Scientist Images of Secondary School Students

Sule EGUZ
Inonu University

Abstract: The importance of scientific knowledge is increasing day by day. In this sense, the role of the scientist who directs science and scientific activities is increasing day by day. In particular, stereotypical images play an important role in influencing the interests and attitudes of individuals. In this study, five different aspects of secondary school students' images of scientists were investigated. The research was designed in accordance with the qualitative research method and in this direction, the phenomenology model was taken as a basis. Maximum diversity sampling method was used to maximize the diversity of individuals who may be a party to the problem studied in the determination of the participants. In this direction, the study was conducted with a total of 72 secondary school students, 18 participants from each grade level. The research data were collected in written form in the spring term of the 2021-2022 academic year through a standardized open-ended interview form. Content analysis technique was used in the analysis of the data obtained in the research. At the end of the research, students' mental images of scientists, their physical images, the source of the image, the scientists around them and their favorite scientists were revealed.

Keywords: Science, Scientist, Secondary school students, Image

Introduction

Science is an effort to understand the universe and what is going on in the universe. This effort to establish harmony between the factual world and our expectations includes processes such as observation, experimentation and measurement on the one hand, and creative and critical thinking processes in the way of forming and examining hypotheses or theories that explain the determined phenomena, on the other hand. At its core is intellectual interest; It is based on a passion for knowing, learning and explaining (Yıldırım, 1979).

The function of science is to continually expand our knowledge of the phenomena of nature, to give us insight into the complex relationships of phenomena or the concepts used to interpret these phenomena (Ramirez & Cayón-Peña, 2017). The only condition for understanding science or scientific knowledge is to understand the scientists who produce scientific knowledge. But we must never forget that knowledge is inevitably constructed in interaction with the neural activity of the knower, and every scientist has his own values, priorities, and may also have all sorts of cognitive biases or speculations (Ramirez & Cayón-Peña, 2017).

A scientist is someone who has expertise or conducts research in a particular field of science. There are many different types of scientists, and their tasks are different. Some scientists spend all day working in the lab with chemicals and microscopes. Some work outside, maybe on the beach looking for sea turtle eggs. There are also scientists who specialize in the ocean and work on water (Buskovitz & Wood, 2022). Although the fields of specialization change, the general qualifications of the scientist remain the same.

Scientists generally have analytical skills, are detail-oriented and very organized. Scientists are also open-minded and unbiased, which enables them to accept results that disprove their hypotheses and change their hypotheses when necessary (Buskovitz & Wood, 2022). The role of scientists who direct science and scientific activities is increasing day by day. As it is known, especially cliché images play an important role in influencing

the interests and attitudes of individuals. In this context, Kelly (1987) emphasized that it is important for students to have positive images and attitudes towards scientists when they need to make decisions about their future careers. As a matter of fact, the exact impact of students' stereotypical scientist perceptions in shaping their career goals is unknown, but it is believed that students with negative perceptions of science and scientists are less likely to choose science as a career in the future (Mason, Kahle & Gardner, 1989). In this study, five different aspects of secondary school students' images of scientists were investigated. In this context, in parallel with the studies of Song and Kwang-Suk (2010), answers to the following questions were sought throughout the research:

Participants;

- What are their mental images of scientists?
- What are their physical images?
- What are the sources of the images?
- Who are the scientists around them? and
- Who are their favorite scientists?

Method

The research was carried out according to the qualitative research methodology. Qualitative research includes knowledge generation processes to understand people's lifestyles, stories, behaviors, organizational structures and social change (Strauss & Corbin, 1990). The research was designed with phenomenology, one of the qualitative research models. In the phenomenology design, it is aimed to reveal common practices and to define and explain the meanings created by the participants (Annells, 2006).

Study Group

Maximum diversity sampling method was used in order to maximize the diversity of individuals who may be a party to the problem studied in the determination of the participants. In this direction, the research was carried out with a total of 72 secondary school students, 18 participants from the 5th, 6th, 7th and 8th grade levels.

Data Collection and Analysis

The research data were collected in written form in the spring term of 2021-2022 academic year through a standardized open-ended interview form. In the process of developing the form, the relevant literature was used to ensure content validity. The standardized interview is a type of interview in which the "interview plan", which determines in the most detailed way how the previously prepared questions will be asked and how the data will be collected, is applied exactly. The freedom of movement left to the interviewer is minimal. Digitizing and checking the answers is easy in this type of interview (Karasar, 2005).

