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SECONDARY SCHOOL STUDENTS' SCIENTIST IMAGE: IS IT SENSATIONAL OR TRADITIONAL?

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Abstract:
It can be said that the positive perception that the students will develop against science and the scientist from childhood is so effective that it can direct their perception in their future lives. Therefore, determination of students' perceptions of science and the scientist is very important for educators. Thus, the purpose of the current study is to determine secondary school students' images of the scientist. Moreover, the study also looked at the classroom factors affecting students' images of the scientist. The study was carried out with the participation of 240 secondary school students in a city located in the western part of Turkey in the fall term of the 2017-2018 school year. In the study, the DAST scale adapted by Farland (2003) was administered to the secondary school students. Within the context of the current study, the secondary school students' images of the scientist were explored in terms of the appearance, working area and works of the scientist.

Keywords: scientist image, DAST, student

1. Introduction

A common definition of science is very difficult to make. This is because science is not a fixed but constantly and rapidly changing and developing endeavor (Bilen, 2015). When defined in the simplest of terms; "*science is a process of accurate thinking, seeking for the truth and knowledge, systematic collection of knowledge by using scientific methods and organization of the collected data and also a set of attempts made to understand and define the*

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universe" (Çepni, 2005, s.2). The absence of a definition that everyone agrees on is also true for the scientist who is the subject of science. According to Kuhn (2008), one of the most important requirements of understanding scientific knowledge is to understand the scientist. Only in this way, individuals can acquire a correct understanding of science and develop a positive attitude towards it. At that point, it should be noted that individuals' perceptions of the scientist begin to be constructed from the pre-school period (Newton & Newton, 1992). When the literature is reviewed, it is seen that there are many studies conducted to determine individuals' perceptions of the scientist. From among these studies, the study of Meade and Metraux (1957) with 35000 students can be considered to be the first study to determine the image of the scientist. In the following years, while working on the scientist image, Chambers (1983) developed the "Draw a Scientist Test (DAST)", considering that it might be difficult for students to express their opinions in writing or orally. A total of seven characteristics of the scientist were identified by Chambers (1983) on the basis of the analysis of the data collected from 4807 students from different socio-economic levels. These characteristics are lab coat (generally white), glasses, messy hair and beard, research symbols, knowledge symbols, technology (computer, microscope, telescope) and captions such as "I have found it". Newton and Newton (1992) used the "Draw a Scientist Test" in a study of 1143 students in the age group of 4-11 to determine the students' perception of the scientist; when something not understood by the students emerged, they asked questions to the students to make it clear. Newton and Newton (1992) have discussed the data obtained in this study under two main headings. These are the characteristics of the figure and the characteristics of the background. While the characteristics of the figure consist of "gender, lab coat, glasses, beard and boldness", the characteristics of the background consist of structures related to scientific knowledge and involvement in scientific process. In order to increase the reliability and validity of the DAST, "Scientist Checklist" was formed by Finson, Beaver and Cramond (1995). This checklist was designed to check the most commonly observed aspects of researchers. As known, the DAST only relies on students' drawings. Therefore, in order to be able to make a good use of the DAST, participants need to be self-sacrificing and researchers should conduct their analyses carefully (Öcal, 2007). According to Song and Kim (1999), the DAST should be supported with interviews or Likert-type scales in order to elicit the abstract characteristics of the scientist.

When the literature is examined, it is seen that the DAST has been administered to different populations of students ranging from pre-school to university. In the literature, the drawings of the scientist have been analyzed in terms the different characteristics of participants such as age (Buldu, 2007; Fung, 2002; Korkmaz and Kavak, 2010; Milford and Tippet, 2012; Ruiz-Mallen and Escalas, 2012), gender

(Gonsoulin, 2001; Nath and Thomas, 2013) and culture (Bayri, Köksal and Ertekin, 2016; Korkmaz, 2011; Rodari 2007; Narayan, Park, Peker and Suh, 2013; Schibeci and Sorenson, 1993;). The findings of these studies have revealed the common characteristics of scientists as follows; in general they are middle-aged or elderly, they wear glasses, they are bald, they wear a white lab coat, they work alone in the lab, they shout "I have found, I have found" and they are generally males. Visual and written resources used by teachers, family, socio-economic level, gender and age seem to be effective on the emergence of these characteristics as the common characteristics of the scientist. Schibeci (1986) concluded that individuals' images of the scientist are affected by the media. In programs shown in the media (For example, the film "Time Machine"), scientists are generally depicted as figures who are crazy, rebellious and working in a lab environment; thus, creating a standard image of a scientist in the minds of people. According to Chambers (1983), the reason for the use of expressions such "I have found, I have found" by students is their being affected by printed and visual resources. It can be said that individuals' family experiences, parents' professions, educational status, friends, environment and even their toys affect their perception of the scientist. According to Entwisle and Greenberger (1972), students' perception of scientist is shaped by the end of primary school (Farland, 2003). During this process, the science course is the course in which students learn the most information about science and the scientist. Matthews and Davies (1996) argue that teachers, especially those working at basic education level, shape students' perceptions of the scientist. Taylor, Jones, Roadwell and Oppewal (2008) have reached a conclusion that when the education given is exciting and enjoyable, it makes important contributions to the development of interest in science. Therefore, teachers' perception of scientist is of great importance.

