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## The effects of technology teaching materials on students' image of scientists

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### Abstract

The purpose of this study was to investigate the effects of technology teaching materials on students' image of scientists. It was an experimental study with a pre-test and post-test control group with participants for this study consisting of 38 (Experimental, n=20 and Control, n=18) middle 6th grade students in Turkey. Data was collected by the DAST to investigate the students' image of scientists. The students in the experimental group abandoned the stereotyped image and saw scientists as men or women with a human image that, in general, made observations on nature, that worked on living beings and did not wear eyeglasses.

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*Keywords:* Image of Scientist; Technology Teaching Materials; Science and Technology Education; Experimental Study; Elementary School Students Introduction.

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### 1. Introduction

It is crucial to highlight the importance of science and its relevance to students' lives; however, students also need more positive and realistic demonstrations of the scope and limitations of science and scientists. Various researchers have investigated the students' image of scientists because of the fact that these images affect their attitudes toward science (Beardslee & O'Dowd, 1961; Brush, 1979; Chambers, 1983; Finson et al., 1995; Flick, 1990; Mason et al., 1991; Mead & Metraux, 1957; Palmer, 1997; Yvonne, 2002). In teaching science, educators could make positive or negative impressions on students about science, scientists or even about educators themselves (Moseley & Norris, 1999). For instance, if students' deeply rooted images of scientists are strange-looking in their classes, in the future they will likely prefer not to be a scientist (Sheffield, 1997). Schibeci and Sorensen (1983) found that children's negative stereotypical images of scientists translated into positive images of science. Moreover, Ross (1993) and MacCorquodale (1984) reported that the reason why females are less likely to enter science classes was their low and negative perceptions with respect to science. The results of the research show that the investigation of which effect can change the students' image of scientists is important.

The studies on the students' image of scientists have been widely investigated in past decades. However, there is a dearth of studies on factors to change the students' negative image of scientists, which is one justification for this study. Therefore, the purpose of this study was to investigate the effects of science and technology education with technology teaching materials on students' image of scientists using Draw A Scientist Test (DAST) developed by Chambers (1983) as a research instrument.

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### 1.1. Research Questions

- (1) Do the science and technology education with technology teaching materials affect on sixth graders students' image of scientists?
  - (a) Are there any significant differences in the DAST data from students in control and experimental group before implementing?
  - (b) Are there any significant differences in the DAST data from students in control and experimental group after implementing?

## 2. Method

This study in which the effects of “Technological Instruction Materials” in the experimental group and “Written and Visual Printed Materials” in control group on students' image of scientist were examined was a qualitative study conducted with the survey method. The experimental method with pre-test/post-test control group was used in the study. In the experimental method used in the study, the independent variable was the instruction method used in both groups. In the study the independent variables were “Technological Instruction Materials” for experimental group and “Written and Visual Printed Materials” for control group. The dependent variables in the groups were the same and it was “Draw a Scientist Test (DAST)”. Gathering the pre-test and post-test documents related to this variable, comparisons were made between groups and within groups. The features to be tested in this study were determined in accordance with the purpose of the study; the learning setting was organized in accordance with the topics and course; and the application was implemented taking the pre-knowledge and preparedness levels of the students. The implementation lasted for about 10 weeks. The dependent and independent variables in the study were examined with the data obtained from the experimental and control groups throughout the study.

### 2.1. Sample

The universe of this study was composed of the students enrolled at in the second level of primary school in the Kaynarca district of Sakarya province in 2010-2011 educational years. The sample which was determined by means of random sampling method was composed of 38 students who were 6th year students at a primary school in aforementioned district in 2010-2011 educational year (Experimental, n=20 and Control, n=18; Female, n=21 and Male, n=17).

### 2.2. Instrument

Draw a Scientist Test (DAST) was used in the study in order to determine the views of the students about the scientist. 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. Then, Finson and Beaver (1995) criticized the scoring of DAST and developed DAST-C to analyze the data. In this study, the author developed a more comprehensive control list based on these previous studies. The students were told that they could use different colours and paints in their drawings. The students were given opportunity to use a second drawing paper if they needed. Moreover, the students were told that they could take small notes about their drawings in order not to have problems during the assessment. By this way, it was aimed at increasing the reliability of the assessment. It was thought that the views of the students about the scientist could be best determined using DAST when the grade levels of the students who composed the study group in the study were taken into account. In addition to this, as the DAST was a data collection tool to be used to determine the behaviour rather than to measure the behaviour, it was possible to think that it was appropriate to construct hypotheses about the views of the students. Moreover, the shortness of the DAST implementation (the implementation lasted for about 20-30 minutes) was appropriate with the attention span of the students composing the study group (Öcal, 2007:57).

