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PRE-SERVICE SCIENCE TEACHERS' FAVORITE SCIENTISTS

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Preservice Science Teachers' Favorite Scientists

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Abstract

The purpose of this study was to investigate preservice science teachers' favorite scientists. This study was conducted according to a screening model. The study group consisted of 199 volunteer preservice teachers who were studying in the science education department at a state university in Turkey. Of the total preservice science teachers, 56 were first year, 57 second year, 55 third year, 31 fourth year; 172 were female, and 27 were male. I asked, "Who is your favorite scientist? Why? Please, write your reason." The preservice science teachers wrote their favorite scientists along with their reasons. The data obtained was analyzed using the content analysis method. The results show that preservice science teachers named 28 different scientists. Eight scientists were Turkish-Islamic, and twenty were foreign. Twenty-seven scientists were male, and one was female. Six female preservice science teachers wrote Marie Curie as their favorite scientist. Preservice science teachers' favorite scientists were mostly foreign, both at each grade level and overall. The most frequently named favorite scientists were Aziz Sancar, Ibn-i Sina, Albert Einstein, Isaac Newton, and Nikola Tesla.

Keywords: favorite scientist, preservice science teacher

Introduction

Children learn science through many different sources. Books, television shows, and movies can be examples of outside-of-school sources. At school, textbooks, science lessons, and teachers' behaviors and personalities can contribute to children's perceptions of the nature of science and of the scientist as an individual. Other people can also have an impact on children's learning (Thomas & Hairston, 2003). In addition, children's favorite scientists can influence their learning and doing science.

In science curriculum, the emphasized aim of science is to create systematic and logical explanations about phenomena, revealing theories and discovering principles and concepts. More specifically, science curriculum aims to help students understand the formation process of scientific knowledge and the use of scientific knowledge in new research. In addition, students are expected to understand the development of scientific knowledge by taking part in the scientific process and to understand the world by doing research with scientific processes included in the learning environment. In this context, scientific process skills are defined as skills used by scientists during scientific studies (Ministry of National Education [MoNE], 2018).

Science is the most dynamic element that shapes the past, present, and future. Science exists through the efforts of scientists. For the sustainability of scientific effort, individuals should receive support to engage in science from an early age. The people who can provide this support are teachers. For this reason, it is extremely important that teachers have awareness of scientists and scientists' contributions to science and humanity. This awareness will also be advantageous in terms of guiding students in their career choices. Favorite scientists and their contributions can influence an individual's career choice.

An individual can do scientific studies and take part in the world of science by choosing a favorite scientist as a role model. Therefore, it is extremely important that every individual have a favorite scientist. In addition, many scientists have resolutely worked in difficult conditions and still contributed to science and humanity. Individuals can take heart from this situation and be motivated to study. Motivation is very important for the continuity and success of studies.

In addition, developed countries are trying to increase the number of scientists by aiming further in science. The scientist image in the minds of today's children, who are the scientists of the future, can greatly affect these efforts (Harman & Şeker, 2017). The people who will create and strengthen the image of scientists in children's minds are teachers and preservice teachers, who are the teachers of the future. For these reasons, this study investigated preservice science teachers' favorite scientists.

Literature Review

In the literature, there are several studies in which participants expressed favorite scientists. Grade seven students frequently reported Thomas Edison (frequency [f]: 6, total [T]: 52), Galileo Galilei (f: 4, T: 52), Benjamin Franklin (f: 3, T: 52), Isaac Newton (f: 2, T: 52), and Aziz Sancar (f: 1, T: 52) as scientists by whom they were influenced. Only one student preferred Marie Curie, a female scientist (Erdoğdu & Taşar, 2019). Durukan and Sadoglu (2018) investigated physicists whom high school students appreciate. Albert Einstein (f: 25, T: 85) was appreciated because of his intelligence. Newton (f: 6, T: 85) was appreciated because of his contribution to physics. Stephen Hawking (f: 3, T: 85) was appreciated because of carrying out his research with care and attention despite all obstacles. Edison (f: 1, T: 85) was appreciated because of his perseverance. Nikola Tesla (f: 1, T: 85) was appreciated because of his genius.

The contributions to science high school students most frequently admired were Edison's light bulb (grade 9: 66%, grade 10: 44%, T: 87), Newton's law of gravity (grade 9: 60%, grade 10: 7%, T: 87), Alexander Graham Bell's telephone (grade 9: 26%, grade 10: 37%, T: 87), Galileo's telescope (grade 9: 20%, grade 10: 2%, T: 87), and Ibn-i Sina's studies in the medical field (grade 10: 28%, T: 87). Among the striking false information on inventions in the answers students gave were Einstein's electricity and atomic bomb, Edison's telephone, Bell's light bulb, and Archimedes's spiral bomb (Başkan-Takaoğlu, 2018).

