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Turkish Primary Students' Perceptions about Scientist and What Factors Affecting the Image of the Scientists

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Students' views of science and scientists have been widely studied. The purpose of this study is to analyze image of scientist from drawn picture of scientists using The Draw-a-Scientist Test (DAST) by 5th grade students and to analyze where this image comes from students' minds in changing Turkish educational perspective. Two hundred eighty seven students from sixteen different primary schools, located in the same city, participated in this study. Like previous studies, the findings generally showed that scientists are male, Caucasians, elderly-aged, working indoors with chemistry. On the contrary, the image of scientists, having glasses and facial hair and/or crazy hair, wearing lab coats, and doing dangerous and secrecy things decreased but smiling scientists and indicator of technology increased in young Turkish students' drawings. Eventually, stereotypical images of the scientist are a slightly lesser than revealed in previous studies. The impact of science teachers and textbooks has shaped what a scientist is and what a scientist does to young students' minds. Notwithstanding, the influence of media (movies, magazines, television, etc.) has been pointed to as not significant source of information by students.

Keywords: The Draw-a-Scientist Test (DAST), Scientist, Science Teaching

INTRODUCTION

Students come into classroom with their own knowledge and they reformulate their existing knowledge, either valid or invalid or incomplete, only if new information is connected to knowledge in their mind. Otherwise memorized information that has not been connected with the students' prior knowledge will be quickly forgotten. Besides, science is no longer presented as a mystery tour or a magic show. Now science is all around us. The contemporary teaching science at school tends to be active and hands-on, and teaches children a great deal about their world In fact, the more opportunities kids ask questions, make observations, and learn through hands-on experiences, the more easily they learn and connect to the real world (Bransford, et.al 2000; Driver, Asoko, Leach, Mortimer, & Scott, 1994; Erduran, Ardac, & Yakmaci-Guzel, 2006; Halat, 2007; Turkmen, & Pedersen, 2005). These accepted two facts caused to Turkish Ministry of National Education to revised Turkish science education curriculum in 2004. The revised programs began in the 2005-2006 academic year. Turkish perspective of teaching science was totally changed to be "doing science" rather than just reading about it. The purpose of this science curriculum is to prepare students to be scientifically literate citizens who are able to use scientific facts in their daily life. New instructional materials were designed for a student-centered (constructivist theory) learning crucially important for implementation of lifelong learning strategies. The main approach in the new science curriculum was to make our students "think like a scientist". Teachers would use a "student as scientist" metaphor for students' activities in the classroom and when conducting an investigation and encourage them by asking "how would

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a scientist find out? In addition, science textbooks were written by paying attention to history and nature of science. Many students come across to stories about scientists and inventors. These stories in the science textbooks tended to emphasize positive characters of scientists, such as curiosity, hardworking, persistency, and encourage students to follow these examples. The purpose of mentioning of scientists in textbooks was to show their achievement and contributions to mankind.

Scientists are often symbolized in visual and verbal images in TV, fictions, and textbooks. Whether inside or outside school, students develop their own images of scientists, which can be very stable and resistant to change. Investigating their images of scientists has significant implications for understanding students' perceptions of scientists. The Draw-a-Scientist Test (DAST) is a useful tool for exploring students' perceptions of scientists by providing symbolic indications of students' basic beliefs. Several studies using the Draw-a-Scientist Tests have assessed students' images of scientists over the last two decades.

The DAST was originally developed by David W. Chambers (1983) in order to learn the person's image of a scientist. In his study, 4807 children, who are from kindergarten to K-5, participated in the DAST. Drawings were analyzed for some indicators of the image He used 7 major indicator, such as lab coat, eyeglasses, and facial growth of hair. He was able to show that views of scientists varied by age and grade level, and that children held stereotypical views of scientists from these indicators. The Draw-a-Scientist-Test revised prompt (DAST-R) was recommended and tested by Symington and Spurling (1990), because they realized that students draws represent what they perceived to be the public stereotype of a scientist instead of their own perception of a scientist. To remedy this problem, Symington and Spurling added "Do a drawing which tells what you know about scientists and their work" section. They compared drawings done by students given both sets of prompts. The drawings showed enough differences that the DAST prompt is critically examined for what it actually is asking the students to draw.