### 3. Result and Discussion

New sub dimensions were added to the DAST-C after the student drawings were examined by the researcher. The data were analyzed using the modified control list which was formed by this way. Table 1 presents the findings obtained from control and experimental groups before the implementation as a result of the data analysis.

Table 1. The findings related to the views of the students in experimental and control groups about the scientist before the implementation

The Characteristics in The Control List		Experimental Group		Control Group	
		f	%	f	%
The Characteristics of the Clothes	Laboratory Coat	11	55	10	56
	Suit	3	15	0	0
	Casual / Sports Wear	0	0	3	16
	Clothes not specified	6	30	5	28
The Characteristics of the Drawing for the Head	Mop Hair	14	70	12	67
	*Well-cared hair	2	10	0	0
	Bald	4	20	6	33
The Characteristics of the Drawing for the Face	With Beard	7	35	7	39
	Without Beard	13	65	11	61
Other Pictures Drawn with the Scientist	Human Being	0	0	0	0
	Animal	0	0	0	0
	Plant	0	0	0	0
	Experiment Equipments	13	65	11	60
	Telephone	0	0	1	6
	Telescope	1	5	0	0
	Robot	1	5	2	11
	Electricity Equipments	2	10	0	0
	Food Ingredients	0	0	0	0
	Plane, car, etc.	1	5	2	11
	Computer	1	5	1	6
	Book	1	5	0	0
No other picture was drawn with the scientist	0	0	1	6	
Gender	Male	20	100	18	100
	Female	0	0	0	0
	**Gender not specified	0	0	0	0
Working place	Laboratory	11	55	8	44
	Study room	2	10	2	11
	Home	0	0	0	0
	Forest	0	0	0	0
	Space	2	10	1	6
	Place not specified	5	10	7	39
Facial Expression	Happy	13	65	12	66
	Annoyed	0	0	0	0
	Grumpy	2	10	0	0
	Sad	0	0	1	6
	Thoughtful	4	20	4	22
	Unidentified Facial Expression	1	5	1	6
Accessories	Glasses	9	45	10	55
	Hat /Cap	1	5	0	0
	Necklace/Ear rings/Hairclip/Belt/Tie/ Collar Handkerchief/Badge/Cloak/Scarf	5	25	3	17
	Accessories not specified	5	25	5	28

\* Combed hair and given shape

\*\* Drawings like creature, cartoon hero, clown, etc.

When the Table 1 was examined, it was seen that the drawings (the characteristics of the clothes, the characteristics of the drawing for the head, the characteristics of the drawing for the face, other pictures drawn with the scientist, gender, working place, facial expressions, accessories) of the students about the scientist were similar

before the implementation . When the drawings of the students participating in the study were examined, it was determined that the students in both groups drew the scientist with laboratory coat, mop hair, without beard, studying in the laboratory with the experiment equipments, as males, happy and with glasses. The image of scientist with mop hair which was found in the studies of Oğuz (2006) and Chambers (1983) supported the pre-implementation data of this study. The scientist image which was found in Chambers’s study in 1983 was in parallel with the finding of this study as “the scientist carries out experiments in the laboratory”. The students’ not drawing other pictures with the scientist was in parallel with the findings of Chambers (1983) and Rampal (1992) that “the scientists are alone (asocial) people”. The unit “The Fertility, Growing and Development in Living Beings” was taught by means of “Technological Instruction Materials” in experimental group and “Written and Visual Printed Materials” in control group for 10 weeks. At the end of this instruction, students were asked to draw “A Scientist” once more and the obtained DAST data were analyzed. The findings obtained at the end of the analysis are presented in Table 2.