2. Methodology

2.1 Research Goal

It can be said that the positive perception that the students will develop against science and the scientist from childhood is so effective that it can direct their perception in their future lives. Therefore, determination of students' perceptions of science and the scientist is very important for educators. Thus, the purpose of the current study is to determine secondary school students' images of the scientist. Moreover, the study also looked at the classroom factors affecting students' images of the scientist.

2.2 Sample and Data Collection

The current study employing the qualitative research approach was conducted in line with the special case method. The special case method; as in the detailed planning of

architectural works, is one of the systematic design types comprised of the stages such as data collection, organization of the collected data, interpreting and reaching research findings (Merriam, 1988). As the special case method providing in-depth data about the case under investigation, interpreting the truth within its context and allowing studying the truth under investigation in a short time span (Yin, 2003; Vural and Cenkseven, 2005), it is thought to be highly suitable for the current study.

The study was carried out with the participation of 240 secondary school students in a city located in the western part of Turkey in the fall term of the 2017-2018 school year. Some features of the study group are given below in Table 1.

Table 1: Features of the study group

		Gender		
		Girl	**Boy**	**Total**
Grade level	Secondary school 1st grade	32	35	67
	Secondary school 2nd grade	20	38	58
	Secondary school 3rd grade	27	34	61
	Secondary school 4th grade	22	32	54
Total		101	139	240

When Table 1 is examined, it is seen that of the 240 participating students, 67 are secondary school 1st graders, 58 are secondary school 2nd graders, 61 are secondary school 3rd graders and 54 are secondary school 4th graders. Moreover, of the participating 240 students, 101 are females and 139 are males. Within the context of the study, the students are coded with numbers (Ö1, Ö2, Ö3,……..Ö240). In these codings, Ö stands for the student and the number indicates his/her rank.

In the study, the DAST scale adapted by Farland (2003) was administered to the secondary school students. According to Farland (2003), in studies conducted by using the DAST, there are many different points to be elicited regarding students' images of the scientist. For example, when the DAST was administered to students, it was observed that the students' drawings included much more than intended such as the appearance of the scientist, the place where the scientist works and what the scientist does. Therefore, the DAST was modified by Farland (2003) to include the appearance of the scientist, the working place of the scientist and the works done by the scientist and became m-DAST (modified DAST). The m-DAST has two parts. The first includes the drawing to be produced on the basis of the given instructions and the second part consists of four questions. The instructions and parts in the m-DAST are given in App. 1. In order to check the extent to which the scale adapted to Turkish serves the purpose of the current study, its comprehensibility and applicability, opinions of two science

teachers about the scale were sought. Then the piloting of the study was conducted on 1 secondary school student and its comprehensibility was thus checked.

2.3 Analysis of Data

In the analysis of the collected data, the content analysis technique was used. The content analysis technique is one of the basic research techniques used to seek for answers to many research questions from different disciplines. The content analysis can be defined as *"a research technique used to derive systematic and unbiased conclusions from certain characters defined in the text"* (Stone, Dunphy, Marshall & Ogilvie, 1966: 213). In the analysis of the data collected after the application, the rubrics formed by Farland (2003) were used. The rubrics concern the appearance of the scientist, working area of the scientist and the works of the scientists. The rubrics are presented in App. 2. Each student's drawing was categorized on the basis of the rubrics given in App. 2 in terms of the appearance of the scientist, the working area of the scientist and the works of the scientist. The data belonging of each category are presented across the grade levels with their frequencies and percentages in tables.

3. Findings / Results

The findings obtained in the current study conducted to determine the secondary school students' images of the scientist are presented in tables below. The secondary school students' images of the appearance of the scientist are given in Table 2.