The majority of presevice science teachers preferred Einstein (26.4%, T: 120) and Edison (14.9%, T: 120); a small number of preservice teachers named Oktay Sinanoğlu (6.6%, T: 120) and Mimar Sinan (1.7%, T: 120); and they mentioned only Marie Curie (4%, T: 120) as a female scientist (Demirbaş, 2009). Preservice science teachers were able to give examples of the most frequently expressed

scientists and scientific events at the level of science education. Preservice science teachers were able to state the scientists who contributed significantly to science, such as Aristotle (f: 24, T: 40), Socrates (f: 35, T: 40), Plato (f: 28, T: 40), Hippocrates (f: 31, T: 40), Archimedes (f: 29, T: 40), Euclid (f: 11, T: 40), and Farabi (f: 22, T: 40) (Özgelen & Öktem, 2013).

The scientists preservice science teachers preferred were predominantly foreign. They most frequently mentioned Newton, Einstein, Sancar, Galileo, Edison, Mendel, and Bell. Only eight preservice teachers named Marie Curie (Şahin et al., 2019). Preservice science teachers frequently named Archimedes (f: 34, T: 65) from ancient history; Ibn-i Sina (f: 18, T: 65) and Farabi (f: 13, T: 65) from the medieval Turkish-Islamic era; and Einstein (f: 53, T: 65), Newton (f: 44, T: 65), and Mendel (f: 26, T: 65) from the contemporary age (Laçin-Şimşek, 2011).

Preservice science teachers predominantly named Charles Darwin (95.7%, T: 94), Gregor Mendel (94.7%, T: 94), Archimedes (93.6%, T: 94), Newton (92.6%, T: 94), John Dalton (86.2%, T: 94), Einstein (87.2%, T: 94), Galileo (87.2%, T: 94), and Bell (79.8%, T: 94) as scientists whom they knew. A significant number of them did not know Marie Curie (76.6%, T: 94) (Bozdoğan et al., 2015). Among the scientists preservice science teachers preferred, Newton (66.66%, T: 165), Einstein (53.33%, T: 165), Edison (38.78%, T: 165), Bell (36.96%, T: 165), Galileo (30.30%, T: 165), Mendel (29.69%, T: 165), Archimedes (27.27%, T: 165), Tesla (23.63%, T: 165), Dalton (23.03%, T: 165), and Darwin (16.96%, T: 165) were the top ten (Görecek-Baybars, 2018).

Preservice classroom teachers predominantly thought of foreign scientists: Einstein (31.71%, T: 104), Edison (19.03%, T: 104), Newton (13.66%, T: 104), and Ibn-i Sina (6.83%, T: 104) (Çermik, 2013). Many preservice classroom and child education teachers named Einstein (21%, T: 140), Newton (19%, T: 140), Edison (11%, T: 140), and Ibn-i Sina (6%, T: 140) as the most famous scientists. They reported the reasons for choosing these scientists as the discovery of laws and theories, contributions to medicine, new discoveries, cognitive skills, finding remedies for diseases, and winning the Nobel Prize (Gheith & Aljaberi, 2019). Newton was early childhood education preservice teachers' most frequently chosen favorite scientist (f: 3, T: 24) (El Takach, 2018). The most frequently expressed scientists by preservice teachers were Einstein, Newton, Darwin and Edison. However, they did not name a female scientist (Sharma & Honan, 2020).

Preservice teachers of gifted students most frequently named Einstein (32%) and Edison (14%) as their favorite scientists. A small number of them mentioned Turkish scientists and female scientists. Only Marie Curie (5%) as a female scientist was expressed by four preservice teachers. Preservice teachers said that they admired Einstein for his intelligence and his interesting life story and because he was thought to be stupid. They cited Edison as their favorite scientist because he invented the light bulb and worked without giving up. Ibn-i Sina was expressed as a favorite scientist because of his studies with limited possibilities, his patience, and his studies that are still effective. Preservice teachers emphasized their favorite scientists' life stories, personal characteristics, and contributions to humanity (Camcı-Erdoğan, 2018).

The Turkish scientists preservice social studies teachers most frequently cited were Aziz Sancar (f: 43, T: 45), Mehmet Öz (f: 41, T: 45), Ali Kuşçu (f: 18, T: 45), İbn-i Sina (f: 18, T: 45), Cahit Arf (f: 17, T:

45), and Farabi (f: 14, T: 45). Their most frequently named foreign scientists were Einstein (f: 36, T: 45), Newton (f: 28, T: 45), Edison (f: 25, T: 45), Bell (f: 15, T: 45), and Tesla (f: 14, T: 45). Some preservice teachers expressed that Aziz Sancar worked in the field of chemistry rather than medicine because of his winning the Nobel Prize for chemistry (Gürgil, 2018). Preservice social studies teachers frequently named Ibn-i Sina (f: 56, T: 75), Farabi (f: 46, T: 75), and Piri Reis (f: 21, T: 75) for as the scientists who trained in the Turkish-Islamic states and contributed to the world of science (Laçin-Şimşek & Şimşek, 2010).

It was determined that two high school students drew scientists who looked like Einstein (Eyceyurt-Türk & Tüzün, 2017). The most common scientists in the drawings of university students were Einstein (f: 9, T: 772), Newton (f: 5, T: 772), and Edison (f: 2, T: 772) (Özkan et al., 2017). In the drawings of preservice teachers, the most well-known scientists such as Einsten and Kohler were included (Bilir et al., 2020). The scientists in the drawings of 314 preservice science and social studies teachers were mostly Einstein (9.2%), Newton (7.%), Mendel (4.7%), Mevlana (7%), and Ibn-i Sina (4.5%) (Ürey et al., 2017).

