. (O'Connor, 2009).

It is an accepted idea today that popular science contents are among the contents that make students love to learn, in short, to provide students with curiosity, scientific research, problem-solving, reading skills, logical and mathematical skills. By building a bridge between popular science, society and science, it enables society to be aware of scientific and technological developments (Akoğlu, 2005). Popular science books play an important role in

developing students' imaginations and making a connection between science and life. It also contributes significantly to language development (Toz, 2007). In addition, popular science; It is thought to be effective in explaining and evaluating science and scientific phenomena scientifically, which attracts students' attention and prompts them to think and interpret. For this reason, the use of popular science content in the lessons provides great convenience to the teachers in reaching the objectives of the lesson, while it also provides benefits in raising the science literacy, which is the main purpose of the science lesson. In addition, when it is used in science lessons, it arouses curiosity and interest in students, while providing examples from nature and daily life, so that science is associated with life. Therefore, the popular science contents used increases the quality of science teaching.

Therefore, it is aimed to examine how much the science and primary school teachers give place to popular science content (books, magazines, documentaries/series, science-related films, activities, etc.), their attitudes towards popular science and their perspectives on popular science.

Method

Research Design

The design of this research was determined as a mixed design in which qualitative and quantitative data were collected. The main purpose of the mixed design is to obtain multiple data with different methods and techniques. Using the methods together is superior to the single method design in providing a better analysis of the problem situation (Pole, 2007). In this and many other aspects, the mixed pattern can be used incorrectly. The reason why mixed design is preferred in research is that it has many advantages. For example, one method may be insufficient to answer the research question, or the weaknesses of the methods used may complicate the research. However, this situation is eliminated with the multiple methods used in the mixed design (Fleming and Guest, 2014).

Participants

For the quantitative aspect of this research, a total of 473 teachers, 175 science teachers and 298 primary school teachers, were selected, working in different provinces of Turkey in the 2020-2021 academic year. For the qualitative dimension of the research, science and primary school teachers working in different provinces of Turkey in the 2020-2021 academic year were selected. In qualitative studies, a heterogeneous group ranging in size from 3-4 people to 10-15 people is determined in order to obtain in-depth data (Karademir, et al., 2017). In a research, observation units can be composed of

people, events, objects or situations with certain characteristics. In this case, units (objects, events, etc.) that meet the criteria determined for the sample are taken into the sample (Büyüköztürk et al., 2008). The study group consists of science and classroom teachers determined through criterion sampling. In determining the participants in this study; the criterion was based on being able to teach science courses in primary and secondary schools. In the study, being a science teacher and a classroom teacher was taken into account as the basic criteria. However, in the interviews, the desired satisfaction was achieved from 7 science and 7 primary school teachers. For this reason, semi-structured interviews were conducted with 7 science and 7 primary school teachers for the qualitative dimension of the research.

Data Collecting Tool

The Attitude Scale Towards Popular Science

The Attitude Scale Towards Popular Science was prepared by Uçar and Karademir (2021), and after 6 items were removed, it was applied to the teachers again as 37 items. 5-point Likert-type scale is two-dimensional; The first sub-dimension was stated as "Attitudes towards popular science in the context of the teaching profession", and the second sub-dimension as "Attitudes towards popular science in the context of personal development". The Bartlett (Sphericity) test result was significant ($p=0.00<0.05$) and the Kaiser Mayer-Olkin (KMO) value was found to be 0.886. Since this value was seen as a very good value, it was concluded that the sample was sufficient and there was no problem in performing factor analysis (KMO= 0.886 > 0.80). The total variance value was found to be 64,535. According to the explained variance value, the Attitude towards Popular Science Scale was found to be valid. The “Croanbach Alpha” value of the scale was found to be 0.916.

Interview Form

A semi-structured interview form was used to collect data in the qualitative dimension of the research. Although semi-structured interview is seen as an easy method that anyone can do, the person who will manage the interview should have skills such as communication, foresight and sensitivity (Akyüz et al., 2010). For these reasons, the draft form on "Teachers' Opinions on Popular Science Practices" prepared by the researchers was created by taking the literature review and expert opinions. Necessary arrangements were made in line with the evaluation and suggestions of the experts. After obtaining permission from the relevant places, the form prepared for the research was applied to three randomly selected teachers and they were asked to make an evaluation regarding the scale. In this way, the validity of

the interview form was tested. As a result of the participant evaluations, a consensus was reached, necessary corrections and additions were made in some articles, and the form was finalized. The final form of the form was applied to the participants on a voluntary basis.

