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Investigating How the Biographies of Today's Scientists Affect 8th Graders' Scientist Image

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This study aimed to investigate how a poster study focusing on the biographies of today's scientists affected 8th graders' scientist images. The study utilized a mixed model which combined qualitative and quantitative research techniques. 142 8th graders from a secondary school in Ankara Province Keçiören District participated in the study. Implementation took place in the spring term of 2013-2014 academic years. In implementation, students were given "Draw A Scientist Test (DAST)" in order to determine the scientist image of students before and after implementation and students were asked to explain scientists in their drawings. After the pretest, control group students continued their training following the curriculum, while experimental group students were given the task of preparing poster studies titled "biographies of today's scientists'" in addition to their regular curriculum. According to research results, poster study on biographies of today's scientists had no effect on 8th graders' scientist images. In this sense, it can be argued that teaching process should include biographies of past scientists rather than today's scientists and teaching practices that include the use of posters in presentations and discussions should be carried out with students at different educational levels.

Keywords: scientist image, poster, science

INTRODUCTION

Starting with the study conducted by Mead and Metraux in 1957, all studies undertaken in various countries of the world with different data collection tools presented that individuals generally imagine scientists as males with unruly hair and beard, wearing lab coats and glasses, working alone indoors, surrounded by symbols of research such as chemicals and lab tools and symbols of knowledge such as books and notes. There are several assumptions as to the origins of this image defined by Mead and Metraux (1957) as the stereotypical scientist image. It is suggested that the origin of this image comes from the media (Schibeci and Sorensen, 1983), textbooks (Özgelen, 2012) and peers and teachers (Türkmen,

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2008). The most important step in connecting the source with the stereotypical scientist image was taken by Chambers (1980). With the help of DAST which he developed, Chambers was able to reorient the studies in the field and showed in his study that male students tended to draw male scientists whereas female students drew female ones and argued that the higher the educational level, the more stereotypical the images were. Many studies suggested that the image of an antisocial scientist who does research in physics, chemistry, astronomy, biology and technology fields in a deserted lab and who incessantly reads affects students' career options in science negatively (She, 1998). In this respect, based on the belief that changing this stereotypical scientist image is the main starting point to encourage future scientist candidates to have careers in science (Finson, 2002), it is of paramount necessity to have students revise this image with a more realistic scientist image who does research in fields other than science and technology. In the context of this rationale, current study explored how poster studies on the biographies of today's scientists affected 8th graders scientist images.

State of the literature

- Many studies have been conducted to determine the individuals' images of scientists. According to those studies, it has been found out that the individuals' defined scientists as: scientists with lab coats, glasses, untidy hair, etc. This image has been defined as stereotype scientist image.
- It's suggested that he stereotype scientists affected the students' career plans in science negatively.
- There were many studies that aimed to change this image and they included some activities like visiting scientists, inviting them to learning environment, etc. As a result of these studies, it was found out that these approaches were effective.

Contribution of this paper to the literature

- The current study followed an informal approach in which students were involved in out-of-class activities to explore the biographies of today's scientists (who are still alive) without any other criteria for selection.
- Although the teaching process should be supported by more comprehensive scientist biographies, it has become a necessity to undertake activities regarding scientist biographies as out-of-class activities in Turkey due to time constraints.
- Findings of the study are expected to enlighten practitioners and researchers by finding answers to the following question: "Is it possible to alter/revise students' scientist images by using out-of-class activities?

Survey studies about scientist image

In the last fifty years, a myriad of studies were carried out on scientist image, a topic which was first brought up by Mead and Metraux in 1957. Mead and Metraux (1957) asked thirty five thousand high school students to prepare written documents related to scientists. Results showed that students had a male scientist image, identified as the stereotypical scientist image by Mead and Metraux, represented by white lab coats, glasses, mustachios, labs filled with chemical materials and tools, shouts of "Eureka!!!", book reading and note taking. Although many other studies (Beardslee and O'Dowd,1961; Krajkovich and Smith, 1982) were undertaken until 1983 in the theoretical ground formed since the Mead and Metraux study by using various data collection tools including Likert type and semantic difference scales, the most important impact in the field was generated by Chambers's (1983) study.

In his study, Chambers (1983) described 4807 primary school students' (Pre-K - 5) scientist images by using the technique which he called DAST. Research results showed that students in general had the image of a male scientist who wears lab coats and glasses, sports a mustache or a beard, uses technological tools, works alone indoors where symbols of knowledge such as books or bookshelves and symbols of research such as chemical materials and tools exist. The researcher also generated a coding list for scientist images by using student drawings.

Many studies were undertaken in various countries and at different educational levels to examine individuals' scientist images by using the test and the control list developed by Chambers. Among these studies; Newton and Newton's (1992) study in England, She's (1995) study in Taiwan, Song and Kim's (1999) study in South Korea, Barman's (1999) study in USA, Fung's (2002) study in China, Rubin, Bar and Cohen's (2003) study in Israel, Medina-Jerez, Middleton and Orihuela-Rabaza's (2011) study in Bolivia and Columbia, Ruiz-Mallen and Escalas's (2012) study in Spain and Christidou's (2010) study in Greece reported that students at different educational levels had stereotypical scientist images. Similarly, studies in Turkey which described students' scientist images by generally using DAST, such as the studies by Muşlu and Macaroğlu-Akgül (2006), Özgelen (2012), Yontar-Toğrol (2013), Özel and Doğan (2013) and Karaçam (2015b) on primary school students, by Akçay (2011) on primary and secondary school students and by Demirbaş (2009) and Uçar (2012) on teacher candidates, found that students dominantly had stereotypical scientist images although they were at different educational levels.

There are many assumptions regarding the reasons why students have scientist images that can be defined as stereotypical in the studies conducted in our country and in other countries. Many studies point to the stereotypical scientist images presented in textbooks (Türkmen, 2008; Ağgül-Yalçın, 2012; Özgelen, 2012) as the reason to form these types of images. Studies that focused on the scientist images presented in textbooks (Laçin-Şimşek, 2011; Karaçam, Aydın and Digilli, 2014) were mostly based on science textbooks and researchers argued that scientist images presented in science textbooks reflected stereotypical images. Another factor presented in these studies was the effect of media (Schibeci and Sorenson, 1983). In this context, Steinke (2005) argued that students had stereotypical scientist images since scientist figures represented in print and visual media included data related to stereotypical scientist images. Literature cites social stakeholders such as parents, teachers and peers as another factor in student acquisition of stereotypical scientist images (Lee, 2002; Scott and Mallinckrodt 2005). Nuhoğlu and Afacan (2011) emphasized the linguistic dimension as the reason for student acquisition of stereotypical scientist images. According to Nuhoğlu and Afacan, students tend to draw scientists as males since the word "*scientist*" in Turkish is "*Bilim adamı*" which means "a male person who does science" and the word "*adam*" refers to males.

Studies related to revising stereotypical scientist images

As a result of various studies undertaken in many countries, it was found that the meaning ascribed to stereotypical scientist images is crucial beyond the fact that students at different educational levels have stereotypical scientist images. Students who have stereotypical scientist images perceive scientists as very boring individuals who work incessantly and therefore they develop negative attitudes towards science (Flick, 1990). In addition, various studies (She, 1998; Finson, 2002) pointed to negative relationships between stereotypical scientist images and science careers and reported that individuals with stereotypical scientist images have lower tendencies to have science careers. In this context, She (1998) stated that revising students' stereotypical scientist images in a realistic manner would positively affect their attitudes towards science and future career options in science.

Various studies were conducted in literature in which several different approaches were used based on She (1998) and Finson's (2002) framework to alter students' stereotypical scientist images. These studies utilized approaches such as visiting scientists (Smith and Erb, 1986; Scherz and Oren, 2006), science camps (Leblebicioğlu, Metin, Yardımcı and Cetin, 2011; Farland-Smith, 2012), inviting scientists to teaching environments (Mason, Kahle and Gardner, 1991; Bodzin and Gehringer, 2001), inviting scientists to teaching environments and visiting them (Flick, 1990; Hopwood, 2012), (hands on) research activities (Avraamidou, 2013; Karaçam, 2015) and presenting scientists' biographies (Sharkawy, 2009; 2012; Korkmaz, 2011; Erten, Kıray and Şen-Gümüş, 2013).