After creating DAST by Chambers, many researchers started to use DAST to gauge various factors in students, including career goals, perceptions of scientists at the elementary through high school level, and perception of technology in 1990's. Each of these studies has shown that students possess interesting stereotypic images of scientists. The typical finding was that students have drawn white men who wear a white coat and work alone in a laboratory. Scientist was elderly or middle aged and wears glasses. This has been interpreted as showing strong confirmation of a stereotype of the scientist (Chambers 1983; Finson, Beaver & Cramond 1995; Fort & Varney 1989; Huber & Burton 1995; Mead & Metraux, 1957; Hadden & Johnstone, 1983; Rubin, & Cohen, 2003; Schibeci & Sorenson 1983; Solomon 1993; Tuckey, 1992). These stereotypical images of the scientist seemed to be common worldwide. Despite, there have been few studies reporting the image of the scientist from non-western countries. In this study, the more comprehensive data from 5th grade Turkish students to identify their image of scientist and highlight to their vision of most effective sources about scientist's image were attempted to provide.

RESEARCH QUESTION/DESIGN

Sample

Fifth grade students were concentrated in this study, because they were the first source of impacted subject group by changing of Turkish education perspective. Two hundred eighty seven (287) 5th grade students, who 120 were boys and 167 girls from 16 different primary schools located in the same city, participated in the data collection procedure. All the students attending this study had taken first time science and technology course.

Instrument

The whole study was carried out in two parts. First part of questionnaire was the DAST. In this part, each student was given a piece of paper with the following instruction: Could you draw a picture of a scientist? (Try to draw one in the rectangular box below) When you are finished, Could you please explain What Scientist is Doing?

The second part of questionnaire regarding source of scientist image was adapted by Pedersen and Turkmen (2005) and a little changed for this study. For the current study, second part consisted of 3 sections identifying "Where Students Receive Information about Scientist," including 15 questions, and "The Most Frequent Way Students Study/Learn about Scientist," including 7 questions.

The questionnaire was administered by the class teacher in one of his/her lessons. The teachers were asked not to give any further directions to students and no time limit was set for drawing the pictures. All teachers reported that students completed the task in 20 minutes or less. The reliability of the instrument is documented at .81.

DATA COLLECTION and ANALYZING

At the end of the 2006 fall semester, the questionnaire was conducted to attempt to ascertain information about the image of scientists and source of

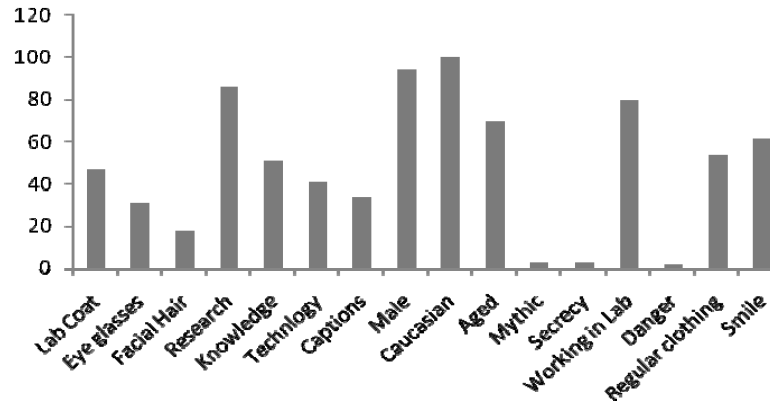

Figure 1. DAST Percentages

scientist image. The student's drawings of scientists were collected and analyzed using the DAST-C. Each drawing was rated for specific stereotypic images and additional information obtained from the student narratives.