Procedure and Data Analysis

Considering that the date of the research coincided with the COVID-19 epidemic and there were many restrictions, the interviews were made with a distance education application, and the collection of scale data was done via online environments. Descriptive statistics, means, standard deviations, etc. of the scales from the data sets. values were found and independent groups t-Test was performed for the independent variables (gender). One-way analysis of variance (ANOVA) was performed for other independent variables (branch, seniority, and place of employment). In the semi-structured interview, all interviews were recorded through the Zoom application. All of these records were written down and analyzed one by one. In the analysis of the interviews, the prominent titles and codes were determined. These codes were determined directly or indirectly from the answers given by the interviewed teachers to the questions. Data diversification was made to ensure the external reliability of the research; Data was collected from the group through both demographic characteristics and an interview form. Reliability in research means collecting data with high credibility and going through the process of analyzing the collected data (Dal, 2012). Reliability = [Consensus / Consensus + Disagreement] *100 According to researchers in the literature, it is stated that the desired reliability will be achieved if it is 90% or above (Karademir et al. 2017,). It was evaluated separately by experts and as a result of pairwise comparisons, it was determined that the reliability of the relevant study varied between 93% and 95%.

Findings

Findings from Qualitative Data

In the interviews, 7 science teachers and 3 primary school teachers expressed their opinions on the question asked about the definition of popular science.

Table 1.

Opinions of science and primary school teachers on the definition of popular science

	Sci.T.*	Pr.Sc.T.**
	f	*f*
Explaining events in daily life in a way that everyone can	4	3

understand		
Explaining difficult and complex concepts in simple ways	2	-
Science associated with life that interests people	1	-
I don't know the definition of popular science	-	4

*Science Teacher, **Primary School Teacher

As indicated in Table 1, the definition of popular science according to the views of science and primary school teachers; In daily life, the views of explaining the events in a way that everyone can understand, explaining difficult and complex concepts in simple ways, science associated with life that attracts people's attention, I do not know the definition of popular science have emerged. For the definition of popular science from science teachers; Explaining the events in daily life in a way that everyone can understand (f=4), explaining difficult and complex concepts in simple ways (f=2), and science related to life (f=1) views that attract people's attention have emerged. For the definition of popular science from primary school teachers; The opinions of explaining the events in daily life in a way that everyone can understand (f=3) have emerged. In addition, the opinions of the primary school teachers that they do not know the definition of popular science were revealed (f=4).

In the interviews, 6 science teachers and 2 primary school teachers stated that they recommend the books they read to their students and use them in the lesson. On the other hand, 1 science and 5 primary school teachers stated that they did not read popular science books and did not use them in the lesson and recommend them to students. The prominent topics in the answers of science and primary school teachers regarding the reasons for recommending popular science books and using them in the course are as shown in the Table 2 below.

Table 2.

Reasons for science and primary school teachers to use popular science books in class

	Sci.T.	Pr.Sc.T.
	f	*f*
Being an interesting	2	-
Creating a science culture and raising science literate	2	-
Current and scientific development follow-up	1	-
Making the connection between science and life	1	-
Reinforce curiosity and increase imagination	1	1
Making science popular	-	1
Using a source other than textbooks	-	1

As stated in Table 2, regarding the reasons why science and primary school teachers recommend popular science books and use them in the lesson; The views of being interesting, creating a science culture, raising science literate, following current and scientific developments, providing the connection between science and life, reinforcing the sense of curiosity and increasing imagination, warming up to science/science, using a source other than textbooks have emerged. Regarding the reasons why science teachers recommend popular science books and use them in the lesson; being interesting (f=2), creating a science culture and raising scientific literacy (f=2), following current and scientific developments (f=1), providing the connection between science and life (f=1), reinforcing the sense of curiosity and nurturing imagination. increasing (f=1) opinions emerged. Regarding the reasons why class teachers recommend popular science books and use them in the lesson; The opinions of reinforcing the sense of curiosity and increasing the imagination (f=1), warming up to science/science (f=1), using a source other than textbooks (f=1) have emerged.

In the interviews, 7 science teachers and 6 primary school teachers stated that they recommend popular science magazines to their students regarding the reasons for recommending popular science magazines. The prominent titles in the answers of the primary school and science teachers regarding the reasons for recommending popular science journals are as shown in the Table 3 below.

Table 3.