Scientists' biographies (Scientific Stories) as a material to revise students' scientist images

Studies that focus on using scientists' biographies *as* teaching materials make up most of the studies that aim to revise students' scientist images. Among these studies, Erten, Kıray and Şen Gümüş's (2013) study examined the effect of experience based teaching approach supported by scientists' biographies on science and scientist images of 11-12 year old students. Results showed that frequencies of stereotype indicators such as working environment and tools decreased after implementation. Since implementation did not generate changes in frequencies related to the indicators related to external appearance of scientists; Erten, Kıray and Şen Gümüş (2013) suggested using research activities in implementations to revise images regarding external images.

Sharkawy (2009), who examined the effects of scientists' biographies on students' perceptions regarding the interactions between scientists or their interactions with the society, presented the biographies of nine scientists to 11th graders in thirteen class hours. The biographies presented in the study emphasized scientists' collaborative studies. During the study, student attention was first drawn to the specific scientist in question and his/her biography and the biography for this scientist were presented orally. During reading, important points were expanded in detail and student questions were answered. After reading, a whole class discussion was held and later students worked in small groups on worksheets to revise what they learned. Researchers proposed that student awareness increased regarding the interaction among scientists and scientists' interaction with the society. However, in the dimension regarding scientists 'interaction with society, it was found that scientist interaction with books was at the foreground.

In another study, Sharkawy (2012) examined the effect of scientist biographies from different cultures on 1st graders' scientist images. Eleven 1st graders participated in the study where Sharkawy implemented the same approach used in his 2009 study. Results showed that students acquired scientist images from less known socio-cultural structures and their views on scientific work expanded from hands on activities to other activities that included more comprehensive cognitive and affective dimensions

Korkmaz's (2011) study explored how story mapping based scientist biographies affected students' biologist images. 121 8th graders who were 13-15 year old participated in the study. The study presented nine biographies in five weeks including those of female biologists such as Barbara McClintock and Rosalinda Franklin. Each biography was read out loud in the class by the teacher and student questions were answered during class. After biographies were read, students were asked to fill in the worksheets based on story mapping and discussions were held in the framework of the ideas presented by the students in the worksheets. Results showed that story mapping based scientists' biographies positively affected 8th graders' images of biologists and many of the stereotypical indicators such as lab coats, eye glasses and use of masculinity decreased. Especially the presentation of Barbara McClintock as a competitive and combatant individuality in her biography was found to have positive effects on female students.

Farland (2006) examined the effect of historical, nonfictional trade books on 3rd graders' scientist images. 156 3rd graders took part in the study in which 72 randomly selected students formed the experimental group while 84 students were in the control group. Control group students received modular/kit based instruction and experimental group students read historical, nonfictional trade books after school in addition to modular/kit based instruction. It was found that students in the experimental group had less stereotypical scientist images compared to pre implementation phase. No significant statistical differences were observed for control group students in terms of their pre and post implementation scientist images. The researcher argued that portrait photos that did not model scientists during work like the historical nonfictional trade books did and the modules that did not contain information about the personality traits of scientists and how they conducted scientific activities had no effect on students' scientist images.

Rationale of the study

Visiting scientists, inviting scientists to teaching environments, science camps and scientist biographies are important approaches utilized in studies in the literature that aim to revise stereotypical scientist images to obtain more realistic images. Some similarities are observed in the studies which use scientist biographies as teaching materials. These similarities include the selection criteria that are contrary to stereotypical images such as selecting biographies that represent female scientists, selecting scientists that do not belong to Caucasian race and scientists who work outdoors, including the biographies of past scientists in teaching environments and implementing activities formally during in-class activities. These studies generally included activities to attract student attention, present scientist biography, engage in in-class discussions regarding the biography and review the student acquisitions obtained from the biography. However, contrary to the general approach used in the studies included in the literature, the current study followed an informal approach in which students were involved in out-of-class activities to explore the biographies of today's scientists (who are still alive) without any other criteria for selection.

Although using scientist biographies during in-class activities have positive effects on students' scientist images, it is reported that scientist figures presented in science textbooks in Turkey are stereotypical and biographies are superficial (Laçin-Şimşek, 2011; Karaçam et al., 2014) and that the most important problem in the implementation of science and technology program is the time constraints and therefore many activities cannot be undertaken during class (Dindar and Yangın, 2007, Ayvacı & Er-Nas, 2009). Although it is evident that the teaching process should be supported by more comprehensive scientist biographies, contrary to the general tendency presented in the literature, it has become a necessity to undertake activities regarding scientist biographies as out-of-class activities in Turkey due to time constraints. With this aim in mind, the current study examined how the poster study focusing on the biographies of today's scientists affected 8^{th} graders' scientist images. Findings of the study are expected to enlighten practitioners and researchers by finding answers to the following question: "Is it possible to alter/revise students' scientist images by using out-of-class activities?"

Research questions

1. Do poster studies related to biographies of today's scientists affect 8^{th} graders' scientist images?
    a. Are there statistically significant differences between the frequencies of pre implementation drawings by experimental and control group students who emphasized stereotypical indicators?
    b. Are there statistically significant differences between the frequencies of control group students who emphasized stereotypical indicators before the implementation and students who emphasized stereotypical indicators after the implementation?
    c. Are there statistically significant differences between the frequencies of experimental group students who emphasized stereotypical indicators before the implementation and students who emphasized stereotypical indicators after the implementation?

d. Are there statistically significant differences between the frequencies of post implementation drawings by experimental and control group students who emphasized stereotypical indicators?

2. What is the content of the scientist images and biographies presented in the posters prepared by students?

a. What is the frequency distribution of scientist figures included in student posters in terms of stereotypical scientist indicators?

b. What is the frequency distribution of scientist biographies included in student posters in terms of in terms of content/information?

METHOD

The study utilized a mixed model that combined qualitative and quantitative research techniques. Pretest-posttest experimental model with experimental and control group, a quantitative research technique, was used in the study (Neuman, 2006) to investigate the effects of scientist biographies on students' scientist images.

Document review technique was used in the qualitative dimension of the study (Meriam, 1998). In the framework of this technique, contents of student posters were examined and more detailed findings were sought related to the effect of the implementation.

Participants

165 students attending the 8th grade of a secondary school in Ankara province Keçiören district during 2014-2015 academic years participated in the study. Three classes randomly selected from 8-A/B/C/D/E/F classes comprised the experimental group (N=87) and the other three classes were identified as the control group (N=78). Although 165 students took part in the pretest, 23 students who did not hand in the performance task and did not participate in the post test were eliminated from the sample. Therefore, data collected from 142 students (experimental group: 71, control group: 71) were analyzed in the study. In general, families of the students participating in the study had migrated to metropolis Ankara from districts, villages or other provinces smaller than Ankara. Due to immigration from rural areas to a metropolis, students are in transition to adapt to urban culture from traditional culture but it can be argued that traditional culture is still dominant in their families. In financial terms, either the fathers or both parents are gainfully employed.

Implementation

Implementation was undertaken in the spring term of 2014-2015 academic year and it consisted of four phases:

Phase 1 (Pretest and definition of the task): This phase was undertaken in the second week of February in three hours. "Draw a Scientist Test-DAST" was performed to determine experimental and control group students' scientist images and students were asked to describe their drawings. Following the pretest, students were asked the following questions: "Have you ever seen a scientists?", "Where did you see a scientist?". In their answers, students mostly mentioned the academicians frequently seen on TV such as Prof. Dr. Canan KARATAY and Prof. Dr. Adnan SARAÇOĞLU. After student answers were received, they were asked the following questions: "Who are these people you mentioned?", "Are their lives different from ours?". Students mostly gave stereotypical answers and then they were asked to prepare posters that depict biographies of todays' scientists' as opposed to historically well known scientists such as Newton, Edison and Einstein and include a photo of the scientist in their posters. Students in the experimental group were given information about the poster study process. Students in the control group were not given this task and they continued their lessons according to the curriculum.