In the previous studies, general opinion would readily find a scientist depicted as a white male, middle-aged or older, wearing a lab coat and glasses and featuring some type of facial hair (Barman, 1996-1997-1999; Bodzin, & Gehringer, 2001; Chambers 1983; Finson, 2002-2003; Finson, Pedersen, & Thomas, 2006; Flick, 1990; Fort & Varney 1989; Finson, Beaver, & Cramond 1995; Fung, 2002; Huber & Burton 1995; Kahle, 1992; Moseley, & Norris, 1999; Odell, Hewitt, Bowman, & Boone, 1993; Pedersen, & Thomas, 1999; Rosenthal, 1993; Ryder, Leach, & Driver, 1999; Schibeci & Sorensen, 1983; Song, & Kim, 1999; Symington, & Spurling, 1990; Thomas, & Pedersen, 1998; Thomas, Pedersen, & Finson, 2001). In this study, the students perceived scientists as being males (94.1%) who are old-aged (69.7%), do their work in some type of laboratory (79.8 %), and wearing lab coat (46.7 %). Indicator of symbols of research (86.1%) were laboratory equipment, including test tubes, various types of flasks, beakers and burners with flames and symbols of knowledge (51.2%), drawn books, shelves or stationery, were almost same percentage in previous studies.

On the other hand, some images of scientists were interestingly found opposite of former studies, such as, regular clothing (blue-jeans and T-shirts) (53.3%), smiling (61%). Turkish 5th grade students were not agreed that facial hair (17.4%), eyeglasses (30.7%), relevant captions (33.5%) including time machines; infra-red eyeglasses; and special watches, mythic stereotypes (2.5%), indications of secrecy (2.4%), and indications of danger (1.7%) are not stereotyped image of scientist.

Ethnic minority representation was practically *nonexistent*. One possible explanation is all Turks are Caucasian and students probably have never seen any black or Hispanic or Asian people. Undoubtedly, students did not depict any minority people as a scientist. Another interesting feature was the computers (40.8 %) in the drawings. This could be reflecting an increasing usage of computers in science lessons.

Another interesting result was that nearly all scientists were in a laboratory and were behind or by the side of a table but very few were outside. Moreover, scientists stood alone in an environment (generally laboratory) surrounded by objects of research (86.1 % percent) or objects of knowledge (51.2 %); barely included other people. In this sense, teachers failed to teach science is a collaborative endeavour and many of today's investigations are team based (Figure 1).

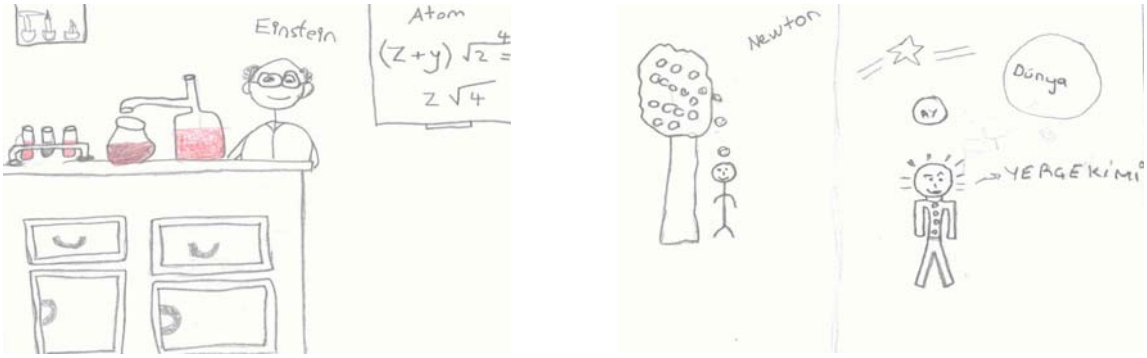

Figure 2. Examples of students' sketches of scientists, Einstein and Newton.