This study aimed to determine preservice science teachers' favorite scientists and their reasons why. In this context, answers to the following open-ended subquestions of research were sought.

1. Who is the preservice science teacher's favorite scientist?
2. What is the preservice science teacher's reason for choosing their favorite scientist?

Method

Study Design

In this study, the screening model was used to describe a situation as it is without intervening (Karasar, 2006). The screening model was used because the preservice science teachers' favorite scientists and their reasons for choosing them were examined in their current form.

Study Group

The study group consisted of 199 preservice science teachers who were attending the science education department at a state university in Turkey. This research was conducted in the spring semester of the 2018–2019 academic year. Table 1 presents the grade level and gender of the preservice science teachers.

As Table 1 shows, of the total preservice science teachers, 56 (28.1%) were first year, 57 (28.6%) second year, 55 (27.6) third year, and 31 (15.6) fourth year; 172 (86.4%) were female, and 27 (13.6%) were male.

Table 1

Grade Level and Gender of Preservice Teachers

		f	%
Grade level	First	56	28.1
	Second	57	28.6
	Third	55	27.6
	Fourth	31	15.6
	TOTAL	199	100
Gender	Female	172	86.4
	Male	27	13.6
	TOTAL	199	100

Data Collection Tool

In the research, I prepared an open-ended question. This question was administered to 199 preservice science teachers. The preservice science teachers were asked to write their favorite scientist with the reason why. I gave 20 minutes to the preservice science teachers to answer this question.

The open-ended question is as follows:

> "Who is your favorite scientist? Why? Please write your reason."

Data Analysis

I analyzed the data using the content analysis method. I coded the preservice science teachers' papers as PT_1, PT_2, etc. I wrote their answers in raw form, and I saved them on a computer. I calculated the frequencies and percentages for their favorite scientists, and I prepared tables with this data. I analyzed the preservice science teachers' reasons for choosing their favorite scientists, and I presented these with frequency values.

In order to ensure external validity, I performed a detailed description. In addition to indicating the grade level (first year: G_1, second year: G_2, third year: G_3, fourth year: G_4) and preservice teachers' numbers (PT_1, PT_2,…), I present direct quotations from the preservice science teachers' answers using italics. In order to ensure internal validity, the raw data and codes were also examined by an expert in science education. Comparisons were done between coders (researcher and expert) to ensure reliability. The comparisons showed that there was complete harmony between the coders.

Findings

I analyzed the preservice science teachers' favorite scientists and present these together with their frequency and percentage values in Table 2. As Table 2 shows, the preservice science teachers wrote 28 different scientists; 8 of them were Turkish-Islamic, and 20 were foreign. Turkish-Islamic scientists were frequently chosen by preservice science teachers studying in the first and fourth years. Foreign scientists were frequently chosen by preservice science teachers studying in the second and third years. In the general total, preservice teachers chose foreign scientists more predominantly than Turkish-Islamic scientists.

Table 2

Preservice Science Teachers' Favorite Scientists

Favorite scientists		Grade 1		Grade 2		Grade 3		Grade 4		TOTAL	
		f	%	f	%	f	%	f	%	f	%
Turkish-Islamic scientists	Aziz Sancar	7	12.5	4	7.0	3	5.5	5	16.1	19	9.5
	İbn-i Sina	9	16.1	1	1.8	1	1.8	4	12.9	15	7.5
	Ali Kuşçu	2	3.6	-	-	-	-	1	3.2	3	1.5
	Piri Reis	1	1.8	-	-	2	3.6	-	-	3	1.5
	Farabi	1	1.8	-	-	1	1.8	-	-	2	1.0
	El Cezeri	1	1.8	-	-	-	-	-	-	1	0.5
	Uluğ Bey	1	1.8	-	-	-	-	-	-	1	0.5
	Mimar Sinan	-	-	1	1.8	-	-	-	-	1	0.5
	Total	22	39.3	6	10.5	7	12.7	10	32.3	45	22.6
Foreign scientists	Albert Einstein	12	21.4	31	54.4	16	29.1	7	22.6	66	33.2
	Isaac Newton	4	7.1	7	12.3	7	12.7	5	16.1	23	11.6
	Nikola Tesla	6	10.7	5	8.8	8	14.5	-	-	19	9.5
	Stephen Hawking	3	5.4	3	5.3	1	1.8	2	6.5	9	4.5
	Thomas Edison	4	7.1	-	-	2	3.6	-	-	6	3.0
	Marie Curie	1	1.8	1	1.8	2	3.6	2	6.5	6	3.0
	Alexander Graham Bell	2	3.6	-	-	2	3.6	1	3.2	5	2.5
	Gregor Mendel	-	-	-	-	3	5.5	-	-	3	1.5
	Galileo Galilei	-	-	-	-	2	3.6	1	3.2	3	1.5
	Archimedes	-	-	1	1.8	1	1.8	-	-	2	1.0
	Keith Campbell	1	1.8	-	-	-	-	-	-	1	0.5
	Anders Celsius	1	1.8	-	-	-	-	-	-	1	0.5
	Michelson and Morley	-	-	1	1.8	-	-	-	-	1	0.5
	Ernest Rutherford	-	-	1	1.8	-	-	-	-	1	0.5
	Euclid	-	-	-	-	1	1.8	-	-	1	0.5
	Werner Heisenberg	-	-	-	-	1	1.8	-	-	1	0.5
	Louis Pasteur	-	-	-	-	1	1.8	-	-	1	0.5
	Johannes Kepler	-	-	-	-	-	-	1	3.2	1	0.5
	Batlamyus	-	-	-	-	-	-	1	3.2	1	0.5
	Aristotle	-	-	-	-	-	-	1	3.2	1	0.5
	Total	34	60.7	50	87.7	47	85.5	21	67.7	152	76.4
No favorite scientist		-	-	1	1.8	1	1.8	-	-	2	1.0