Table 2. The findings related to the students’ views in experimental and control groups about the scientist after the implementation

The Characteristics in The Control List		Experimental Group		Control Group	
		f	%	f	%
The Characteristics of the Clothes	Laboratory Coat	3	15	11	61
	Suit	1	5	0	0
	Casual / Sports Wear	8	40	1	6
	Clothes not specified	8	40	6	33
The Characteristics of the Drawing for the Head	Mop Hair	4	20	14	78
	*Well-cared hair	16	80	1	6
	Bald	0	0	3	16
The Characteristics of the Drawing for the Face	With Beard	1	5	6	33
	Without Beard	19	95	12	67
Other Pictures Drawn with the Scientist	Human Being	0	0	0	0
	Animal	2	10	0	0
	Plant	2	10	0	0
	Experiment Equipments	5	25	9	50
	Telephone	2	10	0	0
	Telescope	1	5	0	0
	Robot	1	5	1	6
	Electricity Equipments	1	5	4	21
	Food Ingredients	1	5	0	0
	Plane, car, etc.	1	5	2	11
	Computer	1	5	0	0
	Book	3	15	1	6
	No other picture was drawn with the scientist	0	0	1	6
	Gender	Male	8	40	16
Female		12	60	1	6
**Gender not specified		0	0	1	6
Working place	Laboratory	1	5	9	50
	Study room	6	30	3	16
	Home	1	5	0	0
	Forest	3	15	0	0
	Space	2	10	1	6
	Place not specified	7	35	5	28
Facial Expression	Happy	15	75	13	72
	Annoyed	0	0	0	0
	Grumpy	0	0	1	6
	Sad	0	0	0	0
	Thoughtful	5	25	2	11
	Unidentified Facial Expression	0	0	2	11
Accessories	Glasses	2	10	10	56
	Hat /Cap	1	5	0	0
	Necklace/Ear rings/Hairclip/Belt/Tie/	3	15	3	16
	Collar Handkerchief/Badge/Cloak/Scarf				

Accessories not specified	14	70	5	28
* Combed hair and given shape				
** Drawings like creature, cartoon hero, clown, etc.				

When the Table 2 was examined, it was seen that the drawings (the characteristics of the clothes, the characteristics of the drawing for the head, the characteristics of the drawing for the face, other pictures drawn with the scientist, gender, working place, facial expressions, accessories) of the students about the scientist were not similar before the implementation. While significant changes occurred in the drawings of the students in experimental group after the implementation, there were no significant changes in the drawings of the students in control group. When the Table 1 and the Table 2 were compared, it was seen that the students in experimental group left the scientist image with laboratory coat, mop hair, without beard, studying in the laboratory with the experiment equipments, as males, happy and with glasses.

The view of the scientist with laboratory coat that emerged as the result of the studies Mead and Metraux (1957) and Chambers (1983) carried out was in parallel with the findings of this study. The image of scientist that carried out experiments which emerged as the result of the studies Chambers (1983) and Mead and Metraux (1957) changed for the students in experimental group after the implementation. The students in the experimental group drew home, forest, space and study room as the working place. According to the findings of the study carried out by Muşlu & Akgül (2006), the view that scientist carried out experiments in the laboratory was changing; and the finding of this study supported this finding. In the facial expression part, the most frequently drawn facial expression in both groups was “happy face” expression. The findings obtained in the facial expression part of this study did not support the view of unhappy and tired scientist that Chambers (1983) found at the end of his study. In accessories part, the scientist with glasses was most commonly observed in the drawings of the students before the implementation. Schibeci (2006) also found the image of “the scientist with glasses” at the end of his study. However, the experimental group students removed the uncared scientist image after the implementation. At the end of the study, it was observed that the students generally drew male scientists with glasses and working in laboratories with laboratory equipments. However, after the unit “The Fertility, Growing and Development in Living Beings” had been done by means of “Technological Instruction Materials” for 10 weeks, it was seen that students left these stereotypical figures and drew male or female scientist without glasses and making observations in the nature and working on the living beings. That is, while it was seen that the experimental group students moved away from the typical scientist view, there was no significant difference in the image of scientist for the students in the control group.

#### 4. Conclusion and Suggestion

In this study, the effect of “Technological Instruction Materials” on the scientist images of the students was examined empirically. At the end of the study, it was found that the “Technological Instruction Materials” including laboratories and computer equipments provided positive changes in the scientist image of the students. The scientist image of the students in the control group in which the instruction was accomplished by means of “Written and Visual Printed Materials” including only books, notebooks, blackboards and chalks did not change after the instruction. Thus, technological instruction materials should be used in developing typical scientist image in students’ minds in a positive way and they should be integrated in all levels of regular education beginning from the first years of primary school.

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