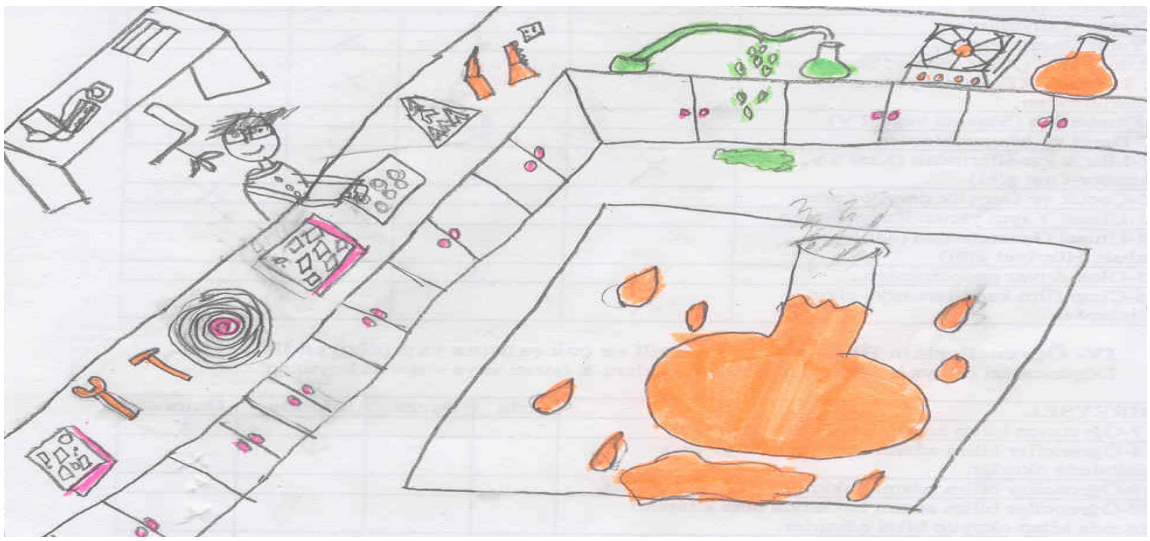

Figure 3. Male scientist is working in the chemistry lab.

In many cases, it was noted that most of the students pay close attention scientists' contributions to the well-known of mankind, such as Newton, Einstein, and Graham Bell (Figure 2). The usual stereotype of the 'brainy' scientist with a large forehead was largely absent. However, white men were sometimes drawn with a bald head and hair at the sides. Most probably, this could be an adaptation of the Albert Einstein. In few cases, there were some images having smoking chemicals, blowing, and dissections. There were one image of bombs/blowing up some planets, three Frankenstein, two where one person and one animal were being injected with dangerous chemicals, and three featured dissections. Although there were the negative images of scientist, they were not many. The negative image of scientists might be coming from such popular movie characters and/or cartoon characters, such as "Norman Osborn (Green Goblin)" from Spiderman movie, "Dr. Lex Luthor" from Superman movie, "Dr Frankenstein" from many Frankenstein movies, and "Dr Moreau" from the Island of Dr. Moreau movie. These scientists were mad, evil, godless, amoral, arrogant, impersonal or inhuman in the movies. These characters have contributed more or less unattractive vision of the scientist. These fictional representations of the scientist were reflections of the response to the role of science and technology in the social context and were drawn by boys mainly, and were massively of males. On the contrary, there were also very few positive statements, like "A scientist is trying to found a cure for Bird Flu (Avian influenza) and AIDS."

Besides, the majority of scientists were drawn as chemistry-based scientists. One possible explanation might be it is easier to draw beakers, funnels, pipettes, and test tubes than common physics apparatus, such as balance, magnifiers, and electrical supplies, and biology apparatus, such as dissecting instruments, model of DNA/RNA, and torso. (Fig. 3)

In the second part of questionnaire, 5th grade students were asked based on items listed on the instrument where they obtain most of their information about scientist. Most of their sources of information came from the *teachers* (61.3 %) and *parents* (40.5 %). Moreover, they thought that friends (37.6 %) were also important sources of information about scientist. *Media* (41.8 %) was somewhat important source. One of the possible reasons is that Turkish media do not have responsibility to educate our children. Often the media present an exaggerated science stories and treating controversial theories as facts and scientists as superior beings who live in a world apart (Table 1).