Stages of science and primary school teachers using the contents of popular science sites in class

	Sci.T.	Pr.Sc.T.
	f	*f*
At the end of the unit or lesson	1	2
While describing the subject	2	-
Introduction, lecture and at the end of the lesson	2	-
At the beginning of the course or at the end of the unit	1	-
Sometimes in the introductory stage, sometimes in the lecture	1	-
Introductory stage	-	1

As stated in Table 3, regarding the stages of using the contents of popular science sites and applications in lessons by science and primary school teachers; At the end of the unit or lesson, while explaining the subject, at the

introduction, at the end of the lecture and at the end of the lesson, at the introductory stage of the lesson or at the end of the unit, sometimes at the introductory stage, sometimes during the lecture, at the introductory stage. Regarding the stages of using the contents of popular science sites and applications in the lessons of science teachers; At the end of the unit or lesson (f=1), while explaining the subject (f=2), at the introduction, at the end of the lecture and at the end of the lesson (f=2), at the introductory phase of the lesson or at the end of the unit (f=1), sometimes at the introductory phase, sometimes at the end of the lecture. (f=1) opinions emerged. Regarding the stages of primary school teachers using content from popular science sites and applications in lessons; At the end of the unit or course (f=2), at the introductory stage (f=1), their opinions emerged.

The highlights of the answers of science and primary school teachers regarding the reasons for using popular science-related films (sci-fi/science-related films, TV series, documentaries, programs, etc.) in the interviews are as shown in the Table 4 below.

Table 4.

Reasons for science and primary school teachers to use popular science related movies in class

	Sci.T.	Pr.Sc.T.
	f	*f*
Creating in-class small group discussions	3	-
Arousing interest	1	2
Reinforcing and perpetuating what has been learned	2	-
Discussion and idea generation	1	1
To give examples	1	1
Showing the truth through some scientific inaccuracies in movies	1	-
To ask a question about	-	1
Increasing the imagination	1	-
Concretizing topics and concepts	1	

As stated in Table 4, science and primary school teachers related to the reasons for using popular science movies; creating small group discussions in class, arousing interest, reinforcing and perpetuating what they have learned, discussing and generating ideas, showing the truth through some scientific mistakes in movies to give examples, asking questions about the subject, increasing imagination, concretizing topics and concepts. they have stated.

Regarding the reasons why science teachers use popular science movies (sci-fi movies, TV series, documentaries, programs, etc.); creating small group discussions in class (f=3), arousing interest (f=1), reinforcing and making permanent what they have learned (f=2), discussion and generating ideas (f=1), giving examples (f=1) stated opinions as showing the truth (f=1), increasing the imagination (f=1), concretizing the subjects and concepts (f=1) over some scientific mistakes in the movies. Regarding the reasons for using popular science-related movies (sci-fi/science-related movies, TV series, documentaries, programs, etc.); They expressed opinions as arousing interest (f=2), discussion and generating ideas (f=1), giving examples (f=1) and asking questions about the subject (f=1).

The highlights of the answers of science and primary school teachers regarding the reason for associating popular science contents (books, magazines, websites, movies, TV series, documentaries, programs, activities, etc.) with the subjects and achievements in the science curriculum during the interviews are as shown in the Table 5 below.

Table 5.

The reasons of science and primary school teachers to associate science subjects and achievements with popular science contents

	Sci.T.	Pr.Sc.T.
	f	*f*
Explaining complex topics and concepts in a simple way	4	1
Show the unobservable	4	-
Include visual content	2	2
Concretizing topics and concepts	2	1
Connecting with life	2	1
Making learning permanent	1	2
Attract attention	1	1
Giving examples on the subject	1	-
Science/science orientation	1	-
Arouse curiosity	-	1
Explain the topic quickly	-	1

As stated in Table 5, for the reason why science and primary school teachers associate popular science content with the subjects and achievements in the science curriculum; explaining complex subjects and concepts in a simple way, showing the unobservable, giving place to visual content, concretizing subjects and concepts, connecting with life, making learning permanent, attracting attention, giving examples related to the

subject, directing to science/science, attracting attention, curiosity waking up, explaining the subject in a short time have emerged. Regarding the reason why science teachers associate popular science content (book, magazine, website, film, series, documentary, program, activity, etc.) with the subjects and achievements in the science curriculum; explaining complex subjects and concepts in a simple way (f=4), showing the ones that cannot be observed (f=4), including visual content (f=2), concretizing subjects and concepts (f=2), connecting with life (f=2), making learning permanent (f=1), attracting attention (f=1), giving examples about the subject (f=1), orienting to science/science (f=1). Regarding the reason why primary school teachers associate popular science content (book, magazine, website, film, TV series, documentary, program, activity, etc.) with the subjects and achievements in the science curriculum; Explaining complex subjects and concepts in a simple way (f=1), including visual content (f=2), concretizing subjects and concepts (f=1), connecting with life (f=1), making learning permanent (f=2), 1 view to attract attention (f=1), to arouse curiosity (f=1), to explain the subject in a short time (f=1).

Findings from Quantitative Data

The data collected from the Attitudes Towards Popular Science Scale prepared by Uçar and Karademir (2020), applied to science and primary school teachers, and the t-Test and ANOVA results made according to the determined variables are as follows.

Table 6.

The t-test findings of the changes of teachers' attitudes towards popular science according to gender of attitudes towards popular science in the context of teaching profession and personal development

	Gender	*n*	$\overline{X}$	*s*	*t*	*p*
Sub-Dimension-1: Attitudes towards popular science in the context of the teaching profession	Female	352	106,60	12,27	2,399	.017
	Male	121	103,26	16,32		
Sub Dimension-2: Attitudes towards popular science in the context of personal development	Female	352	40,28	6,32	2,130	.034
	Male	121	38,87	6,63		
Total Points	Female	352	146,88	17,58	2,442	.015

	Male	121	142,14	21,72	

As shown in Table 6, according to the findings obtained from the t-Test; There was a significant difference in favor of female teachers in terms of "attitudes towards popular science in the context of teaching profession", "attitudes towards popular science in the context of personal development" and "attitudes towards popular science" between female and male teachers ($p<0.05$).

Table 7.

One-way analysis of variance (ANOVA) findings of the changes of teachers' attitudes towards popular science in the context of teaching profession and personal development according to the year of seniority

Seniority	Source of Variance	Sum of Squares	*df*	*F*	*p*	Difference *
Sub-Dimension-1: Attitudes towards popular science in the context of the teaching profession	Between Groups	2483,558	3	4,80	.003	1-4 2-4 3-4
	In Groups	80791,00	469			
	Total	83274,56	472			
Sub Dimension-2: Attitudes towards popular science in the context of personal development	Between Groups	599,408	3	5,19	.002	1-4 2-4 1-2
	In Groups	18040,69	469			
	Total	18640,10	472			
Total Points	Between Groups	5452,181	3	5,43	.001	1-4 2-4
	In Groups	156784,0	469			
	Total	162236,2	472			

*Groups: 1: 1-5 years, 2: 6-10 years, 3: 11-15 years, 4: 16 years and above

As shown in Table 7, according to the results of the one-way analysis of variance, it was determined that there was a significant difference in terms of "attitudes towards popular science in the context of the teaching

profession", "attitudes towards popular science in the context of personal development" and "attitudes towards popular science" ($p<0.05$). Since there were significant results in the Anova test, the paired groups were compared with the Tukey test and the following findings were obtained.

In terms of "attitudes towards popular science in the context of the teaching profession" of teachers with 1-5 years of seniority, teachers with a seniority of 16 years or more; Of the teachers with 6-10 years of seniority, teachers with 16 years or more; It has been determined that teachers with 11-15 years of seniority have higher attitudes than teachers with 16 or more seniority years ($F(3, 469) = 4.80$, $p = .003$).

In terms of "attitudes towards popular science in the context of personal development", teachers with a seniority of 1-5 years are among the teachers with a seniority of 16 years or more; Of the teachers with 6-10 years of seniority, teachers with 16 years or more; It has been determined that teachers with 1-5 years of seniority have higher attitudes than teachers with 6-10 years of seniority ($F(3, 469) = 5.19$, $p = .002$).

In terms of "attitudes towards popular science", teachers with 1-5 years of seniority are among the teachers with 16 years and more; It has been determined that teachers with 6-10 years of seniority have a higher attitude than teachers with 16 years or more ($F(3, 469) = 5.43$, $p = .001$).

Table 8.