For the reliability of the prepared interview form, the formula Reliability = Consensus / Consensus + Disagreement X 100 was used (Miles & Huberman 2016). According to this formula, the researcher and another academician coded the written data separately. The agreement between the two encoders was calculated as 92 percent. In line with the phenomenological research tradition, the analysis process of the study was carried out in parallel with the content analysis in accordance with the steps of 'bracketing', 'phenomenological reduction', 'imaginary variation', 'synthesis of meaning and essences' (Giorgi, 2009). In the content analysis, the data were first divided into sections and these sections were compared by examining them.

Findings

The research findings were analyzed under the headings of 'Participants' mental and physical images of scientists', 'The source of the images created by the participants', 'Scientists around the participants and their favorite scientists'.

Participants' Mental and Physical Images of Scientists

In order to reveal the mental and physical images of the participants towards scientists, they were asked to 'write the first word that comes to mind when the scientist is mentioned'. The distribution of the answers given to the participants is given in Table 1.

Table 1. Mental images of secondary school students for scientists

Mental image created	Frequency (f)	Percent (%)	Mental image created	Frequency (f)	Percent (%)
1. Information	9	13	22. Number	1	1,3
2. Laboratory	6	9	23. Writing	1	1,3
3. Magnifying Glass	5	8	24. Old	1	1,3
4. Glasses	4	6	25. Documentary	1	1,3
5. Experiment	4	6	26. Famous	1	1,3
6. Computer	3	4	27. World	1	1,3
7. Apron	3	4	28. Potion	1	1,3
8. Book	3	4	29. Tired	1	1,3
9. Invention	2	3	30. Flower	1	1,3
10. Animal	1	1,3	31. Prize	1	1,3
11. Library	1	1,3	32. Nature	1	1,3
12. Hardworking	1	1,3	33. Herb	1	1,3
13. Paper	1	1,3	34. Bouquet	1	1,3
14. Success	1	1,3	35. Ancient	1	1,3
15. Sculptor	1	1,3	36. Robot	1	1,3
16. Formula	1	1,3	37. Bald	1	1,3
17. Pencil	1	1,3	38. Wizard	1	1,3
18. Leaf	1	1,3	39. Bomb	1	1,3
19. Microscope	1	1,3	40. Ant	1	1,3
20. Bottle	1	1,3	41. Bee	1	1,3
21. Liquid	1	1,3	42. Sleepless	1	1,3

As seen in Table 1, a total of 42 metaphors for the concept of "scientist" were developed by the students participating in the research. It is seen that 13% (f=9) of the participants liken the scientist to knowledge. As a reason for this, they stated that the scientist has a "knowledge-producing" feature. Again, 9% (f=6) of the participants focused on the "laboratory" image. Students with this view explained the reason why they liken scientists to a "laboratory" because their "workspace is laboratory". Other than that, "magnifying glass 8% (f=5), glasses 6% (f=4), experiment 6% (f=4), computer 4% (f=3), apron 4% (f=3), book %4 (f=3) and invention 4% (f=3) were metaphors frequently used by students. When the resulting images were examined, it was seen that the physical images were limited to glasses, apron, fatigue, old and bald images.

The Source of Images Created by the Participants

The distribution of the image sources of the participants by class levels is given in Table 2.

Table 2. Distribution of the image sources created by the participants by grade levels

Source of images	5th grade (n=18) f (%)	6th grade (n=18) f (%)	7th grade (n=18) f (%)	8th grade (n=18) f (%)
School	9 (50%)	8 (44%)	8 (44%)	7 (39%)
Social media	3 (17%)	4 (22%)	5 (28%)	10 (55,5%)
TV	4 (22%)	1 (5,5%)	1 (5,5%)	
Book	1 (5,5%)	3 (17%)	3 (17%)	1 (5,5%)
Family	1 (5,5%)	1 (5,5%)	1 (5,5%)	
Friend		1 (5,5%)		

When Table 2 is examined, the image sources of the students at the 5th, 6th and 7th grades are mostly "school"; at the 8th grade level, it was revealed that 'social media' constituted the most. It was seen that the sources of 'family' and 'friend' were preferred as the least image source at all grade levels. 'Television' and 'book' were other preferred image sources.

Scientists around the Participants and their Favorite Scientists

First of all, students were asked to identify someone who could be considered a scientist in their daily lives and to state the reason for their choice. The distribution of the answers given is shown in Table 3.

Table 3. Scientists around middle school students

Scientists around	5th grade (n=18) f (%)	6th grade (n=18) f (%)	7th grade (n=18) f (%)	8th grade (n=18) f (%)
Teachers	15 (83%)	12 (67%)	9 (50%)	10 (56%)
No one	3 (17%)	5 (28%)	2 (11%)	6 (33%)
Doctors		1 (5%)	7 (39%)	2 (11%)

When Table 3 is examined, 46 participants (63%) mostly defined their teachers at all grade levels as scientists around them. The rate of students who stated that there is no scientist around them is 22% (f=16). The rate of students who claimed that doctors were around as scientists was 14% (f=10). Again, under this heading, students were asked to name the scientist they liked and respected the most. Table 4 contains details of the answers.