Five grade students responding to this instrument were also asked to indicate which media sources they used to gather information about scientists. Although media was somewhat important sources, music channels (34.8 %), local radios (36.6 %), and local (39.1 %) and national (40.1 %) newspapers were ranked in important or very important categories in media. On the contrary, respondents indicated that movies (42.4 %), national magazines (61.3 %), school events TV (47.4 %) were not important sources of information about scientists. These results showed that most of Turkish 5th grade students believed movies, TV programs, and magazines were not a trustable source of information about scientists. One of the possible reasons is that these sources do not represent realistic and educational news to people in their broadcastings and editions (Table 2).

The students' responses about their insights regarding how they most frequently studied about scientist indicated that "Students read about scientists in textbooks" and "A teacher talks about scientists in class." have the highest and "Students participate in field trips related to scientists" has the lowest mean

scores. In contrast, statements of "Students write papers about scientist" (31.1 %) and "Students participate in field trips related to scientists" (50.3 %) were seen as the least likely manner (never) and "Students read about scientists in an article or journal," "Students read about scientists in books (other than textbooks)," and "Students complete projects on scientists" were ranked in "sometimes" manner by which 5th grade students learn about scientists. These results were very similar with She's (1995) findings, which suggested that Taiwanese students' images of scientists were influenced to a considerable degree by the content of science textbooks, this study illustrated the possible impact of the curriculum (Table 3).

In general the results of this study indicate that boys and girls are seeing scientists in realistic ways and science as an exclusively male preserve. There was no statistically difference between male and female students' "DAST" and "source of information about scientists" mean scores. But some boys tended to see scientists do something weird and magical things in science and girls in this study did not see science as an exclusively male preserve as much as boys'.

CONCLUSION and DISCUSSION

Undoubtedly, the image of scientists is a part of science. It is essential responsibility for teachers, science educators, and curriculum developers involved in developing science curriculum materials to know what students' perception is about science. It also helps students' understanding and use of science in their lives.

Table 1. Where 5th Grade Students Receive Information about Scientist: Individuals

Questions	Mean	Standard Deviation	Not Important	Somewhat Important	Important	Very Important
B1: Media	2,5958	,94816	12.9 %	41.8%	39.7 %	5.6 %
B2: Friends	2,5401	,95216	19.8 %	29.6 %	37.6 %	13.0 %
B3: Parents	2,9861	1,05105	13.9 %	13.9 %	31.7 %	40.5 %
B4: Teachers	3,3380	,98984	10.1 %	7.3 %	21.3 %	61.3 %

Table 2. Where 5th Grade Students Receive Information about Scientist: Media

Questions	Mean	Standard Deviation	Not Important	Somewhat Important	Important	Very Important
BM5: Local TV News	2,26	,868	20.2 %	40.8 %	31.4 %	7.6 %
BM6: Local Radio	2,73	,937	10.5 %	29.3 %	36.6 %	23.6 %
BM7: Local Newspaper	3,01	,998	11.5 %	14.6 %	34.8 %	39.1 %
BM8: National TV News	2,29	1,00	25.1 %	34.1 %	26.5 %	14.3 %
BM9: Movies	1,89	,971	42.5 %	35.1 %	12.5 %	9.9 %
BM10: National Magazines	1,67	,980	61.3 %	17.8 %	12.9 %	8.0 %
BM11: MTV and other music channels	2,56	,954	14.9 %	31.7 %	34.8 %	18.6 %
BM12: Teen Magazines	2,56	,947	12.9 %	37.3 %	30.3 %	19.5 %
BM13: National Public Radios	3,01	,951	7.7 %	21.6 %	32.8 %	37.9 %
BM14: National Newspapers	2,58	,945	15.3 %	27.5 %	40.1 %	17.1 %
BM15: School Events TV	1,86	,988	47.4 %	27.9 %	15.7 %	9.0 %