TOTAL	56	100	57	100	55	100	31	100	199	100

Table 3 presents preservice science teachers' favorite Turkish-Islamic scientists and their reasons. The favorite scientist of 19 preservice science teachers (G_1:7, G_2:4, G_3:3, G_4:5) was Aziz Sancar. The most common reasons were his being Turkish, his studies, and his winning the Nobel Prize.

Some examples of preservice science teachers' answers are as follows:

> *"Aziz Sancar. He has been a role model with his knowledge and tolerance to the Turkish nation and he has won very important prizes around the world."* G_1-PT_{36}

> *"Aziz Sancar. He won the Nobel Prize for his discoveries on DNA. I have been proud of him because he is Turkish."* G_4-PT_{17}

The favorite scientist of 15 preservice science teachers (G_1:9, G_2:1, G_3:1, G_4:4) was Ibn-i Sina. The most common reasons were his doing research on medicine and many fields and his contribution to humanity and science.

Some examples of preservice science teachers' answers are as follows:

> *"Ibn-i Sina. He contributed to medicine a lot. In addition, his book has been appreciated in Europe for years."* G_2-PT_{26}

> *"Ibn-i Sina. He did research despite the difficult conditions during his lifetime. He invented medical methods and equipments that are used even today."* G_4-PT_{18}

Three preservice teachers (G_1:2, G_4:1) chose Ali Kuşçu as their favorite scientist, but they did not write a reason.

Three preservice science teachers' favorite scientist was Piri Reis. Their reasons were stated as "inventing compass" (G_3-PT_7) and "showing America on the map before its discovery, although his possibilities were not very good" (G_3-PT_{26}). One preservice teacher (G_1-PT_4) did not write a reason.

Two preservice science teachers' favorite scientist was Farabi. Their reasons were his "doing remarkable research" (G_1-PT_{27}) and "doing much research" (G_3-PT_{47}).

Some preservice science teachers' favorite scientists were El Cezeri, Uluğ Bey, and Mimar Sinan. Their reasons included "being the first engineer and doing the first robot" (El Cezeri) (G_1-PT_{15}), "doing great studies" (Uluğ Bey) (G_1-PT_{40}), and "self-improvement in many fields" (Mimar Sinan) (G_2-PT_9).

Table 3

Preservice Science Teachers' Favorite Turkish-Islamic Scientists and Their Reasons

			G1	G2	G3	G4	T
			f	f	f	f	f
Aziz Sancar (19)	Nationality	Turkish	3	-	-	2	5
G_1:7, G_2:4, G_3:3, G_4:5	Prize	Nobel Prize	3	-	-	2	5
	Field of study	DNA	-	-	-	3	3
		Health	-	-	-	1	1
	Contribution to humanity and science	Useful ideas	1	-	-	-	1
		Interesting research	-	1	-	-	1
		Being a role model with knowledge and tolerance	1	-	-	-	1
	His life and products	Impressive	-	-	1	-	1
	No reason		1	3	2	1	7
İbn-i Sina (15)	Field of study	Medicine and many fields	3	-	-	1	4
G_1:9, G_2:1, G_3:1, G_4:4	Contribution to humanity and science	His research in ancient times	1	-	1	-	2
		Benefiting from his book in Europe for years	-	1	-	1	2
		Contribution to medicine	-	1	-	-	1
		Cure diseases before the West	1	-	-	-	1
		Medical methods and equipments that are used today	-	-	-	1	1
		Role model	1	-	-	-	1
	Transcending his time and later times	Thoughts far ahead of his own time	1	-	-	-	1
		His studies that cannot be done today	1	-	-	-	1
	Dedication to science	Researching under difficult conditions	-	-	-	1	1
		Doing science from an early age	1	-	-	-	1
	Nationality	Turkish	1	-	-	-	1
	No reason		1	-	-	1	2
Ali Kuşçu (3)	No reason		2	-	-	1	3
G_1:2, G_4:1							
Piri Reis (3)	Contribution to humanity and science	Compass*	-	-	1	-	1
G_1:1, G_3:2		Showing America on the map	-	-	1	-	1
	His facilities	Inadequate	-	-	1	-	1
	No reason		1	-	-	-	1
Farabi (2)		Remarkable studies	1	-	-	-	1

G_1:1, G_3:1	Contribution to humanity and science	Doing many study	-	-	1	-	1
El Cezeri (1) G_1:1	Contribution to humanity and science	First engineer and first robot	1	-	-	-	1
Uluğ Bey (1) G_1:1	Contribution to humanity and science	Great studies	1	-	-	-	1
Mimar Sinan (1) G_2:1	Contribution to himself	Self-improvement	-	1	-	-	1

G: Grade, T: Total, *: false

Table 4 shows preservice science teachers' favorite foreign scientists and their reasons. The favorite scientist of 66 preservice science teachers (G_1:12, G_2:31, G_3:16, G_4:7) was Albert Einstein. The most common reasons included his studies and inventions, his intelligence and thoughts, and his having difficulties and still achieving much. Some examples of preservice science teachers' answers are as follows:

> *"Albert Einstein. He said that the greatest speed is the speed of light and not greater than this speed."* G_2-PT_{46}

> *"Albert Einstein. Even though he had Asperger's syndrome, he didn't give up."* G_3-PT_3

The favorite scientist of 23 preservice science teachers (G_1:4, G_2:7, G_3:7, G_4:5) was Isaac Newton. The most common reasons were his work with the apple and gravity, his important inventions, and his difficult living conditions. Some examples of preservice science teachers' answers are as follows:

> *"Isaac Newton. He discovered gravity from an apple."* G_1-PT_{34}

> *"Isaac Newton. Although people saw him as an unsuccessful student and he was excluded by the environment, he contributed to the world of science."* G_3-PT_{35}

The favorite scientist of 19 preservice science teachers (G_1:6, G_2:5, G_3:8) was Nikola Tesla. The most common reasons were his inventions and his work with electricity. Some examples of preservice science teachers' answers are as follows:

> *"Nikola Tesla. He is the father of electricity."* G_1-PT_8

> *"Nikola Tesla. Although he developed many important inventions, his name was not heard."* G_2-PT_{49}

The favorite scientist of nine preservice science teachers (G_1:3, G_2:3, G_3:1, G_4:2) was Stephen Hawking. The most common reason was his living conditions. Some examples of preservice science teachers' answers are as follows:

> *"Stephen Hawking. He contributed to science despite being a disabled person."* G_1-PT_{48}

> *"Stephen Hawking. He became ill at an early age, and then he became paralyzed. But it impressed me that he didn't give up and continued to research." G_3- PT_2*

The favorite scientist of six preservice science teachers (G_1:4, G_3:2) was Thomas Edison. The most common reason was that he invented the light bulb. In addition, one preservice science teacher wrote Edison as a favorite scientist because "he invented the telephone." This is not a correct thought because the telephone was invented by Alexander Graham Bell.

The favorite scientist of six preservice science teachers (G_1:1, G_2:1, G_3:2, G_4:2) was Marie Curie. The most common reasons were her being a woman and her winning the Nobel Prize. Some examples of preservice science teachers' answers are as follows:

> *"Marie Curie. Although she was a female, her studies made a big impact and she pioneered other female scientists." G_1-PT_{33}*

> *"Marie Curie. At that time, it was difficult for a woman to do science. Also, she was married and she had children. Even though she got sick in the later times, she didn't give up." G_3-PT_{24}*

The favorite scientist of five preservice science teachers (G_1:2, G_3:2, G_4:1) was Alexander Graham Bell. The most common reason was that he invented the telephone.

The favorite scientist of three preservice science teachers was Gregor Mendel. Some examples of preservice science teachers' answers are as follows:

> *"He gave the first scientific explanation on inheritance. He did science while working in the monastery. He was not appreciated while living." (G_3-PT_{32})*

> *"His information about cross and genetic were remarkable." (G_3-PT_{50})*

> *"His inventions and patience." (G_3-PT_{55})*

The favorite scientist of three preservice science teachers (G_3:2, G_4:1) was Galileo Galilei. An example of their reasons is as follows:

> *"Galileo Galilei was on the trail of science even while being killed." (G_3-PT_{38})*

The favorite scientist of two preservice science teachers (G_2:1, G_3:1) was Archimedes. Their reasons are as follows:

> *"Archimedes found the buoyancy of water by using the bath bowl." (G_2-PT_{33})*

> *"Archimedes was intelligent." (G_3-PT_{54}).*

One preservice science teacher chose Keith Campbell as favorite scientist because "he cloned a sheep" (G_1-PT_{55}). Another preservice science teacher chose Anders Celsius because "he did an instrument that

measures temperature" (G_1-PT_{56}). One preservice science teacher chose Michelson and Morley as their favorite scientists because "they revealed successful results" (G_2-PT_{11}). Another preservice science teacher wrote Ernest Rutherford as favorite scientist because "he did the gold foil experiment" (G_2-PT_{43}). One preservice science teacher wrote, "Euclid. Euclid progressed in geometry and mathematics" (G_3-PT_{15}), and another one wrote, "Louis Pasteur. He brought innovation to science" (G_3-PT_{52}). Other preservice teachers wrote Werner Heisenberg (G_3-PT_{39}), Batlamyus (G_4-PT_{10}), and Arsitotle (G_4-PT_{30}) as their favorite scientists, but they did not give a reason. One preservice science teacher (G_4-PT_2) wrote Johannes Kepler as the favorite scientist because "he observed the planets and the sky."

Table 4

Preservice Science Teachers' Favorite Foreign Scientists and Their Reasons

			G1	G2	G3	G4	T
Albert Einstein (66) G_1:12, G_2:31, G_3:16, G_4:7	Contribution to humanity and science	Important and valid studies on physics, astronomy and engineering	-	4	2	-	6
		Studies and discoveries about the speed of light	-	3	-	1	4
		Breaking the absolute laws of physics	-	3	-	-	3
		The theory of relativity	1	2	-	-	3
		Atomic bomb*	-	3	-	-	3
		Smashing atom	1	1	-	-	2
		Pioneering many studies and inventions	1	1	-	-	2
		Changing the history of science	-	-	1	-	1
		Using his intelligence for useful purposes	1	-	-	-	1
	Cognitive characteristics	Intelligent	2	2	1	-	5
		Thought experiments	-	-	5	-	5
		Comprehensive thoughts	-	2	1	-	3
		Thoughts on physics	-	2	-	-	2
		An incredible imagination	-	1	1	-	2
		Using imagination in experiments	-	2	-	-	2
		Remarkable theories	-	2	-	-	2
	Negative situations and dedication to science	Having difficulties	3	1	2	-	6
		Seen as a failed student	-	-	2	1	3
		Seen as insane	-	-	1	-	1
		Striving for science	-	1	-	-	1
	Affective characteristics	Introversion	-	1	-	-	1
	Well-known person	Being heard frequently his name and inventions	-	-	1	-	1
		Explained with praise by the instructor	-	-	1	-	1
		No reason	4	3	1	5	13
Isaac Newton (23) G_1:4, G_2:7, G_3:7, G_4:5	Contribution to humanity and science	Apple and gravity	3	4	4	2	13
		Important inventions	1	-	2	-	3
		Innovations in all areas	-	-	-	1	1
	Life conditions	Difficult	-	-	3	-	3

	Affective characteristics	Patience	-	-	-	1	1
		Passion for science	-	-	1	-	1
	No reason		-	3	1	1	5
Nikola Tesla (19)	Contribution to humanity and science	Inventions	3	1	-	-	4
G_1:6, G_2:5, G_3:8		Father of electric	1	-	-	-	1
		Working for the benefit of society	-	-	1	-	1
		Pioneer of scientists	1	-	-	-	1
	Field of study	Electric	-	1	2	-	3
	Transcending his own time	Thoughts beyond the time	-	2	-	-	2
	Well-known person and appreciation	The unheard name of scientist	-	2	-	-	2
		The unknown value of scientist	-	-	2	-	2
	Living conditions	The overshadowed scientist	-	-	1	-	1
		The stolen ideas	-	-	1	-	1
		Difficult	-	1	-	-	1
	Cognitive and affective characteristics	Intelligent	-	-	1	-	1
		Not giving up	-	-	1	-	1
	No reason		1	1	1	-	3
Stephen Hawking (9)	Living conditions	A disabled individual	2	1	1	1	5
G_1:3, G_2:3, G_3:1, G_4:2	Contribution to humanity and science	His books	1	-	-	-	1
		His studies	-	1	-	-	1
		His actual information	-	1	-	-	1
	Field of study	Black hole	-	-	-	1	1
	Prize	Nobel prize in physics*	-	1	-	-	1
	No reason		-	1	-	-	1
Thomas Edison (6)	Contribution to humanity and science	Bulb	1	-	1	-	2
G_1:4, G_3:2		Telephone*	1	-	-	-	1
		The used inventions in every field	1	-	-	-	1
	No reason		1	-	1	-	2
Marie Curie (6)	Gender and success	Impressive studies	1	2	1	1	5
G_1:1, G_2:1, G_3:2, G_4:2		Forerunner of women	1	-	-	-	1
	Prize	Nobel Prize	-	-	1	2	3
	Negative situations and dedication to science	The difficulty of doing scince as a woman	-	-	1	-	1
		Being sick	-	-	1	-	1
		Married with children	-	-	1	-	1

Alexander Graham Bell (5) G_1:2, G_3:2, G_4:1	Contribution to humanity and science	Telephone	1	-	1	1	3
		The used tools in everyday life	1	-	-	-	1
		An important invention	-	-	1	-	1
Gregor Mendel (3) G_3:3	Field of study	First scientific explanations on inheritance	-	-	1	-	1
		Remarkable information on cross and genetics	-	-	1	-	1
	Appreciation	Unappreciated while living	-	-	1	-	1
	Contribution to humanity and science	Inventions	-	-	1	-	1
	Affective characteristics	Patience	-	-	1	-	1
Galileo Galilei (3) G_3:2, G_4:1	Dedication to science	The sacrificed a life for science	-	-	2	1	3
Archimedes (2) G_2:1, G_3:1	Linking	Science in everyday life	-	1	-	-	1
	Cognitive characteristics	Intelligent	-	-	1	-	1
Keith Campbell (1) G_1:1	Field of study	Cloning (sheep)	1	-	-	-	1
Anders Celsius (1) G_1:1	Contribution to humanity and science	Thermometer	1	-	-	-	1
Michelson and Morley (1) G_2:1	Success	The results of their study	-	1	-	-	1
Ernest Rutherford (1) G_2:1	Field of study	Gold foil experiment	-	1	-	-	1
Euclid (1) G_3:1	Success	Progress in geometry and math	-	-	1	-	1
Werner Heisenberg (1) G_3:1	No reason		-	-	1	-	1
Louis Pasteur (1) G_3:1	Contribution to humanity and science	Innovator	-	-	1	-	1
Johannes Kepler (1) G_4:1	Field of study	Planets and sky	-	-	-	1	1
Batlamyus (1) G_4:1	No reason		-	-	-	1	1
Aristotle (1) G_4:1	No reason		-	-	-	1	1

G: Grade, T: Total, *: false

Conclusion and Discussion

According to the results of this study, preservice science teachers chose 28 different favorite scientists. Eight scientists were Turkish-Islamic, and 20 were foreign. Twenty-seven scientists were male, and one, Marie Curie, was female.

Of the preservice teachers, 22.6% chose Turkish-Islamic scientists, and 76.4% chose foreign scientists. Similarly, other studies report that the scientists favored by preservice science teachers (Demirbaş, 2009; Görecek-Baybars, 2018; Laçin-Şimşek, 2011; Şahin et al., 2019), preservice classroom teachers (Çermik, 2013), preservice teachers (Sharma & Honan, 2020), and preservice teachers of gifted students (Camcı-Erdoğan, 2018) are mostly foreign. The scientists whom preservice science teachers know are mostly foreign (Bozdoğan et al., 2015).

According to current results, Aziz Sancar (9.5%) and Ibn-i Sina (7.5%) were the most frequently chosen Turkish-Islamic favorite scientists. This finding was consistent with the literature. Seventh-grade students frequently reported Sancar as a Turkish-Islamic scientist by whom they were influenced (Erdoğdu & Taşar, 2019). Preservice science teachers most frequently named Sancar as a scientist (Şahin et al., 2019). Sancar and İbn-i Sina were among the Turkish scientists who were frequently named by social studies preservice teachers (Gürgil, 2018). Preservice science teachers (Laçin-Şimşek, 2011), preservice classroom teachers (Çermik, 2013), and preservice social studies teachers (Laçin-Şimşek & Şimşek, 2010) chose Ibn-i Sina. One of the scientists in the drawings of the science and social sciences preservice teachers was Ibn-i Sina (Ürey et al., 2017). A significant number of preservice classroom and child education teachers named Ibn-i Sina as the most famous scientist (Gheith & Aljaberi, 2019).

Some preservice teachers' (7.5%) favorite scientist was Ibn-I Sina, and their reasons mostly included his doing research on medicine and many fields and his contribution to humanity and science. Similarly, high school students mentioned Ibn-i Sina and his studies in the medical field (Başkan-Takaoğlu, 2018). In this study, one preservice teacher's reason was Ibn-i Sina's medical methods and instruments that are used today; another preservice teacher's reason was his researching under difficult conditions. Similarly, preservice teachers of gifted students named Ibn-i Sina as a favorite scientist because of his studies with limited possibilities, his patience, and his studies that are still effective (Camcı-Erdoğan, 2018).

In this study, one preservice science teacher wrote Mimar Sinan as favorite scientist. Demirbaş (2009) also reported that a small number of preservice science teachers chose Mimar Sinan.

According to the findings of this study, Albert Einstein (33.2%), Isaac Newton (11.6%), and Nikola Tesla (9.5%) were the most frequently chosen foreign favorite scientists. Seventh-grade students reported Newton as a scientist by whom they were influenced (Erdoğdu & Taşar, 2019). In another study, the majority of presevice science teachers chose Einstein (Demirbaş, 2009). Preservice science teachers mentioned Newton and Einstein (Şahin et al., 2019). Preservice science teachers frequently expressed Einstein and Newton for the contemporary age (Laçin-Şimşek, 2011). Preservice science teachers most frequently chose Newton or Einstein as a scientist whom they knew (Bozdoğan et al., 2015). Among the scientists mentioned by preservice science teachers, Newton, Einstein, and Tesla were in the top ten (Görecek-Baybars, 2018). A significant percentage of preservice classroom and child education teachers also stated Einstein and Newton as the most famous scientists (Gheith & Aljaberi, 2019). In addition, a majority of early childhood education preservice teachers' favorite scientist was Newton (El Takach, 2018). Einstein and Newton were frequently mentioned by preservice teachers (Sharma & Honan, 2020). Einstein, Newton, and Tesla were the most frequently chosen

foreign scientists by social studies preservice teachers (Gürgil, 2018). Also, one of the most well-known scientists in the drawings of preservice teachers was Einstein (Bilir et al., 2020). Two high school students drew scientists who looked like Einstein (Eyceyurt-Türk & Tüzün, 2017). Einstein and Newton were among the most common scientists in the drawings of university students (Özkan et al., 2017). Einstein and Newton were also seen in the drawings of preservice science and social sciences teachers (Ürey et al., 2017). Scientists in preservice classroom teachers' minds were predominantly Einstein and Newton (Çermik, 2013).