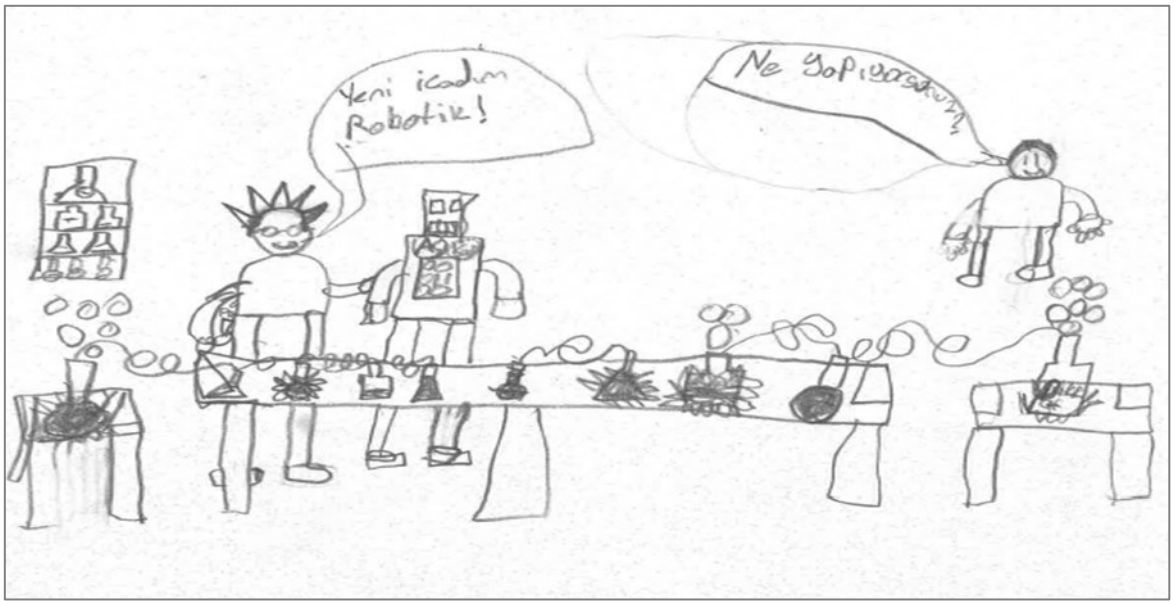
Table 2: Secondary School Students' Images of the Appearance of the Scientist

	Grade Level					
	1st grade	**2nd grade**	**3rd grade**	**4th grade**	**f**	**%**
Sensational	11	18	6	7	42	17,5
Traditional	31	30	38	34	133	55,4
Broader than traditional	22	9	15	8	54	22,5
Drawing without a category	3	1	2	5	11	4,6

When Table 2 is examined, it is seen that 17.5% of the students have the sensational scientist image. Of the students having the sensational scientist image, 11 are first graders, 18 are second graders, 6 are third graders and 7 are fourth graders. In the drawings considered in this category, the scientist is generally depicted as a man with a strange appearance, erect hair and like a bad man or monster. The samples of the drawings evaluated in this category are presented below.

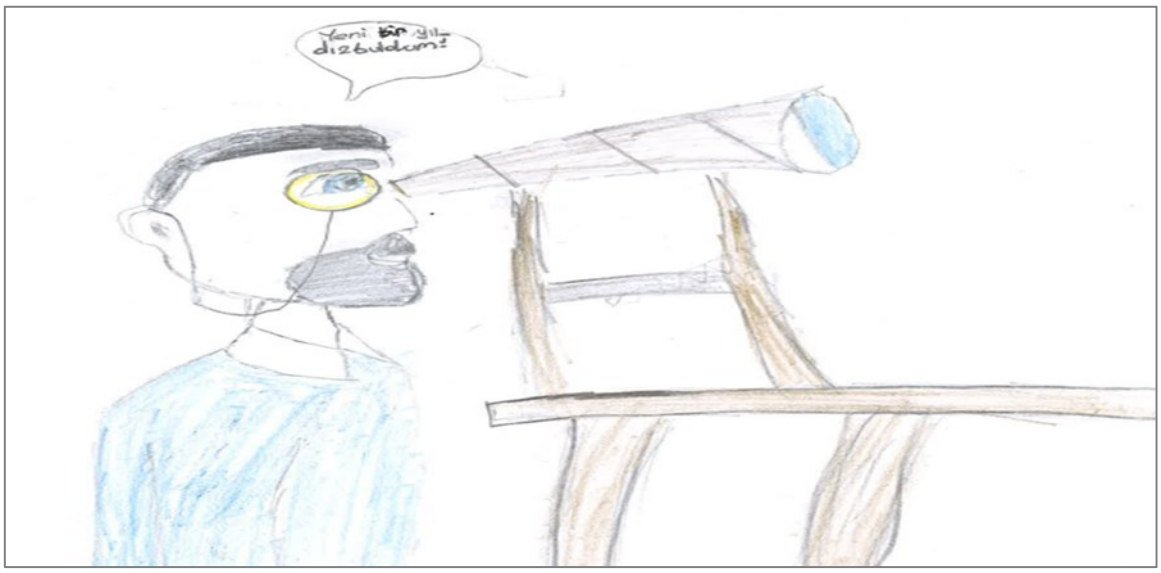
Ö96: (Secondary School 2nd Grade Student)

Ö5: (Secondary School 1st Grade Student)



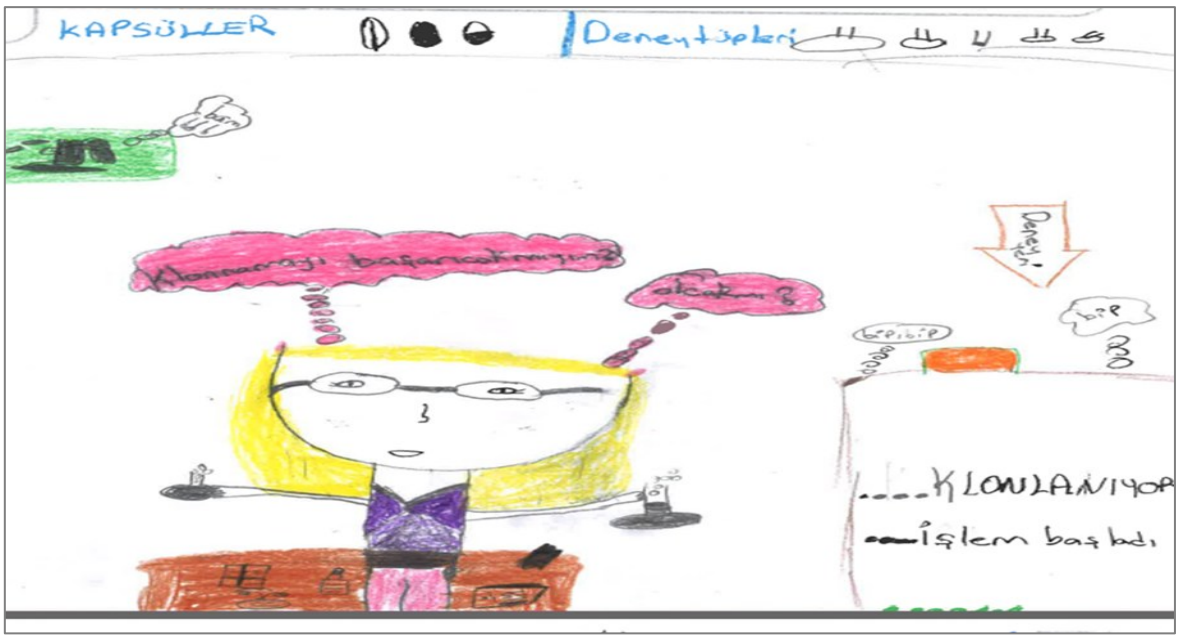
When Table 2 is examined, it is seen that 55.4% of the students have the traditional scientist image. Of the students having the traditional scientist image, 31 are first graders, 30 are second graders, 38 are third graders and 34 are fourth graders. In these drawings, the scientist is depicted as a white man. The samples of the drawings evaluated in this category are presented below.

Ö200: (Secondary School 4th Grade Student)



When Table 2 is examined, it is seen that 22.5% of the students have a broader than traditional image of the scientist. Of the students having a more extensive image of the scientist than the traditional, 22 are first graders, 9 are second graders, 15 are third graders and 8 are fourth graders. What is expected from the drawings in this category is that the scientist is depicted as a woman or a member of a minority group. In all the drawings evaluated in this category in the current study, the scientist is depicted as a woman. A sample drawing in this category is presented below.

Ö220: (Secondary School 4th Grade Student)



When Table 2 is examined, it is seen that the drawings of 4.6% of the students were not included in any category. In the drawings evaluated in this category, the students were found to have drawn the figures of stick man.

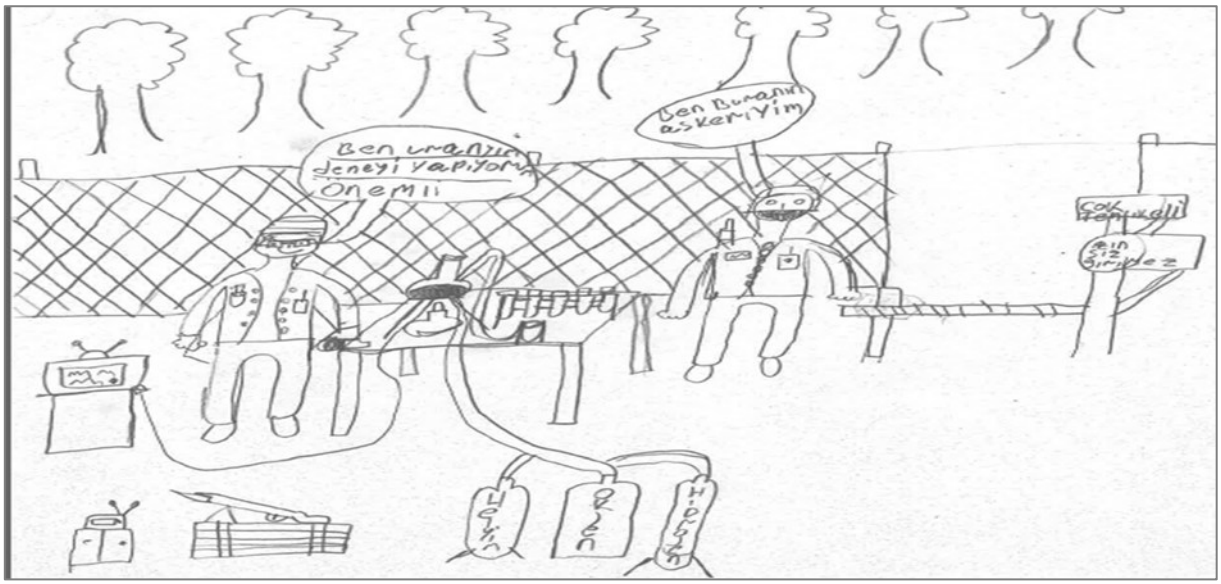
The secondary students' images of the working areas of the scientist are presented in Table 3.

Table 3: Secondary School Students' Images of the Working Areas of the Scientist

	Grade Level					
	1st grade	**2nd grade**	**3rd grade**	**4th grade**	**f**	**%**
Sensational	32	5	1	3	41	17,1
Traditional	34	53	60	50	197	82,1
Broader than traditional	1	0	0	1	2	0,8

When Table 3 is examined, it is seen that 17.1% of the secondary school students depicted sensational areas as the working areas of the scientist in their drawings. Of the students thinking that the scientist works in sensational areas, 32 are first graders, 5 are second graders, 1 is a third grader and 3 are fourth graders. These sensational areas can be places different from the usual laboratory environment such as caves or frightening dark places. Moreover, they include constructs different from the ones found in the usual laboratory environment. A sample drawing in this category is presented below.

Ö15: (Secondary School 1st Grade Student)



When the drawing given above is examined, it is seen that the scientist is conducting an experiment with uranium in a military zone and he/she is accompanied by military personnel during this experiment.

When Table 3 is examined, it is seen that 82.1% of the students drew the traditional lab setting as the working area of the scientist. Of the students drawing the traditional lab setting as the working area of the scientist, 34 are first graders, 53 are second graders, 60 are third graders and 50 are fourth graders. In traditional settings, it is seen that generally, there are cupboards; there are books and lab equipment inside the cupboards, there is a desk and there are equipment such as a computer, a microscope etc. on this desk. A sample of the drawings evaluated in this category is presented below.

Ö130: (Secondary School 3rd Grade Student)

When Table 3 is examined, it is seen that the drawings of 2 students are evaluated as broader than traditional. A sample of the drawings considered in this category is presented below. The drawing given below belongs to a fourth grade girl. In her picture, the student depicted a female scientist conducting research in an open are like a swamp and wetland.

Ö210: (Secondary School 4th Grade Student)

The secondary school students' images of the works of the scientist are given in Table 4.

Table 4: Secondary School Students' Images of the Works of the Scientist

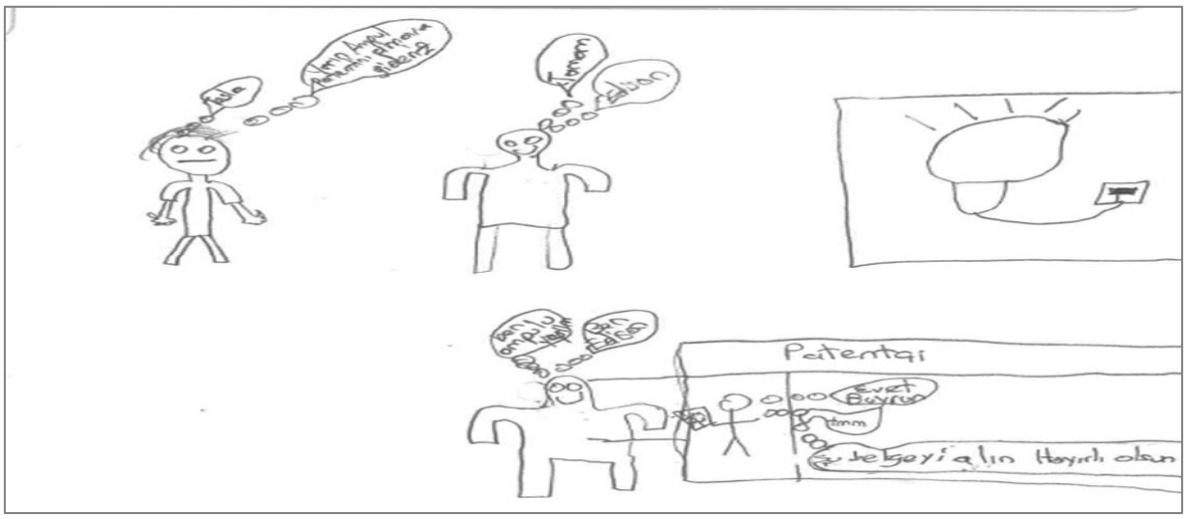
	Grade level					
	1st grade	**2nd grade**	**3rd grade**	**4th grade**	**f**	**%**
Sensational	23	3	2	2	30	12,5
Traditional	43	54	59	51	207	86,2
Drawing without any category	1	1	0	1	3	1,2

When Table 4 is examined, it is seen that 12.5% of the secondary school students depicted the scientist conducting sensational works in their drawings. Of the students thinking that the scientist conducts sensational works, 23 are first graders, 3 are second graders, 2 are third graders and 2 are fourth graders. In this connection, scientists conduct horrifying activities that are not possible to carry out in a normal lab. In the drawings in this category, the themes of space and alien come to the fore. Sample of the drawings evaluated in this category are presented below.

Ö60: (Secondary School 1st Grade Student)

When the drawing given above is examined, it is seen that the scientist is examining the alien egg they have found by using strange equipment. In this drawing, it is also remarkable that the scientist is accompanied by soldiers.

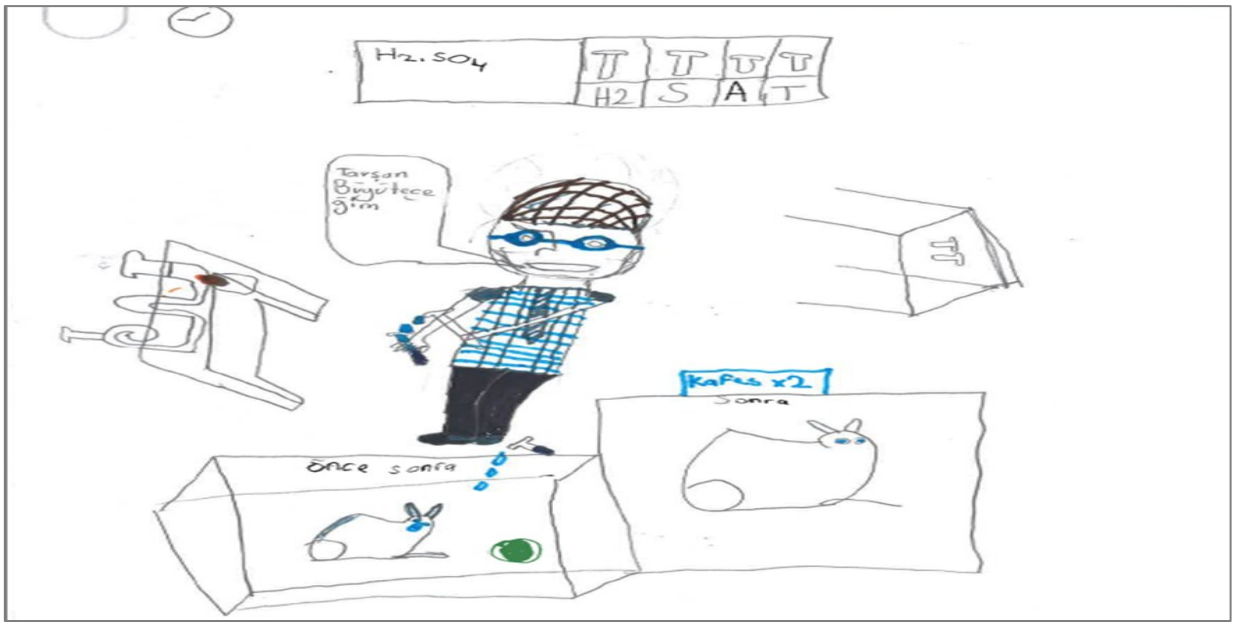
Ö72: (Secondary School 2nd Grade Student)



When the drawing given above is examined, it is seen the event of patent stealing having occurred between Edison and Tesla is depicted.

When Table 4 is examined, it is seen that in the drawings of 86.2% of the students, scientists are depicted conducting traditional works. Of the students thinking that the scientist conducts traditional works, 43 are first grade students, 54 are second grade students, 59 are third grade students and 51 are fourth grade students. In the drawings considered in this category, it is seen that not all aspects of the work of the scientist are explained. The students only used the expressions "I am working on the teleporting elixir." or "I am conducting works on the treatment of cancer." A sample of the drawings evaluated in this category is presented below.

Ö180: (Secondary School 3rd Grade Student)



When the drawing presented above is examined, it is seen that the scientist is conducting experiments on rabbits in the laboratory. It is seen that the animals rapidly grow as a result of the elixir treatment. The student does not give any other information about the experiment conducted by the scientist.

When Table 4 is examined, it is seen that the drawings of three students are evaluated as the drawings without category. In these drawings, what the scientist is doing cannot be thoroughly understood.

With the scale administered within the context of the current study, data were obtained about the gender and the working area (indoor or outdoor) of the scientist. Data regarding the gender and the working area of the scientist are presented in Table 5 and Table 6. The data related to the secondary school students' perceptions of the gender of the scientist are given in Table 5.

Table 5: Secondary School Students' Perceptions of the Gender of the Scientist

	Grade Level					
	1st grade	**2nd grade**	**3rd grade**	**4th grade**	**f**	**%**
Female	21	14	18	16	69	28,8
Male	46	43	43	35	167	69,6
Female/Male	0	1	0	3	4	1,7

When Table 5 is examined, it is seen that 28.8% of the students depicted the scientist as female in their drawings. Of the students depicting the scientist as female, 21 are first grade students, 14 are second grade students, 18 are third grade students and 16 are fourth grade students. In Table 5, it is also seen that 69.6% of the students depicted the scientist as male in their drawings. Of the students depicting the scientist as male, 46 are first grade students, 43 are second grade students, 43 are third grade students and 35 are fourth grade students. Only 4 of the 240 students participating in the study indicated that the scientist can be both male and female and included both genders in their drawings. Of these 4 students, 1 is second grade student and 3 are fourth grade students.

The secondary school students' perceptions of the working area of the scientist are given in Table 6.

Table 6: Secondary school students' perceptions of the working area of the scientist

		Grade Level					
		1st grade	**2nd grade**	**3rd grade**	**4th grade**	**f**	**%**
Working area	Indoor	40	37	38	26	141	58,8
	Outdoor	27	21	23	28	99	41,2

When Table 6 is examined, it is seen that while 58.8% of the students depicted the working area of the scientist as an indoor area, 41.2% depicted it as an outdoor area. Of the 141 students depicting the working area of the scientist as an indoor area, 40 are first grade students, 37 are second grade students, 38 are third grade students and 26 are fourth grade students. Of the 99 students depicting the working area of the scientist as an outdoor area, 27 are first grade students, 21 are second grade students, 23 are third grade students and 28 are fourth grade students.

4. Discussion and Conclusion

In the current study investigating the secondary school students' images of the scientist, the students' images of the scientist are also examined in terms of the grade level. As a result of the study, it was found that in 28.8% of the drawings of the students, the scientist was depicted as female, in 69.6% of the drawings, the scientist was depicted as male and in 1.7% of them, the scientist is depicted as both male and female. Only 4 of the 240 students participating in the study depicted both male and female scientists in their drawings. When similar studies in the literature are examined, it is seen that a similar finding was reported by Ayvacı, Atik and Ürey (2016). As a result of the study by Ayvacı et al. (2016), it was found that 66.17% of the pre-school children participating in their study included only male scientists in their drawings, 22.05% only female scientists and 11.76% both male and female scientists. The current study's finding that the scientist is depicted as male in 69.6% of the drawings concurs with the findings reported by Toğrol (2000), Fung (2002), Monhardt (2003), Buldu (2007), Nuhoğlu and Afacan (2007), Rodari (2007), Kaya, Doğan and Öcal (2008), Tükmen (2008), Demirbaş (2009), Korkmaz and Kavak (2010), Akcay (2011), Ağgül Yalçın (2012), Çermik (2013), Kara and Akarsu (2013), Nath and Thomas (2013), Özsoy and Ahı (2014). The reason behind this general finding is shown to be the effect of media on students' images of the gender of the scientist by Steinke, Lapinski, Crocker, Zietsman - Thomas, Williams, Evergreen and Kuchibhotla, (2007) and Ambusaidi, Al-Muqeemi and Al-Salmi, (2015).
Another finding of the current study is related to the working area of the scientist. Of the secondary school students, 58.8% depicted the working area of the scientist as an indoor area, 41.2% depicted it as an outdoor area. This finding is supported by the findings of Chambers (1983), Demirbaş (2009), Kohen and Bar (2009), Akcay (2011), Medina-Jerez, Middleton & Orihuela-Rabaza (2011), Nath and Thomas (2013), Özsoy and Ahi (2014), Eyceyurt Türk and Tüzün (2017). In these studies, it was concluded that the participants are of the opinion that the scientist conducts his/her works mostly in indoor areas. This might be because of the visuals of the scientist used in textbooks because in textbooks the scientist is generally depicted as a person working in indoor

areas. This finding indicates that the belief that scientific works are conducted in specially-equipped laboratories is widely held by people. What should be noted here is that the whole universe can be a laboratory for the scientist.

Within the context of the current study, the secondary school students' images of the scientist were explored in terms of the appearance, working area and works of the scientist. As a result of the study, of the students' images of the scientist, 17.5% are sensational, 55.4% are traditional and 22.5% are broader than traditional. In the sensational drawings, the scientist was usually depicted as someone with a strange appearance, with a gun in his/her hand, like a bad man or monster. It is seen that the drawings evaluated in the sensational category were mostly produced by the first and second grade students. This finding is similar to the finding reported by Bang, Wong and Jeffery (2014). In the study conducted by Bang et al. (2014) to determine the scientist image of the high school students attending different types of high schools in South Korea, they found that one of the images of the scientist held by the students is the scientist wearing protective clothes and looking like a witch or devil. The reason for this finding might be films and cartoons watched by children attending secondary school 1st and 2nd grades. When the drawings evaluated in the category of traditional are examined, their ratios across the grade levels are close to each other. The scientist in the drawings in this category was mostly depicted as a white man working in a lab. This finding concurs with some findings reported in the literature (Barman, 1997; Chambers, 1983; Çermik, 2013; Güler and Akman, 2006; Özsoy and Ahi, 2014). When the drawings considered in the category of broader than traditional are examined, it is seen that the scientist was depicted as a woman. In all the drawings in this category, female scientists were depicted as working individually. Individual working of the scientist concurs with the findings reported by Deniş Çeliker and Erduran Avcı (2015).