Table 4. The scientist that secondary school students love and respect the most

Most loved and respected scientists	Frequency (f)	Percent (%)
Aziz Sancar	37	51
Yunus Emre	11	15
Ibn Sina	8	11
Farabi	7	10
Khwarezmi	3	4
Piri Reis	2	3
Newton	2	3
Edison	1	1
Galileo	1	1

When Table 4 is examined, it has been determined that the students mostly (f=37, 51%) love and respect Aziz Sancar. Yunus Emre, Ibn Sina and Farabi were the other names most frequently mentioned by the participants. Edison and Galileo were sung by only one student.

Results and Discussion

Science broadens our knowledge of nature, giving us an insight into complex relationships. Scientists must not only follow scientific methods, but also find ways to get the most out of their research and study plans. To take risks, to find new avenues, methods and fields of study, they have to take some risks. In addition, scientists have obligations such as observation, curiosity, creativity, skepticism, objectivity, and up-to-dateness. At the end of the research, students' mental images of scientists, their physical images, the source of the image, the scientists around them and their favorite scientists were revealed. In the determinations made, it was determined that they reflect stereotypical perceptions towards scientists.

A total of 42 metaphors for the concept of "scientist" were developed by the students participating in the research. It was revealed that the participants compared the scientist to knowledge the most. Apart from this, images of laboratory, magnifying glass, glasses, experiments, computers, aprons, books and inventions were frequently used by students. When the resulting images were examined, it was seen that the physical images were limited to glasses, apron, fatigue, old and bald images. These results are in line with the research of Çakıcı (2018) and Monhardt (2003).

At the 5th, 6th and 7th grade levels, the image resources of the students are mostly the school; at the 8th grade level, it was revealed that social media constituted the most. It has been seen that family and friend resources are preferred as the least image resource at all grade levels. Television and books were other preferred image sources. These results show parallelism with the findings of Çakıcı (2018) and Song and Kwang-Suk (2010). 46 participants defined their teachers most at all grade levels as the scientists around them. The rate of students who state that there is no scientist around them is 22%. The rate of students claiming that doctors are around as scientists was 14%. In the study, it was also determined that the students most loved and respected Aziz Sancar.

Yunus Emre, Ibn Sina and Farabi were the other names most frequently mentioned by the participants. Edison and Galileo were sung by only one student.

Scientific Ethics Declaration

The author declares that the scientific ethical and legal responsibility of this article published in EPESS journal belongs to the author.

Acknowledgements

References

Buskovitz, D., & Wood, D. (2022). What is a scientist? *Qualities, Traits & Values.* Retrieved from https://study.com/learn/lesson/characteristics-scientist-overview-traits-examples.html

Çakıcı, E. (2018). *Farklı öğretim kademelerindeki öğrencilerde bilim insanı algısının belirlenmesi.* (Unpublished master thesis). Mersin University, Mersin.

Giorgi, A. (2009). *The descriptive phenomenological method in psychology: A modified husserlian approach.* Pittsburgh: Duquesne University Press.

Huberman, M. A. & Miles, M. B. (2016). *Nitel veri analizi.* (S. Akbaba-Altun & A. Ersoy, Trans.). Ankara: Pegem Akademi.

Karasar, N. (2002). *Bilimsel araştırma yöntemi.* Ankara: Nobel Yayıncılık.

Kelly, A. (1987) Why girls don't do science. In A. Kelly (Ed.), *Science for girls* (pp.12-17). Milton Keynes: Open University Press.

Monhardt, R. M. (2003). The image of the scientist through the eyes of navajo children. *Journal of American Indian Education, 42*(3), 25-39.

Mason, C., Kahle, J. B., & Gardner, A. (1989). Draw-a-scientist test: Future implications. *School Science and Mathematics, 91*(5), 193-198.

Ramirez, J. M., & Cayón-Peña, J. (2017). The role of scientists in a human-centered society. *CADMUS, 3*(2), 113-130.

Song, J., & Kwang-Suk, K. (1999) How Korean students see scientists: the images of the scientist. *International Journal of Science Education, 21*(9), 957-977.

Strauss, A., & Corbin, J. (1990). *Basics of qualitative research: Grounded theory procedures and techniques.* New Delhi: Sage Publications.

Yıldırım, C. (1979). *Bilim felsefesi.* İstanbul: Remzi Kitabevi.

Author Information

Şule Egüz
Inonu University
Education Faculty, Department of Social Studies Education
Turkey
Contact e-mail: *suleeguz@gmail.com*

To cite this article: