

Gifted Students' Perceptions of Scientists

Abstract

Despite a high number of studies on students' images of scientists, there is a lack of research on gifted students' perceptions of scientists in the research literature. The aim of this study was to investigate gifted students' perceptions of scientists and stereotypical images of scientists. The participants were 42 gifted students. The Draw-a-Scientist Test (DAST) was used to collect data. The findings demonstrated that gifted students had a variety of stereotypical images of scientists. The findings also showed that students' drawings included fewer indicators of the stereotypic model on average. The drawings of fourth-grade students included more elements when compared to fifth-grade students' drawings. As a result, it was found that there are some findings different from previous research. Considering the findings obtained from this study, this study has provided findings for teachers and science educators.

Keywords: *gifted students, scientist, perception of scientist*

Introduction

Over the years, perceptions of scientists have become one of the most domains of research in science education. The research studies in this domain have focused on students' perceptions of scientists. Many studies have been conducted to discern what those perceptions are (e. g., Kaya, Ocal, & Dogan, 2008; Barman, 1999; Buldu, 2006; Christidou, Hatzinikita, & Samaras, 2010; Finson, Beaver, & Cramond, 1995; Fung, 2002; Koren & Bar, 2009; Losh, Wilke, & Pop, 2008; Medina-Jerez, Middleton, & Orihuela-Rabaza, 2010; Newton & Newton, 1992; Newton & Newton, 1998; Song & Kim, 1999; Turkmen, 2008). This type of research was important since the

research studies (Chambers, 1983; Schibeci & Sorenson, 1983; Finson et al., 1995) have revealed that students have a certain stereotypical image of scientists. Several researchers (Boylan et al., 1992) believe that perceptions about scientists influence students' interest, attitudes toward learning science and having science-related careers in the future. Hence, assessing and revealing students' perceptions about scientists have become important for science educators.

The findings of the studies investigating students' perceptions of scientists (Buldu, 2006; Finson et al., 1995; Fung, 20002; She, 1998) indicated that students' perceptions of scientists greatly influence the number of students interested in studying science and choosing a career related to science. In addition, researchers reported that students' perceptions about the scientist affect their willingness to become a scientist (e.g., Finson et al., 1995). In general, the findings of previous research (Buldu, 2006; Fung, 20002; She, 1998) revealed that students perceived scientists as males wearing white lab coats and glasses, working in a laboratory equipped with test tubes, flasks, books.

A number of researchers studying students' perceptions of scientists (Newton & Newton, 1992) reported that students began forming stereotypical images of scientists at elementary school (e. g., Losh et al., 2008; Medina-Jerez et al., 2010). These stereotypical images and perceptions about scientists may differ relating to age, gender, culture, socioeconomic level, and also with respect to the students' education level (Medina-Jerez et al., 2010). Although there is a relatively high number of studies on elementary, middle, and high school students, there is a lack of research on gifted students' perceptions of scientists in the available literature.

Gifted students have different cognitive, affective and physical, intuitive and social characteristics compared to their peers. Because of this, it is generally accepted that gifted students are academically strong and are a group of students from whom future scientists can emerge (Melber, 2003). In order to meet gifted students' special learning needs, science educators need a better understanding of the perceptions held by this group of students. If we know the way in which students depict and view a scientist, then it is reasonable to contribute to science education practices for students. Thus, a better understanding of the nature of gifted students might inform science educators about how science curricula contribute to students' stereotypical images of scientists. With this in mind, this study investigated gifted students' perceptions of scientists. The research questions of this study were as follows:

- How do gifted students perceive scientists?
- What are the stereotypical images of scientists among gifted students?

Method

Participants

For this study, a convenience sample of gifted students was used. A total of 42 gifted students who enrolled in a Scientific and Art Center were invited to participate in the study. Participants included 12 fifth-graders (8 male, 4 female) and 30 fourth-graders (15 male, 15 female) from the Scientific and Art Center in Ankara, the capital city of Turkey. The Scientific and Art Center is a typical government funded elementary school and accepts only gifted students. Of the students, 23 students were male and 19 were female. Participants were between 10 and 11 years-old.

Data Collection

A Draw-a-scientist-test (DAST), which was developed by Chambers (1983), was used to obtain students' images of scientists. It asks students to simply reflect their impressions about scientists in their drawings. It takes very little time to administer and has been used to reveal and assess perceptions of scientists in numerous studies (Chambers, 1983; Finson et al., 1995; Kaya et al., 2008; Monhardt, 2003; Newton & Newton, 1992). In this study, students were asked to draw their own illustrations of their image of scientists. A worksheet featuring a large framed area was provided and it asked to draw "a scientist at work". Students were also asked to clarify their drawings through their own sentences. Each student completed his/her drawing in approximately 25–30 minutes. There was no time limit. The DAST was administered by the science teacher in one of his lesson. Data were collected in the spring semester of the 2009 school year.

Data Analysis

A control list for the DAST instrument, which was originally constructed by Chambers (1983), was used to analyze the data obtained from the students' drawings. Accordingly, each student's drawings were firstly analyzed according to whether or not the students drew specific indicators in his/her drawings, such as a lab coat. In addition, both in one of the previous studies (Kaya et al., 2008) and in this study, a few indicators, such as "tie" and "garden," which actually do not exist in the control list were ascertained. As for the data analysis, data were firstly analyzed by one of the researchers. Then, other researcher separately analyzed the students' drawings. We used the rater codes for each indicator with either 1 or 0 points depending on the presence or absence of the examined feature in the checklist. Differences were discussed until we reached consensus. The correlation

for inter-rater-reliability was found .93. The statistical package for social science software (SPSS) was used to calculate the descriptive statistics analyses.

Results

The findings pertaining to the analysis of the students' drawings are shown in Figure 1 presenting the distribution of the stereotypical indicators by grade level and gender. The framework of analysis involves four distinct axes: a) stereotype indicators, b) researchers' gender, c) alternative views, d) researchers' activities. Each of these axes is presented along with their particular dimensions. Each drawing involved 2.92 stereotypic indicators on average, the boys' drawings being slightly more stereotypical than the girls' ones (3.42 and 2.42 average indicators per drawing). The most popular indicators included by the students were a lab coat, facial hair, and eyeglasses. In addition, various indicators, such as being bald, having a beard or mustache, and wearing a tie, were slightly present in the drawings. Research symbols (e.g., test tube, beaker, table, cupboard, chemicals, and other laboratory tools), technology symbols (e.g., computer and cell phone) and relevant captions (names of the renowned scientists, headlines – earthquake, electricity-, and mathematical formulas) are also found in the students' drawings.

The findings in Figure 1 show that 61.9% of the students imagined a scientist who wears a lab coat, 30.9% of them drew a scientist with facial hair, and 21.4% of them drew a scientist with eyeglasses. Moreover, 9.5% of the students drew a bald scientist, 4.7% of the students drew a scientist with a mustache. Similarly, 4.7% of the students used a tie in their drawings. Interestingly, the drawings of fourth-grade students included more elements when compared to fifth-grade students' drawings. For example, while 63.33% of the fourth-grade students drew a scientist with a lab coat (e.g. in Figure 2), 58.33% of the fifth-grade students included a lab coat in their drawings. Furthermore, the majority of the students used research symbols (59.5%), knowledge symbols (14.2%), and technology symbols (54.7%), and relevant captions in their drawings, respectively.

The science equipment drawn by the students in this study included research symbols (scientific instruments and laboratory equipment of all kinds) and knowledge symbols (principally books, filing cabinets), technology symbols (computers, robots), and captions (mathematics or chemical formulae, names of well-known scientists, e.g. Einstein). In detail, 59.5% of the students included research symbols (e.g., Figure 2), 14.2 % used knowledge symbols, 54.7% involved technology symbols (e. g., computer in Figure 3), and captions in their drawings. It should be noted

Figure 1. The descriptive statistic of the image of scientist with relevant frequencies and percentages

DAST indicators		Grade		Gender		
	Properties	4 N (%)	5 N (%)	Boys N (%)	Girls N (%)	Total N (%)
Stereotype indicators	Lab coat	19 (63.33)	7 (58.33)	15 (46.87)	11 (57.89)	26 (61.90)
	Eye glasses	8 (26.66)	1 (8.33)	2 (6.25)	6 (31.57)	9 (21.40)
	Facial hair	9 (30.00)	4 (33.33)	9 (28.12)	4 (21.05)	13 (30.9)
	Bald	0 (0.00)	4 (33.33)	0 (0.00)	4 (21.05)	4 (9.50)
	Beard	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)
	Mustache	0 (0.00)	1 (8.33)	0 (0.00)	1 (5.26)	2 (4.70)
	Tie	0 (0.00)	1 (8.33)	0 (0.00)	1 (5.26)	2 (4.70)
	Research symbols	19 (63.33)	6 (50.00)	13 (40.62)	12 (63.15)	25 (59.5)
	Knowledge symbols	3 (10.00)	3 (24.99)	3 (9.37)	3 (9.37)	6 (14.20)
	Technology symbols	17 (56.66)	6 (50.00)	12 (37.50)	11 (57.89)	23 (54.70)
	Relevant captions	12 (40.00)	5 (41.66)	9 (28.12)	8 (42.10)	17 (40.40)
Researchers' gender	Male	23 (76.66)	9 (75.00)	20 (62.50)	12 (63.15)	32 (76.10)
	Female	5 (16.66)	2 (16.66)	1 (3.12)	6 (31.57)	7 (16.60)
	Male and Female	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)
	Indeterminate	3 (10.00)	1 (8.33)	3 (9.37)	1 (5.26)	4 (9.50)
Alternative views	Indications of danger	0 (0.00)	1 (8.33)	1 (3.12)	0 (0.00)	1 (2.30)
	Light bulbs	3 (10.00)	2 (16.66)	5 (15.62)	0 (0.00)	5 (11.9)
	Indications of secrecy	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	
	Laboratory	24 (80.00)	8 (66.66)	18 (56.25)	14 (73.68)	32 (76.1)
	House	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)
	Garden	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)
	Middle age/elderly					
	Happy	4 (13.33)	2 (16.66)	4 (12.50)	2 (10.52)	6 (14.2)
	Sad	1 (3.33)	0 (0.00)	0 (0.00)	1 (5.26)	1 (2.3)
	Angry	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)
	Thoughtful	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)
	Crazy	11 (36.66)	6 (50.00)	12 (37.50)	5 (26.31)	17 (40.4)
Indeterminate	13 (43.33)	5 (41.66)	7 (21.87)	11 (57.89)	18 (42.8)	

DAST indicators			Grade		Gender		
		Properties	4 N (%)	5 N (%)	Boys N (%)	Girls N (%)	Total N (%)
Researchers' activities	}	Repairing/manipulating tools	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)
		Inventing and designing a new material	26 (86.66)	10 (83.33)	20 (62.50)	16 (84.21)	36 (85.7)
		Doing experiments	16 (53.33)	5 (41.66)	12 (37.50)	9 (47.36)	21 (50.0)
		Explaining and teaching a subject	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)
		Doing observation	1 (3.33)	1 (8.33)	1 (3.12)	1 (5.26)	2 (4.70)
		Other (nothing)	2 (6.66)	0 (0.00)	2 (6.25)	0 (0.00)	2 (4.70)

that more than one of these symbols was observed in some students' drawings. The findings also indicated that non-stereotypical features, such as monsters, paintings, and typewriters, were drawn as well.

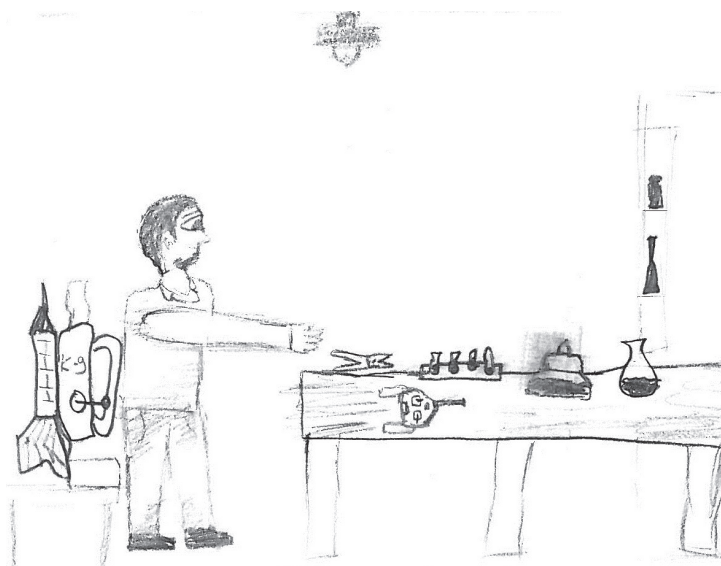
The findings related to the gender of the scientists showed that the majority of the students (76.1%) drew male scientists. However, a number of the students (16.6%) presented their scientists as female in the drawings. These findings demonstrate that there are strong preferences for male scientists. Regarding the presence of a female in the drawings, only 16.66% of the students in both grades drew a female scientist. Interestingly, our findings demonstrated that female scientists were drawn by female students. In a small proportion of the drawings, the gender of the scientists was not clear. The interesting finding here is that 31.57% of the female students drew scientists as female. It is important to note that only one of the male students drew a scientist as female.

The findings also revealed the students' alternative views about scientists. The findings pertaining to the students' drawings associated with signs and symbols related to scientists demonstrated that a few the students did not include warning or privacy signs in their drawings. While only 1 student (2.3%) drew danger symbols in his drawings, 5 students (11.9%) drew light bulbs (cf. Figure 2). In terms of the research setting, the findings showed that researchers were most frequently depicted as working in a laboratory (as indicated in Figures 2 and 3). The majority

Figure 2. Researcher with a white coat, facial hair, research instruments (glassware), technology products (machine) and relevant captions (light bulb and stars)



Figure 3. Researcher with research instruments (tubes), technology products (jet engine) and light bulb



of the students (76.1%) drew a scientist in a laboratory. However, none of the drawings included both a house and a garden as places where scientists worked out. Furthermore, it was found that the majority of the female students (73.68%) used laboratory settings in their drawings that the boys did.

The drawings also included views of the personal characteristics of scientists. Nearly half of the students (40.4%) drew a scientist as crazy. In total, 6 students (14.2%) drew happy scientists. In addition, a small number of students (2.3%) also drew sad scientists. None of the students drew angry scientists. However, in some of the drawings (42.8%) the personal characteristics of the scientists were not identified. The most common scientist type drawn in this study was that depicted as someone who tries to invent new materials/things (85.7%) and conducts experiments and tests (50%), and makes observations (4.7%). Interestingly, the majority of the students perceived a scientist as someone who tries to invent new material/things. On the other hand, a small proportion of students drew a scientist as someone who makes observations. Other stereotypical types, such as explaining a subject, or repairing tools, were not shown in the drawings. Finally, one of the interesting findings in this study regards the number of scientists. Table 1 illustrates the distribution of the numbers of scientists. 42 students drew scientists; most of the students (93.33%) drew only one scientist; and only one student drew one or more scientists (cf. Table 1).

Table 1. Number of children drawing scientists with relevant frequencies and percentages

	4	5	Boys	Girls	Total
One scientist	28 (93.33)	12 (100.00)	22 (96.33)	18 (96.33)	40 (93.33)
One or more scientists	1 (3.33)	0 (0.00)	1 (3.33)	0 (0.00)	1 (3.33)
No scientist	1 (3.33)	0 (0.00)	0 (0.00)	1 (3.33)	1 (3.33)

Discussion

Although many studies investigated students' perceptions of scientists (Kaya et al., 2008; Buldu, 2006; Chambers, 1983; Fung, 2002), gifted students' perceptions of scientists have been neglected. The purpose of the presented study was to investigate gifted students' perceptions of scientists. Overall, the findings obtained from this study demonstrated that gifted students had a variety of stereotypical images of scientists. The findings showed that the students' drawings included on

average fewer indicators of the stereotypical model. More than half of the students in this study drew scientists wearing a lab coat. This finding is consistent with the findings of previous research (Barman, 1999; Buldu, 2006; Chambers, 1983; Fung, 2002; Samaras, 2009). These findings suggest that the students perceive a scientist as someone who wears a lab coat. Another possible reason may be the impact of textbooks, the mass media, and especially cartoons of students' images of scientists. Monhardt (2003) suggested that scientists presented in textbooks greatly influence what students believe about scientists (Monhardt, 2003).

The overall image of the depicted scientist in the presented study tends to be male. A low proportion of students included female scientists in their depictions. Interestingly, some girls drew a male scientist. This finding is important because it expresses the role of females in a given culture and/or male-biased presentation of scientists in the media. This finding is consistent with previous research findings (Buldu, 2006; Chambers, 1983; Finson, 2002; Losh et al., 2008; She, 1998; Turkmen, 2008). The reason might be that the students believe that scientific knowledge is predominantly constructed by male scientists, such as Einstein and Newton. In this study, the students typed the names of scientists, such as Einstein and Newton. The findings of previous research and this study reveal the need for presenting female scientists who could be role models for students.

The participants in the study drew scientists in laboratory settings. This finding is consistent with the findings of previous research (Barman, 1999; Buldu, 2006; Chambers, 1983; Kaya et al., 2008; Turkmen, 2008); however, inconsistent with those of Christidou et al. (2010), who found that research is predominantly performed in fieldwork. It can be said that, in general, students depicted a scientist as someone who works alone in a laboratory. This finding demonstrates that there is a need for teachers to emphasize that scientists can work together.

The students' drawings indicated that researchers are mostly represented primarily as those who conduct research and who try to invent a new material and secondarily as those who do experiments. The student's representations of scientists in such a way reveal a view which reflects scientific research. However, it should be noted that such a view is not unusual in the representations of scientists who are working in the field of social sciences. This finding shows that the social dimension of scientific research is missing in the students' representations of scientists. Our findings demonstrate that there is a need to point out the social aspect of scientific research.

Conclusion

This study showed that gifted students in fourth and fifth grades (10–11 years old) had a variety of stereotypical images of scientists and these images are more stereotypical in some respects and less stereotypical in others. The findings provide useful information for both science educators and the teachers of these students. In order to promote the image of scientists, teachers should employ a variety of activities in their lessons, including: visiting scientists who represent both social-related and science-related occupations, a scientist's visit in the classroom, presenting scientists' lives, organizing field trips that contain the works of scientists, giving details about scientists' work, working as a team in the classroom, and bringing more books to the classroom that are relevant stories of scientists. Each of these experiences would make a unique contribution to what perceptions students have of scientists.

It would be noteworthy to mention here that the media play an important role in shaping students' perceptions. Especially, the negative scientist characters, such as a 'mad scientist' or a 'man in a lab coat' in cartoons and TV programs, may cause the formation of negative image of scientists. Such an image could prevent students from becoming a scientist and having a career associated with science (Finson et al., 1995). There is a need to highlight that scientists could work on social topics.

While these findings provide valuable information about the perceptions of gifted students, they also offer an overall image that gifted children have about scientists and what scientists do. Considering the findings of this study, there is a need to highlight that science is a part of our daily life. Further research should investigate gifted students' perceptions of scientists and what factors affect students' images through a variety of data collection tools, including the DAST, interviews, and Likert-type questionnaires. Moreover, in order to help students to build an inclusive image of scientists, there is a need to conduct experimental studies.

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