Phase 2 (Collecting and Sharing Materials): After the experimental group students' task was identified, they started to collect the materials to be used in their posters in the six week process. In groups of five, students shared their materials and the information about how they obtained these materials with their friends every two weeks for two hours during this 6-week period and the researcher visited each group to provide solutions to problems and information on how to access more resources. Students were observed to have problems in understanding whether the scientists they came across on the internet were still alive or whether individuals titled as Dr. were scientists. Students were provided with guidance in these respects.

Phase 3 (Creating the Posters): After the materials related to the biographies of today's scientists were collected students started to create their posters. Students worked in groups every two weeks for one class hour after school just like they did during the material collection phase. Students showed their designs to the others in their groups and finalized their posters based on the feedback they received. The researcher visited the groups in the process and assessed their work.

Phase 4 (Collecting the posters and implementing the post test): Posters developed by experimental group students were collected in this phase of the implementation. Samples of student posters are presented in Appendix D. Following the collection of the posters, student absenteeism started due to the upcoming TEOG (transition from primary to secondary education) exam given by MoNE for the 8th graders and therefore experimental group students were unable to present the posters they prepared in the classroom and consequently discussions were not held either. DAST was administered in the second week of May following the collection of posters to determine their scientist images after the implementation and students were asked to describe their drawings.

Instruments and Data Analysis

Draw A Scientist Test (DAST)

DAST was used to determine secondary school students' pre and post test images about scientists. This test was developed by Chambers (1983) and was used in various studies. Students were informed before DAST implementation that they could use colored pen/pencils in their drawings and that they could also write on their drawings. Students were also told that their drawings were not to be examined for accuracy or validity, they were not going to be judged for accuracy and they were expected to present their visual imageries about scientists in their drawings. Students were asked to provide a written expression about their drawings to support the analysis. Students were given 40 minutes to complete their drawings.

The data obtained via DAST was analyzed by using DAST-C. DAST-C was developed by Finson et al. (1995). DAST-C consists of fifteen indicators about scientists. Those indicators are "lab coat, eyeglasses, facial hair, symbols of research, symbols of knowledge, technology products, relevant captions, male gender, Caucasian, indicators of danger, presence of light bulbs, mythic stereotypes, indicators of secrecy, scientist working indoors, and middle-aged or elderly scientist". Indicators of presence of light bulbs, mythic stereotypes, indicators of secrecy and danger were excluded from analysis because of their low percentages. Indicators related to Caucasian race were excluded from analysis since all students represented this indicator. Indicators found in the study that were not normally included in DAST-C were not added to the coding list. 71 students' pre and post drawings were analyzed by two independent coders to determine inter-rater reliability. As a result, each coder assigned 1704 codes across the indicators. The evaluation showed that 51 of the codes assigned by coders were different from one another. According to an approach defined by Miles and Huberman (1994) consistency coefficient between coders was found to be 0,97. Frequencies and percentages of stereotypical indicators across students' conceptual categories about scientists found in student drawings were identified and compared descriptively.

Document Analysis

Posters prepared by students in the framework of the study on scientist biographies were considered as documents and their contents were examined. Meriam (1998) classifies documents in four groups as public records, personal documents, physical materials and researcher-generated documents. Meriam stated that public records, personal documents and physical materials are not produced for research purposes or during implementation of research. On the contrary, researcher-generated documents are documents prepared by the researcher or by participants -to be used by the researcher- during the research process. Examination of scientist photos and content of biographies included in student posters provided detailed information related to the impact of the implementation. Similarly Meriam asserted that researcher-generated documents provide opportunities to learn more about the situation, person, or event that is being investigated.

Examination of poster contents was undertaken in two phases: photos of scientists in posters were examined in the first phase whereas the contents of scientist biographies were investigated in the second phase. Photos of scientists were analyzed descriptively (Yıldırım and Şimşek, 2005). According to Yıldırım and Şimşek, data are described and interpreted based on previously identified themes. Using this perspective, scientist photos were analyzed by using DAST-C developed by Finson et al. (1995). However, since there was no content related to the work environment of scientists in the photos, indicators in the checklist such as symbols of research, symbols of knowledge, technology products, relevant captions, indications of danger, presence of light bulbs, mythic stereotypes, indications of secrecy, scientist working indoors were eliminated. The analysis included the following indicators: lab coat, eyeglasses, facial hair, gender and middle-aged or elderly. Data were analyzed by two independent coders. Each coder assigned 1326 codes across the indicators. The result of comparison of codes assigned by coders showed that 26 codes were different. So consistency coefficient between coders was calculated based on the approach defined by Miles and Huberman (1994) and was found to be 0,97.

Scientist biographies included in the posters were analyzed via content analysis (Yıldırım and Şimşek, 2005). At first, all biographies were reviewed in the framework of content analysis. The basic purpose of reviewing the data set was to identify the common themes in the biographies prepared by the students. Reviewing the data set showed that students included the following themes in scientist biographies: date and place of birth, educational information, topics of interest, the most important contribution to the field and career development. A coding list was generated based on the themes proposed by the two researchers who undertook the analysis independently and coding process started. Each coder provided 193 codes during the coding process. When these codes provided by the coders were compared, 26 codes were found to be different. Consistency coefficient between coders was calculated to be .91 based on the perspective proposed by Miles and Huberman (1994).

FINDINGS

This section provides findings under two headings: findings related to the content in scientist photos and biographies presented in student posters and findings related to comparisons of experimental and control group students' scientist images obtained during pre and post implementation.

Findings related to the content in scientist photos and biographies presented in student posters

Table 1 presents the frequencies and percentage distribution for scientist photos presented in student posters in terms of stereotypical scientist image indicators. Table 2 presents frequency distribution based on biographies.

Table 1 shows that 52% of the scientists presented in students posters were depicted in formal clothes, 35.8% were depicted in casual clothes and 12.2% were wearing lab coats. 51% of the scientist photos in student posters depicted scientists wearing glasses while 48.9% depicted them without glasses. In terms of facial hair, 74.2% of the scientist photos in student posters presented scientists as clean shaven, 25.8% as bearded/mustachioed and in terms of hair style, 72% of the scientists in the photos had tidy hair, 14% were bald and 14% had untidy/unkempt hair. Additionally, 95% of the scientists presented in student posters were middle aged/old whereas 5% were young and in terms of gender, 89.2% were males and 10.8% were females. In this context, the majority of the scientists presented in student posters were elderly or middle aged males who wore formal clothes and glasses, had tidy hair and were clean-shaven. Figure 1 presents some of the scientist photos presented in student posters.

Table 2 shows that 34.7% of scientist biographies presented in student posters included scientists' date and place of birth, educational information, interests and career development and 21.2% included scientists' educational information,

Table 1. Frequencies and percentage distribution for scientist photos presented in student posters in terms of stereotypical scientist image indicators

Stereotypical scientist image indicators		f	%
Dressing Style	Lab Coat	27	12.2
	Formal	115	52.0
	Informal	79	35.8
Total		221	100
Use of glasses	Wears glasses	113	51.1
	No glasses	108	48.9
Total		221	100
Hair style	With untidy hair	31	14
	Bald	31	14
	Tidy hair	159	72
Total		221	100
Age	Aged/middle aged	210	95.0
	Young	11	5.0
Total		221	100
Bear/Mustache	Sports beard/mustache	57	25.8
	No beard or mustache	164	74.2
Total		221	100
Gender	Male	197	89.2
	Female	24	10.8
Total		221	100

Figure 1. Some examples of scientist photos shared in student posters

Table 2. Frequencies and percentage distribution for scientist biographies presented in student posters in terms of content

Themes based on the content of biographies	f	%
Students who provided information regarding scientists' date of birth, place of birth, educational information, interests and career development	67	34.7
Students who provided information regarding scientists' educational information, interests and career development	41	21.2
Students who provided information regarding scientists' date of birth, place of birth, educational information, interests, most important contribution to the field and career development	33	17.1
Students who provided information regarding scientists' date of birth, place of birth, educational information and career development	32	16.6
Students who provided information regarding scientists' date of birth, place of birth, interests and most important contribution to the field	20	10.4
Total	193	100

interests and career development. Also, 17.1% of scientist biographies presented in student posters included date of birth, place of birth, educational information, interests, most important contribution to the field and career development, 16.6% included scientists' date of birth, place of birth, educational information and career development and 10.4% included scientists' date of birth, place of birth, interests and most important contribution to the field. Appendix A presents some samples of scientist biographies presented in student posters based on themes.

Findings show that in their posters, students presented scientists' date and place of birth, educational information, interests, career development and their most important contributions to the field without mentioning the information related to scientists' personality traits, scientific communications and the reasons behind having science careers.

Findings related to comparisons of experimental and control group students' scientist images obtained during pre and post implementation

Findings obtained from Chi Square and McNemar Tests used in analyzing the data collected from DAST, which was implemented to identify experimental and control group students' scientist images before and after the implementation, are presented below.

Table 3 shows a statistically significant difference in the frequencies between experimental and control group students' pre-implementation drawings that emphasize stereotypical indicators such as lab coat and working indoors in favor of experimental group students at α=.05 level there. On the other hand, there is no statistically significant difference between the frequencies of experimental and control group students who emphasized stereotypical indicators such as eyeglasses, untidy hair, facial hair, symbols of research, knowledge and technology, relevant captions, male, aged/middle aged and working alone.

Although differences were found in experimental and control group students' stereotypical scientist images in terms of indicators such as lab coat and working indoor, the groups can be regarded as identical in other dimensions. Therefore, lab coat and working indoor indicators which pointed to differences were eliminated from the analysis during post implementation comparison between experimental and control group students' stereotypical scientist images.

As Table 4 shows; experimental group students were found to emphasize lab coat, eye glasses, untidy hair, facial hair and working indoor indicators less following the implementation. On the other hand, experimental group students were observed to emphasize symbols of knowledge, relevant captions and working alone indicators more following the implementation compared to their use of these indicators before the implementation process. Also, it was seen that the number of students who emphasized symbols of research and technology, male and aged/middle aged

Table 3. Chi Square Test results regarding the comparison of experimental and control group students' scientist images before the implementation

Indicators	Experimental/Control Group	Exists/yes f	Absent/No f	N	χ^2	Φ	sd	p
Lab Coat	Control	26	45	71	7.217	0.24	1	0.000*
	Experimental	43	28	71				
	Total	69	73	142				
Eye Glasses	Control	26	45	71	0.000	0.015	1	1.000
	Experimental	27	44	71				
	Total	53	99	142				
Untidy Hair	Control	34	37	71	1.856	-0.129	1	0.173
	Experimental	25	46	71				
	Total	59	83	142				
Facial Hair	Control	23	48	71	0.546	-0.078	1	0.459
	Experimental	18	53	71				
	Total	41	101	142				
Symbols of Research	Control	53	18	71	0.158	0.05	1	0.691
	Experimental	56	15	71				
	Total	109	33	142				
Symbols of Knowledge	Control	49	22	71	0.283	-0.06	1	0.595
	Experimental	45	26	71				
	Total	94	48	142				
Symbols of Technology	Control	18	53	71	0.00	0.00	1	1.000
	Experimental	18	53	71				
	Total	36	106	142				
Relevant Captions	Control	8	63	71	0.00	0.00	1	1.000
	Experimental	8	63	71				
	Total	16	126	142				
Male	Control	57	14	71	0.042	-0.035	1	0.837
	Experimental	55	16	71				
	Total	112	30	142				
Aged/Middle Aged	Control	52	19	71	0.823	-0.091	1	0.364
	Experimental	46	25	71				
	Total	98	44	142				
Working Indoor	Control	61	10	71	8.714	0.275	1	0.003*
	Experimental	71	0	71				
	Total	132	10	142				
Working Alone	Control	69	2	71	2.689	-0.165	1	0.101
	Experimental	63	8	71				
	Total	132	10	142				

**p<0.05*

Table 4. McNemar Test results regarding the comparison between experimental group students' pre and post implementation scientist images

	Indicators	Exists-Yes/ Absent-No	Post Test Exists/Yes f	Post Test Absent/No f	Total f	McNemar p
	Lab Coat	Exists	38	5	43	0.453
		Absent	2	26	28	
		Total	40	31	71	
	Eye Glasses	Exists	15	12	27	0.832
		Absent	10	34	44	
		Total	25	46	71	
	Untidy Hair	Exists	18	7	25	1.000
		Absent	6	40	46	
		Total	24	47	71	
	Facial Hair	Exists	9	9	18	0.424
		Absent	5	48	53	
		Total	14	57	71	
		Absent	3	12	15	
		Total	56	15	71	
Pre Test	Symbols of Knowledge	Exists	42	3	45	0.057
		Absent	11	15	26	
		Total	53	18	71	
	Symbols of Technology	Exists	14	4	28	1.000
		Absent	4	49	53	
		Total	28	53	71	

Symbols of Research	Exists	53	3	56	1.000
	Absent	3	12	15	
	Total	56	15	71	
Symbols of Knowledge	Exists	42	3	45	0.057
	Absent	11	15	26	
	Total	53	18	71	
Symbols of Technology	Exists	14	4	28	1.000
	Absent	4	49	53	
	Total	28	53	71	
Relevant Captions	Exists	5	3	8	0.508
	Absent	6	57	63	
	Total	11	60	71	
Male	Yes	52	3	55	1.000
	No	3	13	16	
	Total	55	16	71	
Aged/Middle Aged	Yes	42	4	46	1.000
	No	4	21	25	
	Total	46	25	71	
Working Indoor	Yes	68	3	71	0.250
	No	0	0	0	
	Total	68	3	71	
Working Alone	Yes	61	2	63	0.687
	No	4	4	8	
	Total	65	6	71	

**p<0.05*

Figure 2a. Scientist drawn by Gizem Nur prior to Implementation

Figure 2b. Scientist drawn by Gizem Nur subsequent to implementation

indicators before and after the implementation did not change. The frequencies of students who emphasized stereotypical scientist indicators before and after the implementation were statistically analyzed with McNemar test and no statistical differences were found at α=0.05 between the frequencies of students who emphasized stereotypical indicators prior and subsequent to implementation.

As depicted in Figure 2, Gizem Nur in the experimental group drew a young female scientist wearing a lab coat and glasses and working alone in a lab equipped with symbols of knowledge such as books, bookshelves, pens and notes and with symbols of research such as microscopes and flasks both in pre and post implementation. Pre and post implementation drawings of the students in the experimental group are provided in Appendix B.

As Table 5 shows; control group students were found to emphasize eye glasses, facial hair, symbols of technology, male, relevant captions and aged/middle indicators less following the implementation. On the other hand, control group students were observed to emphasize lab coat, untidy hair, symbols of research and

Table 5. McNemar Test results regarding the comparison between control group students' pre and post implementation scientist images

	Indicators	Exists-Yes/ Absent-No	Post Test		Total	McNemar p
			Exists/Yes	Absent/No		
			f	f	f	
Pre Test	Lab Coat	Exists	25	1	26	0.375
		Absent	4	41	45	
		Total	29	42	71	
	Eye Glasses	Exists	16	11	27	1.000
		Absent	10	34	44	
		Total	26	45	71	
	Untidy Hair	Exists	31	3	34	0.727
		Absent	5	32	37	
		Total	36	35	71	
	Facial Hair	Exists	8	15	23	0,134
		Absent	7	41	48	
		Total	15	56	71	
	Symbols of Research	Exists	52	1	53	0.219
		Absent	5	13	18	
		Total	57	14	71	
	Symbols of Knowledge	Exists	46	3	49	0.344
		Absent	7	15	22	
		Total	53	18	71	
	Symbols of Technology	Exists	11	7	18	0.774
		Absent	5	48	53	
		Total	16	55	71	
	Relevant Captions	Exists	6	2	8	1.000
		Absent	1	62	63	
		Total	7	64	71	
	Male	Yes	51	6	57	1.000
		No	5	9	14	
		Total	56	15	71	
	Aged/Middle Aged	Yes	47	5	52	1.000
		No	4	15	19	
		Total	51	20	71	
	Working Indoor	Yes	61	0	61	0.500
		No	2	8	10	
		Total	63	8	71	
	Working Alone	Yes	69	0	69	0.500
		No	2	0	2	
		Total	71	0	71	

$^*p<0.05$

knowledge, working alone and working indoor indicators more following the implementation compared to their use of these indicators before the implementation process.