Table 3. The Most Frequent Way Students K-12 Students Study/Learn About Scientist

Questions	Mean	S.D	Never	Sometimes	Frequently	Always
C16: A teacher talks about scientists in class.	2,90	,903	2.8 %	31.9 %	26.5 %	38.8 %
C17: Students read about scientists in an article or journal.	2,40	,821	19.8 %	41.9 %	26.5 %	11.8 %
C18: Students write papers about scientist.	2,48	,896	31.1 %	26.0 %	26.5 %	16.4 %
C19: Students read about scientists in books (other than textbooks).	2,79	,968	8.7 %	32.8 %	28.6 %	29.9 %
C20: Students read about scientists in textbooks.	2,96	,905	3.5 %	32.4 %	28.6 %	35.5 %
C21: Students complete projects on scientists.	2,37	,910	25.7 %	35.3 %	25.1 %	13.9 %
C22: Students participate in field trips related to scientists.	1,92	,807	50.3 %	33.3 %	10.1 %	6.3 %

Many researchers and educators believed that the less stereotypical the image of scientists one holds, the more probable s/he will have positive attitudes toward science and subsequently consider entering a profession in the sciences (Bodzin & Gehringer, 2001; Flick, 1990; MacCorquodale, 1984; Matkins, 1996; Rosenthal 1993). Hence, information about students' perceptions of scientist is vital tool to evaluate science curriculum.

The perception of scientists being male, Caucasians, elderly-aged, working indoors with chemistry was seen a prevalent in previous research using DAST to explore students' image of scientists. Although the results of study resemble the findings of previous research, the elements of those scientists having glasses and facial hair, wearing lab coats, with crazy hair and doing dangerous and secrecy things decreased. Eventually, indicator of technology and smiling face increased in young Turkish students' drawings. Even, a number of students view scientists as realistic people rather than as mythical creatures.

What factors influence all these perceptions have been inferred by various researchers? Most of them stated that the impact of classroom activities with the influence of today's media and literature (Evans, 1992) shapes students' attitudes toward science and role of scientists in our society (Talsma, 1997). Notwithstanding, the influence of media (movies, magazines, television, etc.) has been pointed to as not significant source of information by students in this study. Thus, if teachers got our students to be curious about the natural world around them and encouraged them to develop their own theories about why something is the way it is, through drawing, or creating structure of their idea, or a way of thinking at an early ages, this would lead them to have science-related hobbies and jobs as they grow up.

IMPLICATIONS of STUDY

Teachers in the primary schools play a central role in sharing and creating perceptions and stereotypes about science and scientists. A clear evaluation of students' views of scientists can pinpoint misconceptions at early ages. These misconceptions can be got rid of students' minds using student-centered learning style. To get rid of negative images of scientists, teachers, science educators, and curriculum developers need to be encouraged to use the special features in science textbooks that highlight science careers, depict scientists as everyday people. They should get students meet with scientists because at that age it is considered the critical time of influence. Scientists can come to the classroom and students can ask them to talk about their lives not just their science. Even, they can get helpful from students' parents having a science background and from university academicisons.

While the DAST is simple method, readers should be cautious about this conclusion because the DAST only provided us with a one dimensional snapshot of students' mental representations about scientists and do not necessarily reflects what students believe. Hence, it would be useful to include interviews for deeper understanding of students' constructs after the drawing activity. Although some students added comments and captions on their drawings, it is not enough evidence for what students believe and probably it difficult to express their views simply through drawing.

The information obtained in this study has been limited to a few schools in the west of Turkey. The other researchers should be encouraged to use the similar research to gain insights about how students in different parts of Turkey perceive scientist and its relevancy to them. These data would provide valuable feedback to teachers regarding whether students are developing a realistic perception about scientist and its usefulness to them. This information could serve as an evaluation tool for teachers to assess the effectiveness of their science instruction.

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