The t-test findings of the changes of teachers' attitudes towards popular science in the context of teaching profession and personal development attitudes towards popular science according to branches

	Branch	*n*	$\overline{X}$	*s*	*t*	*p*
Sub-Dimension-1: Attitudes towards popular science in the context of the teaching profession	Sci.T*	175	109,09	11,09	4,268	< .001
	Pr.Sc.T**	298	103,78	14,06		
Sub Dimension-2: Attitudes towards popular science in the context of personal development	Sci.T	175	41,21	5,77	3,578	.010
	Pr.Sc.T	298	39,16	6,45		
Total Points	Sci.T	175	150,30	15,74	4,242	< .001
	Pr.Sc.T	298	142,94	19,51		

*Science Teacher, **Primary School Teacher

As shown in Table 8, a significant difference was found in terms of the first sub-dimension, the second sub-dimension and total scores according to the results obtained from the scales for the branches according to the t-Test results ($p<0.05$). According to the branches of the teachers in terms of "Attitudes towards popular science in the context of teaching profession" (first sub-dimension), "Attitudes towards popular science in the context of personal development" (second sub-dimension), "Attitudes towards popular science" (total scores) of science teachers than primary school teachers. They were found to have high attitudes.

Table 9.

One-way analysis of variance (ANOVA) findings regarding the changes of teachers' attitudes towards popular science in the context of teaching profession and personal development attitudes towards popular science by position

Position	Source of Variance	Sum of Squares	*sd*	*F*	*p*
Sub-Dimension-1: Attitudes towards popular science in the context of the teaching profession	Between Groups*	682,725	2	1,943	.144
	In Groups	82591,837	470		
	Total	83274,562	472		
Sub Dimension-2: Attitudes towards popular science in the context of personal development	Between Groups	83,354	2	1,056	.349
	In Groups	18556,751	470		
	Total	18640,106	472		
Total Points	Between Groups	1228,486	2	1,793	.168
	In Groups	161007,72	470		
	Total	162236,20	472		

*Groups: 1: province, 2: district, 3: village

As shown in Table 9, one-way analysis of variance in order to test whether

"attitudes towards popular science in the context of the teaching profession", "attitudes towards popular science in the context of personal development" and "attitudes towards popular science" (total scores) differ according to their place of employment as shown in Table 9. used and the results are presented in Table 9. According to the results obtained from the scales according to the teachers' position, no significant difference was found in terms of the first sub-dimension, the second sub-dimension and the total scores ($p>0.05$).

Conclusion and Discussion

In the research, science and primary school teachers; It is aimed to examine the attitudes and perspectives to popular science. For this purpose, the Attitude Scale Towards Popular Science prepared by Uçar and Karademir (2020) was applied to a total of 473 teachers, including 175 science teachers and 298 primary school teachers, working in different provinces of Turkey in the 2020-2021 academic year. In addition, semi-structured interviews were conducted with 7 science and 7 primary school teachers. All of the opinions were analyzed and prominent topics were determined. All the obtained data were written in the findings section of the research. In line with the findings, the following conclusions were reached.

According to the qualitative and quantitative data in the study, it was found that science teachers' attitudes and perspectives towards popular science were higher than primary school teachers. According to this, science teachers prefer popular science books, magazines, sites and applications, movies and documentaries, etc., according to primary school teachers. It has been concluded that the rate of following and using the content is higher. The data obtained from the qualitative interviews are among the results obtained that science teachers follow the contents of popular science books, magazines and websites more than primary school teachers, talk about these contents to their students and use them in their lessons. On the other hand, it is among the results that most of the primary school teachers are not aware of these contents and the followers do not use them in their lessons. In quantitative data, it is supported by statistical data that science teachers have higher attitudes towards popular science than primary school teachers.

It has been determined that the awareness of popular science is at a higher level of science teachers than primary school teachers. Teachers expressed opinions about the definition of popular science as science that everyone can understand, science associated with life that attracts people's attention. On the other hand, it is among the results that more than half of the primary school teachers could not have an opinion on popular science. Küçükvardar's (2020) study is similar to the popular science definition finding of the research. As Küçükvardar (2020) stated in his study, publications on science

and journalism provide communication between society and science. According to Küçükvardar (2020), science journalism is a means of informing the public about opportunities related to science. Presenting scientific content in a language that the public can understand is one of the most important features of science journalism.

In the research, it is among the results that science teachers are more likely to read popular science books, recommend students and use popular science content in the lesson than primary school teachers. When the reasons why teachers recommend popular science books to students and use them in the lesson are examined; It was determined that they expressed their views as being interesting, creating a science culture, raising science literate individuals, keeping up with current and scientific developments, providing the connection between science and life, reinforcing the sense of curiosity and increasing imagination, warming up to science/science, and using a source other than textbooks. . In their study, Kıyıcı and Yavuz (2012) found that most of the teachers follow popular science books. Teachers stated that they want to use popular science books as a scientific source in addition to textbooks and to be informed about scientific developments as the reasons for following these books. In this respect, the study of Kıyıcı and Yavuz (2012) supports the results of the research.