The frequencies of students who emphasized stereotypical scientist indicators before and after the implementation were statistically analyzed with McNemar test and no statistical differences at α=0.05 were found between the frequencies of students who emphasized stereotypical indicators prior and subsequent to implementation.

As depicted in Figure 3, Rabia in the control group drew a young female scientist wearing a lab coat and glasses and working alone in a lab equipped with symbols of knowledge such as books, bookshelves, pens and notes, with symbols of technology such as computers and with symbols of research such as microscope and flasks both in pre and post implementation. Pre and post implementation drawings of students in the control group are provided in Appendix C.

Table 6 shows no statistical differences at α=.05 level between the frequencies of experimental and control group students who emphasized stereotypical indicators in their post implementation drawings such as eye glasses, untidy hair, facial hair, symbols of research, knowledge and technology, relevant captions, male, aged/middle aged and working alone.

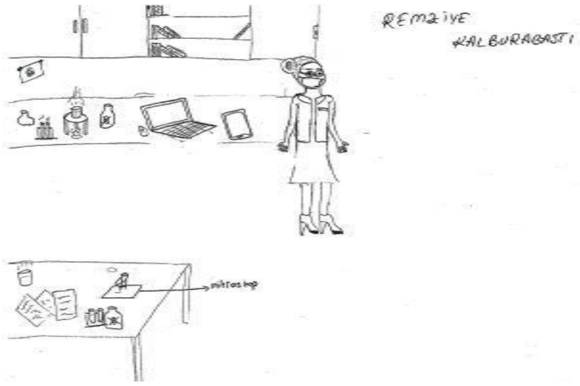

Figure 3a. Scientist drawn by Rabia prior to implementation

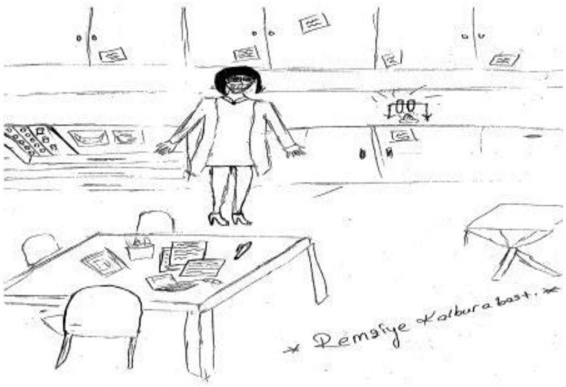

Figure 3b. Scientist drawn by Rabia subsequent to implementation

Table 6. Chi Square Test results regarding the comparison of experimental and control group students' pre and post implementation scientist images

Indicators	Experimental/Control Group	Exists/Yes f	Absent/No f	N	χ^2	Φ	sd	p
Eye Glasses	Control	27	44	71				
	Experimental	25	46	71	0.03	-0.029	1	0.862
	Total	52	90	142				
Untidy Hair	Control	36	35	71				
	Experimental	24	47	71	3.492	-0.171	1	0.062
	Total	60	82	142				
Facial hair	Control	15	56	71				
	Experimental	14	57	71	0.00	-0.017	1	1.000
	Total	29	119	142				
Symbols of Research	Control	57	14	71				
	Experimental	56	15	71	0.00	-0.017	1	1.000
	Total	113	29	142				
Symbols of Knowledge	Control	53	18	71				
	Experimental	53	18	71	0.000	0.000	1	1.000
	Total	106	36	142				
Symbols of Technology	Control	16	55	71				
	Experimental	18	53	71	0.039	0.033	1	0.844
	Total	34	108	142				
Relevant Captions	Control	7	64	71				
	Experimental	11	60	71	0.573	0.085	1	0.449
	Total	18	124	142				
Male	Control	56	15	71				
	Experimental	55	16	71	0.00	-0.017	1	1.000
	Total	111	31	142				
Aged/Middle Aged	Control	51	20	71				
	Experimental	46	25	71	0.521	-0.076	1	0.471
	Total	97	45	142				
Working Alone	Control	68	3	71				
	Experimental	63	8	71	1.577	0.132	1	0.117
	Total	131	11	142				

$p<0.05$

DISCUSSION

Research results show that students generally included some information on scientists' date and place of birth, educational information, interests, career development and their most important contributions to the field in poster biographies and scientists' portrait photos emphasized stereotypical indicators. In addition, it was found that there was no statistically significant difference at $\alpha=0.05$ level between the frequencies of experimental and control group students who emphasized stereotypical indicators both before and after the implementation and between experimental and control group students who emphasized stereotypical indicators before the implementation and who emphasized stereotypical indicators after the implementation. In the light of these findings it can be argued that 8th graders' informal learning activities to explore scientists' biographies do not affect their scientist images. The results of the current study are not consistent with those of other studies on the effects of scientists' biographies on students' scientist images (Sharkawy, 2009; Korkmaz, 2011; Sharkawy, 2012; Erten, Kıray and Şen Gümüş, 2013). However, findings of this study support the results of the study conducted by Farland (2006).

The reasons why the results of this study are inconsistent with those of other studies in the literature should be sought in the differences among the implementations carried out in the studies. The differences between the current study and the other studies in the same realm cited in literature can be listed as follows;

i) While the current study made use of the biographies of today's scientists , the studies in the literature generally used the biographies of scientists such as Einstein and Marie Curie who lived in the modern scientific age.

ii) While the current study did not state any criteria for the selection of scientists' biographies, studies in the literature selected biographies of scientists on the basis of selection criteria that contradict stereotypes such as being female, belonging in a race other than Caucasian etc.

iii) While the teaching process in this study was based on informal out of class activities in which scientists' biographies were researched via Internet and posters were prepared, studies in the literature were conducted formally with group and individual in-class activities to raise awareness about scientists by reading scientists' biographies, answering questions related to the reading, forming discussion environments related to the scientists that were studied and reviewing student acquisitions.

Comparison of the current study and the studies in the literature shows that the following facts probably contributed to the results that pointed to lack of implementation effect on students' scientist images: using the biographies of today's scientists, adopting no criteria for selection among scientists and utilizing informal activities with no in-class implementation. Similarly, Hwang (2015) states while using scientist biographies in teaching environments, it is necessary to present scientists from different cultures and genders, to use biographies that contain scientists' personality traits and knowledge structuring process (scientific process) and to ensure the use of discussion opportunities to have students discuss the biographies that are examined.

Another reason for the current findings may be related to the fact that Internet generally carries superficial information and visuals with stereotypical indicators about the biographies of today's scientists. Since no print biographies currently exist about today's scientists that combine their childhood, youth and their scientific activities, students had to make informal Internet based searches. Steinke (2005) reports that visual media such as Internet generally includes visuals with stereotypical indicators and superficial information about the lives of scientists. Therefore it can be argued that study participants utilized scientists' photos that emphasized stereotypical indicators in their posters and their biographies included superficial information such as date and place of birth and educational information. Similarly, Farland (2006) suggested that there were no statistically significant differences in control group students' pre and post implementation scientist images when they were taught via modular/kit based instruction in which 2-3 page short scientist biographies and black and white portrait photos were used. This finding suggests that portrait photos that do not depict scientists while working and short biographies that do not include information about scientists' personality traits and how they realize their scientific activities do not affect students' scientist images. Based on these findings, although it is not included in the criteria proposed by Hwang, it can be suggested that biographies of today's scientists should not be utilized in studies that focus on the use of scientist biographies.