Sixty-six preservice science teachers' favorite scientist was Einstein. The most common reasons were as his studies and inventions, his intelligence and thoughts, and his having difficulties and achieving. Twenty-three preservice science teachers' favorite scientist was Newton. The most common reasons were his work with the apple and gravity, his important inventions, and his having difficult living conditions. Nineteen preservice science teachers' favorite scientist was Tesla. The most common reasons were his inventions and electricity. Similarly, Einstein was appreciated because of his intelligence, Newton was appreciated because of his contribution to physics, and Tesla was appreciated because of his genius by high school students (Durukan & Sadoglu, 2018). The most frequently stated scientist and scientist's contribution to science by high school students were Newton and his discovery of gravity (Başkan-Takaoğlu, 2018). Preservice teachers of gifted students stated mostly Einstein or Edison as their favorite scientist. Preservice teachers admired Einstein for his intelligence and interesting life story and because he was thought to be stupid. They chose Edison as their favorite scientist because he invented the light bulb and worked without giving up (Camcı-Erdoğan, 2018).

In this study, some preservice science teachers gave false reasons such as Einstein having invented the atomic bomb, Stephen Hawking having won the Nobel Prize in physics, or Edison having invented the telephone. Similarly, among the striking false information on inventions in the answers given by students were Einstein's having discovered electricity and invented the atomic bomb, Edison's inventing the telephone, Alexander Graham Bell's inventing the light bulb, and Archimedes's inventing the spiral bomb (Başkan-Takaoğlu, 2018).

The favorite scientists of 191 preservice science teachers were male. Similarly, previous studies have shown that scientists in the minds of participants were mostly male. Science teachers (El Takach & Yacoubian, 2020), teachers (El Takach & Al Tobi, 2021), preservice primary school teachers (Çermik, 2013), preservice science teachers (Demirbaş, 2009; Reinisch et al., 2017; Yenikalaycı, 2016), preservice teachers (Bilir et al., 2020; Milford & Tippett, 2013; Sharma & Honan, 2020), preservice science and preschool education teachers (Angın & Özenoğlu, 2019), preservice teachers of gifted students (Camcı-Erdoğan, 2018), and university students (Meyer et al., 2019; Özkan et al., 2017) drew mostly male scientists. Contrary to these results, Şentürk (2020) reported that preservice science teachers drew almost the same number of male and female scientists.

Six female preservice science teachers chose Marie Curie as their favorite scientist, and female scientists other than Curie were not chosen. This finding of the study is consistent with previous studies. Curie was mentioned as a female scientist by one seventh-grade student (Erdoğdu & Taşar, 2019), preservice science teachers (Demirbaş, 2009), eight preservice science teachers (Şahin et al., 2019), and four preservice teachers of gifted students (Camcı-Erdoğan, 2018). A small number of preservice science teachers knew Curie (Bozdoğan et al., 2015).

The results of the study revealed that the preservice teachers' favorite scientists were mostly foreign and male. Foreign and male scientists are predominantly mentioned both in lessons and in daily life, especially in the media. In addition, since the history and philosophy of science course is taught in one semester, preservice teachers cannot fully learn about scientists and their contributions to science in this limited time. For this reason, preservice teachers remember the scientists who are frequently mentioned in other lessons (physics, chemistry, biology, etc.) in the science education program. This situation may be a reason for the results obtained from this research. In fact, this situation proves that it is not sufficient to teach this course in only one semester. Moreover, some scientists are favored by some preservice teachers. These results prove that not all scientists are included in lessons, textbooks, and media.

Suggestions

It is necessary to train successful scientists to advance in science. To this end, it is very important that individuals learn about scientists who have contributed to science and their lives. Individuals who learn about scientists, their lives, and their contributions to science are motivated to become successful scientists by having their favorite scientists and scientists' lives as role models. In this context, considering that it is important that preservice science teachers learn about all scientists who have contributed to science and to teach their students, the following suggestions are presented.

1. The history and philosophy of science could be a compulsory subject.

2. The history and philosophy of science is taught in one semester of the undergraduate program. It is not appropriate to teach such a comprehensive subject in one semester. This subject could be taught in eight semesters. In this way, preservice teachers can learn more easily and permanently.

3. In addition to the scientists' contributions to science and humanity, their life stories and the conditions of the times in which they lived could also be taught.

4. Within the scope of the study, preservice teachers could be asked to do research on scientists using both books and media.

5. Preservice teachers could be asked to prepare boards about the history and philosophy of science in the schools they attend for teaching practice lessons I–II. In this way, they can increase middle school students' awareness about scientists.

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