In terms of following popular science magazines, recommending them to students and using them in the course; It has been determined that science teachers use and recommend popular science magazines more than primary school teachers. Teachers recommend popular science magazines to their students and use them in the lesson; They stated that they are interesting, have visual content, reinforce the sense of curiosity, benefit from being aware of new scientific and technological developments, include a number of activities, and are easily accessible resources. Akoğlu (2005) stated in his study that popular science publishing is important in popularizing astronomy. TÜBİTAK stated that popular science journals, books and other popular science publications are very important sources for astronomy issues. With these publications, he stated that everyone can follow the astronomy issues. In this respect, the study of Akoğlu (2005) supports the research. In the study of Kıyıcı and Yavuz (2012), popular science journals; They stated that they are important resources in terms of following current developments, gaining scientific process skills and taking part in education. Science teachers stated that they benefited from popular science journals in enriching the content and following scientific events. They also stated that these magazines, which are interesting in education and training, should be used as a supplementary resource alongside the textbook. In this respect, the study of Kıyıcı and Yavuz (2012) partially supports this research. In the study by Arslan, Kurt, and Turan

(2016) in which they examined Mini Moneybox Magazine, they stated that there were visual content and age-appropriate texts in the magazine that attracted the attention of students. In this respect, it has been concluded that the magazine is an instructive tool that provides students with new concepts, opportunities for different experiences and enables them to connect with real life. The study of Arslan, Kurt, and Turan (2016) partially overlaps with the findings of this research.

In the research, from the point of view of following popular science sites and web applications by teachers and their use in the lesson; It has been determined that science teachers use it more than primary school teachers. As the reasons for using the contents of popular science sites and web applications, teachers; They stated the following expressions: giving examples on the subject, reinforcing and making permanent what students have learned, arousing interest, performing experiments that are not done in the primary school, associating with daily life, using it as a visual material, and concretizing the subject. Küçükvardar (2020) stated in his study that people today follow science news more on shorter, constantly updated and more visual sites. On these science journalism sites, videos and pictures attract people's attention. In this respect, Küçükvardar's (2020) study partially overlaps with the finding of this research. In research, science films, documentaries, etc. From the point of view of monitoring and use in the course; It has been determined that science teachers use it more than primary school teachers. Teachers' reasons for using science films, documentaries, etc.; creating small group discussions in the primary school, arousing interest, reinforcing and perpetuating what they have learned, discussing and generating ideas, giving examples, showing the truth through some scientific mistakes in movies, asking questions about the subject, increasing imagination, concretizing topics and concepts. Birkök (2008) stated in his study that movies are an effective educational tool that easily conveys complex information to many people. When movies are used for certain purposes in education, a positive attitude and behavior change is expected in students. In the study of Şahin and Tatlı (2020), science fiction films; He stated that it was effective in teaching scientific concepts, reinforcing existing knowledge and eliminating some misconceptions. It has been concluded that science-based movies have a positive effect on science teacher candidates' scientific literacy and attitudes towards science. These studies partially overlap with the findings of the research.

In the study, teachers stated that the contribution of popular science materials to science teaching is high. In the study of Ucer (2019) in which he investigated the role of popular science articles in science teaching based on the concept of atom; It has been concluded that popular science articles are