Another reason for these findings may be related to the fact that contrary to participants in other studies, participants of the current study were 8th graders who had to take the central placement exam which is specific to Turkey and that condition may have contributed to their lack of attention to the given task. Students in the participant group generally tend to study multiple choice tests throughout the year to get ready for the exam and regard these informal activities as drudgery (Kaya, Karaçam, Eş and Tuncel, 2013).

CONCLUSION AND IMPLICATIONS

Research results show that out-of-class activities about the biographies of today's scientists had no effect on students' scientist images and students utilized scientist photos that contained stereotypical indicators and biographies that provided superficial information such as scientists' date and place of birth and their educational information in their posters. Based on these findings, it can be argued that implementations that make use of biographies of today's scientists as informal out-of-class teaching materials without any other selection criteria have no effect on 8th graders' scientist images.

I expected that the implementation would positively affect students' scientist images based on both the results of previous studies that utilized scientist biographies as teaching materials and the opportunity for students to come across today's scientists in TV programs as individuals who enlighten the community. Results that were contrary to my expectations can be explained in two dimensions: student perceptions regarding such tasks and problems in implementation. Student perceptions are affected by the multiple choice central placement test that students in Turkey must sit at the end of 8th grade whose results are used for high school placement. Therefore, students are busy preparing for the test throughout the year by solving multiple choice questions and do not give sufficient attention to these types of tasks. Hence, similar implementations may be undertaken for different class levels and even with adults for more stable results.

In terms of problems in implementation, it can be argued that the following reasons may have contributed to the current results: i) scientist biographies were not selected based on any criteria that specified inclusion of information that contradicted stereotypical indicators, ii) the implementation was based on biographies of today's scientists, iii) students followed an informal out-of-class learning process and it was not possible to generate a discussion environment in which posters were presented. In this respect, it can be suggested that future implementations to revise 8th graders' scientist images should include a selection of scientist biographies (such as Marie Curie and Einstein, excluding today's scientists) that include contradictory information against stereotypical images to be used in-class activities in which students will experience cognitive disequilibrium. However, since the most important problem in implementing the Science and Technology Program in Turkey is related to time constraints, it is necessary to implement the teaching process informally. It is necessary to increase the number of Internet sites that include scientist biographies with contradictory information about scientists in terms of stereotypes and about how scientists undertake scientific activities since the most available environment to conduct informal learning activities is the Internet.

Although results suggest that this study in which scientist biographies were used in informal teaching process did not positively revise students' scientist images, it should be considered as a beginning and not as an end. Hence, activities that aim to revise students' scientist images should be directed to out-of-class activities in Turkey where the Science and Technology Program, that targets students to learn science concepts, acquire problem solving, scientific process skills, to obtain technological awareness and to acquire attitudes and behaviors towards science-community, technology and environment, is already too heavy a program. Therefore, future studies with different class levels, scientist biographies from different periods and different measurement tools are required.

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APPENDIX A

Theme 1: Scientist biographies, used in the posters with information on the scientists' date and place of birth, educational background, interests and career development, are presented below:

Gökçe's poster work that presents Prof. Dr. Mehmet Tokmak's biography;
Prof. Dr. Mehmet Tokmak, Turkish physicist and academician, was born in İzmir on February, 2, 1945. He graduated from Middle Eastern Technical University in 1968. He received his Master's degree from Yale University in the next two years and obtained his doctorate from Kansas State University in the following two years. He became associate professor in 1979 and professor in 1989. Tokmak who has various studies in the field of condensed matter physics currently teaches at ODTÜ Physics Department.

Hatice Büşra's poster work that presents Prof. Dr. Melahat Okuyan's biography;
Okuyan was born in Diyarbakır in 1926. She founded the Fight against AIDS Association. She graduated at the top of her class from Ankara University Veterinary School as a veterinary surgeon in 1946. She received her master's degree from Maryland University in 1950-1952 in the field of medical microbiology. She received her epidemics specialization diploma in 1954. She did research in Cambridge University in the field of virology for 5 years during the period between 1954 and 1955. She did research in American NIOH Institute during 1961-1963 about cancer viruses. She became an instructor in Hacettepe University Medical Faculty in 1963 and started her first organizational management experience after obtaining her master's degree in health. She became clinical microbiology professor in Hacettepe University Medical Faculty in 1974. Okuyan, an expert on cancer viruses, worked in Manchester University as a guest scientist for virus research in human cancer in 1974. She embedded integrated education with a team of eleven during the foundation of Dokuz Eylül University Medical Faculty in 1979. She retired in 1991. She is the founding president and current president of Fight against AIDS Association.

Muhsin's poster work that presents Prof. Dr. Can Fuat Delale's biography;
Prof. Dr. Can Fuat Delale was born in Diyarbakır in 1954. He graduated from Istanbul Technical University Faculty of Mechanical Engineering in 1977. He completed his master's degree in USA in the field of physics in 1979 and finished his doctorate in the same field in 1983. Delale, who worked in Boğaziçi University Mathematics Department, Bilkent University Mathematics Department, and Istanbul Technical University Faculty of Mechanical Engineering as an instructor since 1984, worked as half time expert researcher in Feza Gürsey Institute. He worked in İTÜ Faculty of Aeronautics and Astronautics after 2000. His interests include kinetic theory, nucleation theory, phase transitions and condensation dynamics and he has many publications in these areas.

Theme 2: Scientist biographies, used in the posters with information on scientists' date and place of birth, educational background, interests, most important contribution to the field and career development, are presented below:

Beyza's poster work that presents Prof. Dr. Canan Karatay's biography;
She was born in Elazığ in 1943. She graduated from Üsküdar American Girls' High School in 1961 and Istanbul University Medical Faculty in 1967. After completing internal diseases specialization training in Istanbul University Outpatient Clinic in 1972, she started cardiology training in Liverpool Regional Cardiac Center with the scholarship she received from the British Government. In the meantime, she broke ground in Turkey as a cardiologist and implemented the permanent and temporary pacemaker technique. She worked in the team of Christian Bernard who successfully managed heart transplant operation for the first time in the world in South Africa Cape Town University Groote Schuur Hospital during 1976-1978 and worked on her associate professor thesis on patients with heart transplants and received the title of associate professor in 1979. Between the years of 2006-2010, she worked as the rector of Istanbul Science University which is the first and only health university in Turkey and she currently works as an instructor in Istanbul Science University Medical Faculty Internal Diseases and Cardiology Departments. She is married to Ali Başok Karatay and the couple has a son named Mehmet Rahmi Karatay.

Hatice Büşra's poster work that presents Prof. Dr. Oktay Sinanoğlu's biography;
Sinanoğlu was born in Bari, Italy in 1935 and in 1953 he attended -with the help of scholarship- TED Yenişehir High School which was founded by Atatürk and graduated at the top of his class. He went to USA to continue his education with the scholarship he received from his school. He finished Massachusetts Institute of Technology in 8 months at the top of his class in 1957. He started working in Yale University as an assistant professor in 1960. He became associate professor at 26 years of age with his theory of Many Electron Theory of Atoms and Molecules. He brought the solution to a mathematics theory which was not solved for fifty years and became a professor. With this title, he was the youngest professor in the modern history of university and also in Yale University. He became consultant professor to ODTÜ in 1964. He was assigned to a second professorship at Yale University. He became one of the few professors in the newly founded molecular biology field. He was selected as the member of American National Science Academy. He is the first and only Turk selected to this academy. He was nominated for Nobel twice. He nominated several candidates for Nobel following Nobel Academy's wishes. He gave numerous conferences in numerous parts of the world with his various discoveries and theorems. He works as a professor in Molecular Biology and Chemistry at Yale University where he works since he was 26 and has been working as a professor in the field of chemistry at Yıldız Teknik University for the past 7 years. .