effective in teaching the concept of atom. Based on the concept of atom, it has been stated that popular science articles will be used in teaching other science subjects and concepts, and that popular science articles can improve students' scientific thinking skills, and their interests and motivations for science can be provided. Therefore, the research; The findings of increasing the student's interest in the lesson, making the learned knowledge permanent, concretizing abstract concepts and subjects, and developing the sense of curiosity are similar to the findings of Ucer's (2019) study. In the research, teachers included popular science content in the science curriculum; It has been stated that it is associated with subjects and achievements such as astronomy, gains related to space, living things, lighting and technological tools, environmental pollution, recycling and global warming. Based on these findings, it is among the results that science and primary school teachers can associate popular science content with all science subjects and achievements. Küçükvardar (2020) stated in his study that science journalism related to health and astronomy issues is being done more today. People are generally interested in these issues. Küçükvardar's (2020) study supports the research. In the research, the teachers, as the reasons for associating popular science content with the subjects and achievements in the science curriculum; explaining complex subjects and concepts in a simple way, making invisible events/situations that cannot be observed, including visual content, concretizing subjects and concepts, connecting with life, making learning permanent, attracting attention, giving examples related to the subject, directing to science/science They expressed it as attracting attention, arousing curiosity, and telling the subject in a short time. In the study of Kıyıcı and Yavuz (2012); They stated that popular science magazines and books provide a bridge between science and society, follow current developments, transfer the learned information to life, become aware of technological developments and understand the essence of scientific knowledge. In addition, popular science magazines and books have stated that they are important tools in achieving the goals of science education and in raising science literacy. In this respect, they stated that if possible, it should be included in all curricula and teachers should easily access/use these resources. The study of Kıyıcı and Yavuz (2012) is similar to the findings of the research. In the studies of Nilsson and Pelger (2015); they stated that popular science articles, texts and publications develop students in a positive way and prepare the individual for the future. In this respect, the study of Nilsson and Pelger (2015) partially overlaps with the findings of the research.

In the study, it was found that the attitudes and perspectives of science and primary school teachers towards popular science changed according to the years of seniority according to the quantitative data. According to this, it is

among the results that as the seniority in teaching increases, their attitudes towards popular science decrease. Qualitative findings also support quantitative findings. It is stated in the methods and findings of the research that 5 teachers have 1-5 years, 5 teachers 6-10 years, 1 teacher 11-15 years, 3 teachers 16 years or more. In the study, it was determined that teachers with 1-10 years of seniority were more likely to read popular science books, recommend them to students, and use popular science content in the lesson than teachers of 16 and above. When the reasons why teachers do not read popular science books, do not recommend them to students and do not use them in the lesson; It was determined that they did not like popular science books, and that they did not find it appropriate for the level and age of the children. In the research, teachers with 1-10 years of seniority were more likely to use science-intensive films, documentaries, etc. than teachers of 16 and over. It has been determined that they attach importance to monitoring and using it in the lesson. As the reasons why teachers do not use science-based films, documentaries, etc.; They stated that they do not like and do not watch science-fiction films, they do not see science-fiction-style documentaries as appropriate, and that science-fiction films contain scientific errors. In the study of Böyük and Kaya (2011) they stated that teachers with 6-10 years of experience have more positive attitudes towards laboratory lessons compared to groups of 11 years and above. In the study, according to quantitative data, it was found that the attitudes of science and primary school teachers towards popular science in the context of teaching profession and their attitudes towards popular science in terms of total score changed according to their genders. In the research, among female and male teachers; It has been determined that female teachers' attitudes towards popular science are more intense than male teachers. So between women and early teachers; It was concluded that female teachers use popular science content more than male teachers. In the study of Çimen, Karakaya, Yılmaz, and Ünal (2018), it was stated that the awareness of female science teachers towards the STEM approach is higher than that of male teachers. In the study of Çimen, Karakaya, Yılmaz, and Ünal (2018), it was stated that female teachers working in the education system were more interested in new approaches. In this respect, the study partially overlaps with the findings of the research. In addition, it was determined that the attitudes and perspectives of science and primary school teachers towards popular science did not change according to the places they work (province, district, village). In the quantitative findings of the study, there was no statistical difference in terms of the places of duty of the teachers, and no relevant findings were reached in the interviews.

Suggestions

Suggestions developed according the results of the research are as follows:

- The research was carried out on science and primary school teachers. Similar studies can be carried out with teachers from different branches or with prospective teachers who will be teachers of the future.
- It can be ensured that the subjects and achievements of the science course curriculum are integrated with popular science contents.
- Trainings can be organized by the Ministry of National Education for all teachers in order to ensure that popular science contents provide a high level of benefit to students, education-teaching and teachers.
- Teachers can be encouraged to use popular science content in the classroom.
- Teachers can inform their students about popular science channels and programs that they can follow on television.
- With the contribution of school principals and teachers, popular science corners can be created in school libraries.
- It can be ensured that students follow popular science sites and applications with safe and accurate content from social media.

References

Akoğlu, A. (2005). Popular science publishing and sky-observing events. Journal of İKU Science and Engineering, 3(2), 1-4. https://acikerisim.iku.edu.tr/server/api/core/bitstreams/ef1b6b24-8f3a-4fb2-9761-5f0d2531b5ce/content

Arslan, N., Kurt, E. & Turan, E, D. (2016). Form and content analysis of mini kumbara magazine as part of popular scienceresources. Journal of Mother Tongue Education, 4(3), 326-336. https://doi.org/10.16916/aded.27874

Belhan, Ö. & Şimşek, C. L. (2012). Effect of science and technology club on students' science and technology literacy and attitudes towards science. The Journal of SAU Education Faculty, 23(23), 103-120. https://dergipark.org.tr/en/pub/sakaefd/issue/11219/133967

Birkök, M. C. (2008). Alternate media usage in education as a socialization tool: Movies. Journal of Human Sciences, 5(2), 1-12.

https://www.j-humansciences.com/ojs/index.php/IJHS/article/view/574/322

Böyük, U. & Kaya, H. (2011). Qualifications of science lectures teachers' towards laboratory studies. Journal of Erciyes University Science Institute, 27(1), 126-134. https://dergipark.org.tr/en/download/article-file/236226

Büyüköztürk, Ş., Kılıç Çakmak, E., Akgün, Ö. E., Karadeniz, Ş. & Demirel, F. (2014). Scientific research methods (17th press). Pegem.

Cevizoğlu, H. (2019). Popular science, Atatürk and history of science. Işık.

Çepni, S. (2019). Understanding logic and questions PISA and TIMSS. Pegem.

Çimen, O., Karakaya, F., Ünal, A. & Yılmaz, M. (2018). STEM awareness levels of science teachers. Journal of Research in Education and Society, 5(1), 124-138. https://dergipark.org.tr/en/download/article-file/496663

Eroğlu, B. & Sağlam, H. İ. (2020). Can popular science books be used as an effective teaching tool?. Cumhuriyet International Journal of Education, 9(3), 656-678. https://doi.org/10.30703/cije.634928

Fleming, P. & Guest, G., 2014, Mixed methods research. Sage.

Karademir, E. (2017). Interdisciplinary skill interaction in exemplary and practice-supported science teaching. Pegem Press.

https://dergipark.org.tr/en/download/article-file/328263

Karademir, E., Sarıkahya, E., ve Altunsoy, K. (2017). The perceptions of the

science teachers toward to the concept of skill: A phenomenological study. Journal of Eskişehir Osmangazi University Social Sciences, 18(1), 53-71. https://doi.org/10.17494/ogusbd.330740

Karamustafaoğlu, S. (2018). 21st century skills and science teaching, In O. Karamustafaoğlu, Ö. Tezel & U. Sarı (Ed), Within the activity-supported science teaching with current approaches and methods (pp. 2-20). Pegem Press.

Kılıç, O. (2009). Popular science through translation: Translation approaches and problems in popular science in Turkey in the case of TÜBİTAK publications [Unpublished master theses]. University of İstanbul.

Küçükvardar, M. (2020). Science Jjournalism: A research on new sites. Journal of Communication Theory and Research, 52, 166-186.

https://doi.org/10.47998/ikad.825370

Nilsson, P. & Pelger, S. (2016). Popular science writing to support students' learning of science and scientific literacy. Research in Science Education, 46, 439–456. https://link.springer.com/article/10.1007/s11165-015-9465-y

O'Connor, R. (2009). Reflections on popular science in Britain. The University of Chıcago Press Journals, 100(2), 333-345. https://doi.org/10.1086/599549

Pole, K. (2007). Mixed methods designs: a review of strategies for blending quantitative and qualitative methodologies. Mid-Western Educational Researcher, 20(4), 1-4. https://scholarworks.bgsu.edu/mwer/vol20/iss4/6

Ridder, J. D. (2014). Science and scientism in popular science writing. Social Epistemology Review and Reply Collective, 3(12), 23-39. https://philpapers.org/rec/RIDSAS

Şahin, F. & Tatlı, E. (2020). Examining the impact of science fiction movies on preservice science teachers' scientific literacy and attitudes towards science. Journal of Mehmet Akif Ersoy Universty Education Faculty, 53, 488-514.

https://dergipark.org.tr/tr/pub/maeuefd/issue/52091/551278

Toz, H. (2007). History of Children's Literature, In T. Lokman (Ed.), Children's Literature, Pegem Press.

Ucar, S. (2021). Science and primary school teachers' opinions on popular science: A mixed-method study [Unpublished master theses]. University of Eskişehir Osmangazi.

Ucer, S. (2019). The role of popular science articles in teaching science: The example of atom concept [Unpublished master theses].