Hatice Büşra's poster work that presents Prof. Dr. Ömer Özkan's biography;
Ömer Özkan was born in Ankara Haymana on December, 31, 1971. He graduated from Hacettepe University Medical Faculty as a doctor in 1995. He started his specialty education in Hacettepe University Plastic and Reconstructive Surgery Department in 1995 and completed it in 2001. He became assistant professor in 2004, associate professor in 2006 and professor in December 2011. Prof. Dr. Ömer Özkan is an instructor at Akdeniz University Plastic and Reconstructive Surgery Department. At the university, Prof. Dr. Ömer Özkan and his team accomplished the first double arm transplant in Turkey to Cihan Topal, the first face transplant in Turkey to a male called Uğur Acar and the first uterus womb from a cadaver in the world to a woman called Derya Sert. He also accomplished the first full face transplant in Turkey with his team. Prof. Dr. Ömer Özkan became well known in Turkey with the double arm transplant which he undertook on 27 September 2010. This successful operation was cited in literature as the first double arm transplant in Turkey. It is known that the operation done at Akdeniz University Medical Faculty was the 16th in the world and the 1st in Turkey. Prof. Dr. Ömer Özkan's wife, Associate Professor Dr. Özlenen Özkan, who also takes parts in his team is a plastic surgeon as well and the department head at Akdeniz University Plastic and Reconstructive Surgery Department.

Theme 3: Scientist biographies, used in the posters with information on scientists' date and place of birth, educational background and career development, are presented below:

Gizem's poster work that presents Prof. Dr. Nuriye Özlem Küçük's biography;
She was born in Nevşehir on November, 18, 1968. After graduating from Nevşehir Primary School (1974-1979), TEFEV Private Tevfik Fikret High School (1979-1986) and Ankara Medical Faculty (1986-1992) she received nuclear medical training. She attended various courses and symposiums. She took part in important projects. She is married and has two children. She knows French and English very well.

Senacan's poster work that presents Prof. Dr. Murat Aksoy's biography;
Prof. Dr. Murat Aksoy was born in Istanbul on September 11, 1970. He completed his primary and secondary education at Şişli Terakki High School Levent Primary School and Kadıköy Anadolu High School respectively. He graduated from Istanbul University Cerrahpaşa Medical Faculty in 1994'de and received the title of medical doctor. He completed his general surgery specialty training at İÜ Istanbul Medical Faculty in 1999. He currently works as a surgeon.
Tuna's poster work that presents Prof. Dr. Koray Coşkun Fırat's biography;
He was born in Ankara in 1970. He completed his secondary school education at TED Ankara College and his medical training at Ankara University Medical Faculty. He accomplished various domestic and international duties. He is in Ömer Özkan's team. He received many important prizes and took part in scientific activities. He currently works at Akdeniz University.

Theme 4: Scientist biographies, used in the posters with information on scientists' educational backgrounds, interests and career development, are presented below:

Ceren's poster work that presents Associate Professor Dr. Sevil Şen's biography;
After graduating from Hacettepe University Department of Computer Engineering, Sevil Şen received her doctorate from New York University Computer Sciences Department in England. She started working at Hacettepe University as an instructor in October 2010. She is currently a member of Security research Group and her interests include machine learning, evolutionary computation, computer networks and network security.

Yağmur's poster work that presents Prof. Dr. Bülent Tıraş's biography;
Bülent Tıraş who graduated from Ankara University Medical Faculty in 1984 as the third in his class completed his specialization at Ege University Gynecology and Obstetrics Department between the years 1986-1992. During this time, he went to England for a year with "Instructor Training Program" scholarship. He gave his specialization thesis on "the frequency of polycystic ovary syndrome in women with anovulatory and idiopathic hirsute problems" in 1992. He became associate professor in 1994 at Gazi University Gynecology and Obstetrics Department. He was successful in associate professor exam in 1997 and assigned as a professor in 2003. He currently works in the field of infertility.

Gizem Nur's poster work that presents Prof. Dr. Abuzer Kendigelen's biography;
In 1986, Prof. Dr. Abuzer Kendigelen was assigned as a research assistant to Istanbul University Faculty of Law Commercial Law Department where he had graduated from in 1985 at the top of his class. He started his master's degree at Istanbul University Social Sciences Institute in 1985 and completed it in 1987. He started his doctorate at Istanbul University Social Sciences Institute and continued his thesis work between the years of 1990-1992 at Munich Ludwing Maximillians University Commerce, Economy and Business Law Institute via a scholarship he received from German Academic Exchange Association. He completed his doctorate work with the thesis titled "usufructary right on joint stock interest" which he defended on 13 April 1994 and which was unanimously accepted. After the exam he sat in December 1999 he received the title of associate professor and was assigned to the post in August 2000. He was assigned to Istanbul University Law Faculty Commercial Law Department in 2005 as professor. After he was assigned to Istanbul University Law Faculty as associate professor, he taught commercial law at Istanbul University Justice College, Istanbul University School of Economics and Istanbul University Political Sciences in addition to teaching at Istanbul University Law Faculty. He acted as deputy dean for two terms during 1999-2000 academic years. Kendigelen, who currently works as professor Istanbul University Law Faculty Commercial Law Department, continues his research in the field of law.

Theme 5: Scientist biographies used in the posters with information on scientists' date and place of birth, interests and the most important contribution to the field are presented below:

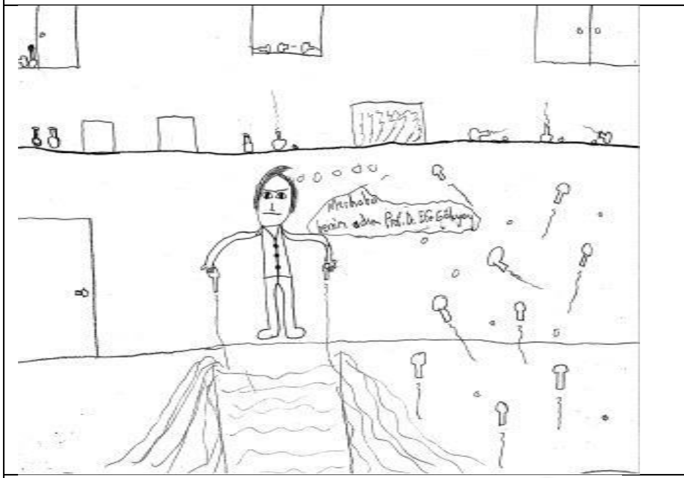
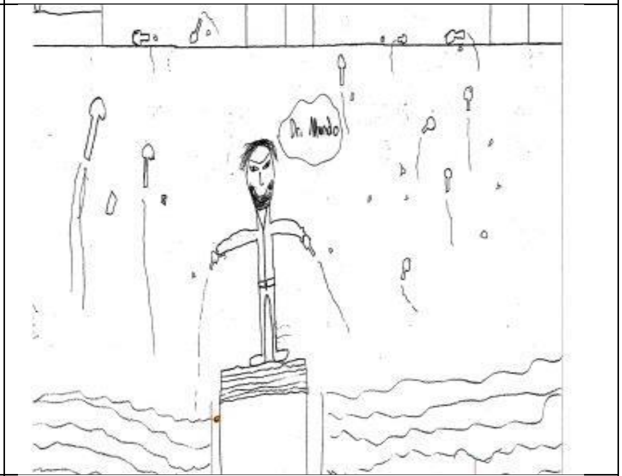
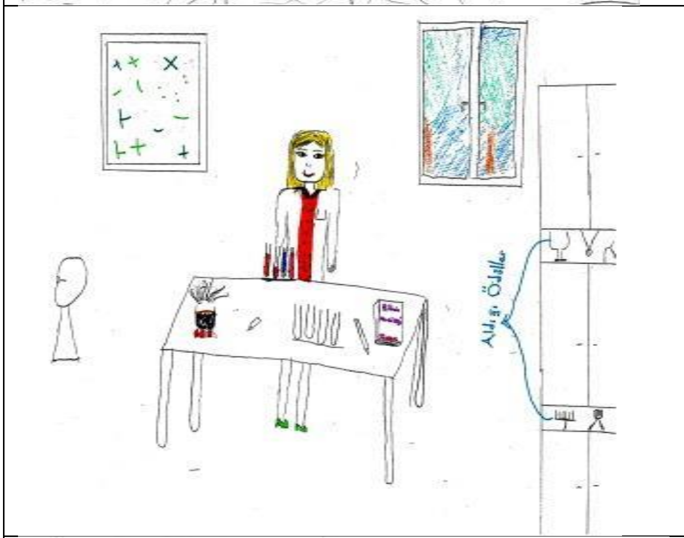
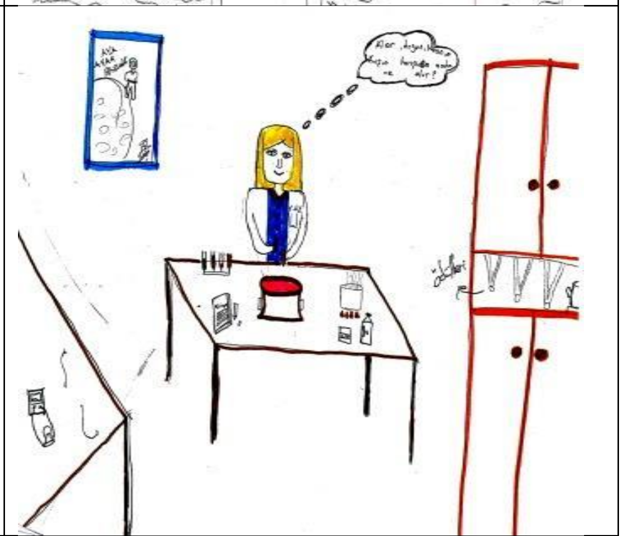
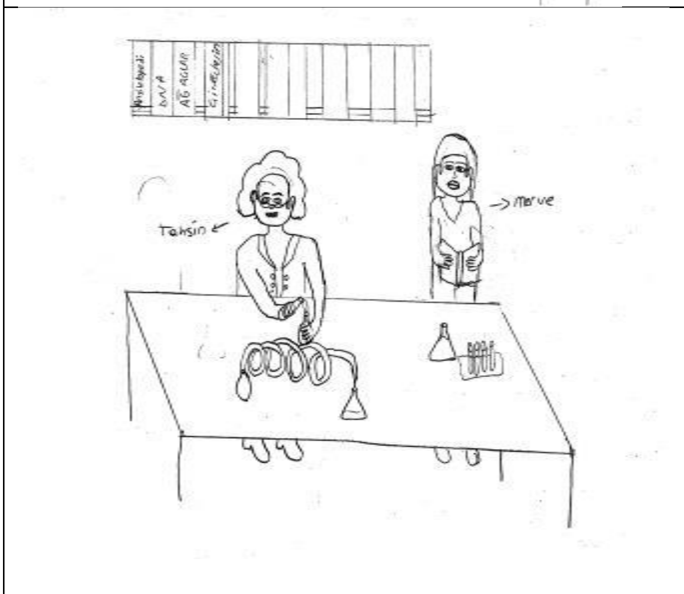
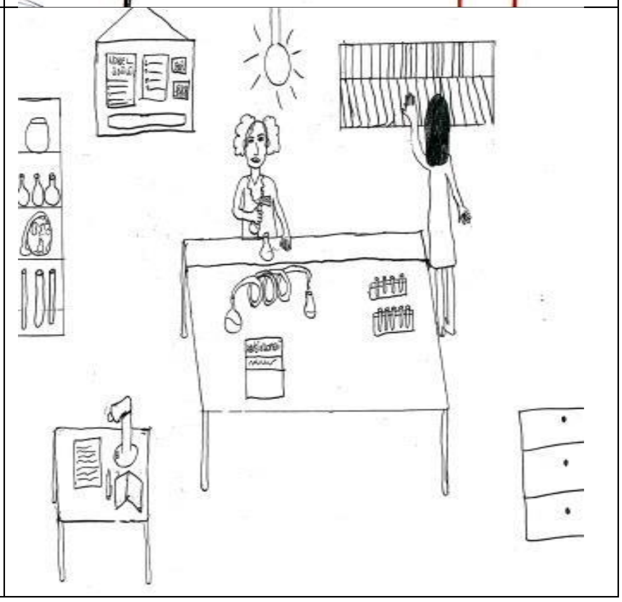
Kadir's poster work that presents Prof. Dr. Gökhan Hotamışlıgil's biography;
He was born in Kütahya Gediz on 24 June 1962. He graduated from Ankara University Medical Faculty in 1986. He received his professorship from Harvard University in 2003. He works on obesity, type 2 diabetes and molecular mechanisms of metabolic syndrome. He discovered a hormone called "lipokin" which can stop diseases such as steatorrhoeic hepatosis.

Zehra's poster work that presents Prof. Dr. Oktay Sinanoğlu's biography;
He was born in Bari on August 2, 1934. He is a Turkish quantum chemist, theoretic chemist and molecular biologist. The five most important theories he works on are: Many Electron Theory of Atoms and Molecules (1961), Solvophobic Theory (1964), network theory (1974), microthermosynamics (1981), valency interaction formula (1983).

Tugay's poster work that presents Prof. Dr. Gökhan Hotamışlıgil's biography;
Hotamışgil who was born in Kütahya Gediz on June 24, 1962 graduated from Ankara University Medical Faculty in 1986. He received the title of professor from Harvard University in 2003. Hotamışgil who works on obesity, type 2 diabetes and molecular mechanisms of metabolic syndrome continues his work in Harvard University since 2005. Prof. Dr. Gökhan Hotamışlıgil and his team discovered a hormone called "lipokin" which can stop disease diabetes and steatorrhoeic hepatosis.

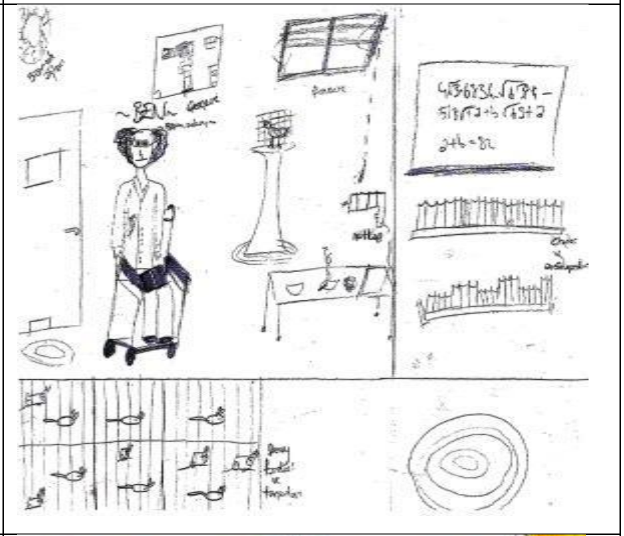
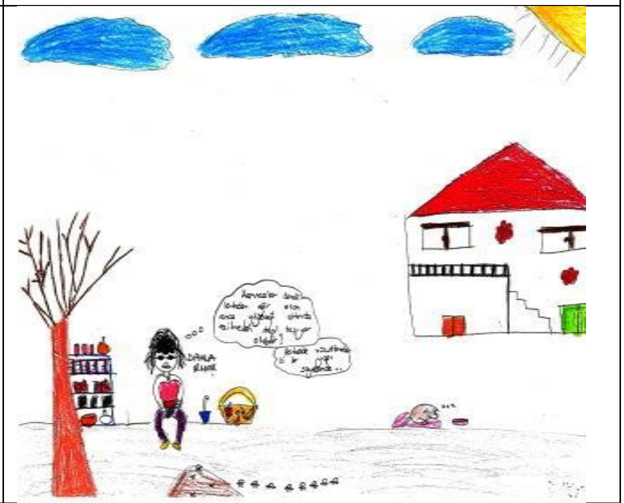
APPENDIX B

Pre and post drawings of Cem, Sümeyye Nur and Nisa, members of experimental group, are presented below respectively.

Pre	Post
	
	
	

APPENDIX C

Pre and post drawings of Kardelen, Hülya and Ecrin Dila, members of control group, are presented below respectively.

Pre	Post
	
	
	

APPENDIX D

Posters, constructed by members of control group, are presented below.