In light of the findings of the current study, it can be argued that in general the secondary school students' images of the working area of the scientist are traditional. This finding concurs with the literature (Chambers, 1983; Nuhoğlu and Afacan, 2007; Demirbaş, 2009; Akçay, 2011; Özsoy and Ahi, 2014; Ayvacı et al. 2016). Of the participating 240 students, 191 depicted the working area of the scientist as traditional places in their drawings. There are a total of 41 students thinking that the working area of the scientist is sensational. Of these 41 students, 32 are secondary school first graders. As a result of the current study, it can be argued that the students in general hold the traditional image of the works of the scientist. Of the 240 students participating in the study, 207 depicted the works of the scientist as traditional works in their drawings. In the drawings in this category, expressions such as "The scientist is doing …… or the scientist is working on"; yet, they did not give any details about the work done.

When the secondary school students' images of the scientist were examined in terms of appearance, working area and works of the scientist, it was found that the sensational drawings were mostly produced by the first grade students. This might be because of the imagination of the students in this age group. With increasing grade level, the number of traditional drawings also increases.

In light of the findings obtained in the current study, it can be suggested that more time should be allocated to activities focusing on the image of the scientist in order to create more realistic images of the scientist in the minds of secondary school students. Particularly in science classes, works of the scientists from both sexes can be studied. Scientists from both sexes can be invited to schools. Bodzin and Gehringer (2001) concluded that the scientists invited to schools altered the students' perceptions of the scientist. In a study by Keser (2012), it was concluded that the students' extent of participating in out-of-school scientific activities positively affected their attitudes towards science and the scientist. Therefore, out-of-school learning environments can be capitalized on. Through field trips, real working areas of scientists, tools and equipment they use and the works they do can be seen by students.

Ambusaidi et al. (2015) found that the information sources of students about science and the scientist are media, textbooks and the internet. Therefore, more places should be allocated to the actual life stories of scientists and the scientific works they have done in printed and visual media with which students are in a constant interaction. The use of the stereotyped figure of the scientist in visual and printed media should be minimized and visuals of scientists always doing the same things in the same environments should be used less.

Carli, Alawa, Lee, Zhao & Kim (2016) concluded that the society sees the man as the individual more representing the society. Moreover, in the study, it was also found that the participants view the scientist as different from the rest of the society and having the power of representing the society. Therefore, in the current study, the students' perception of the scientist may have more matched with the man. Thus, in every opportunity, the existence of the female scientists needs to be emphasized.

References

1. Hudson, P. (2013). Desirable Attributes and Practices for Mentees: Mentor Teachers Expectations. *European Journal of Educational Research*, *2*(3), 107-119.
2. Kingsley, L. & Romine, R. (2014). Measuring Teaching Best Practice in the Induction Years: Development and Validation of an Item-level Assessment. *European Journal of Educational Research*, *3*(2), 87-109.

3. Ağgül Yalçın, F. (2012). Öğretmen Adaylarının Bilim İnsanı İmajlarının Bazı Değişkenlere Göre İncelenmesi. *İlköğretim Online,* 11(3), 611-628.
4. Akcay, B. (2011). Turkish Elementary and Secondary Students' Views About Science And Scientist. *Asia- Pasific Forum on Science Learning and Teaching, 12(1),* 1-11.
5. Ambusaidi, A., Al-Muqeemi, F., & Al-Salmi, M. (2015). Investigation into Omani Secondary School Students' Perceptions of Scientists and Their Work, *International Journal of Instruction*, 8(1): 173-188.
6. Ayvacı, H.Ş., Atik, A. & Ürey, M. (2016). Okul Öncesi Çocuklarının Bilim İnsanı Kavramına Yönelik Algıları, *Bartın Üniversitesi Eğitim Fakültesi Dergisi*, 5(3), 669-689.
7. Bang, E., Wong, S. S. & Jeffery, T. D. (2014). High School Students' Stereotypic Images of Scientists İn South Korea. *Mevlana International Journal of Education*, 4(1), 96-112
8. Barman, C. R. (1997). Students' Views of Scientists and Science: Results From A National Study. *Science and Children*, 35(1), 18-24.
9. Bayrı, N., Köksal, M. S. & Ertekin, P. (2016). "Investigating Gifted Middle School Students' Images about Scientists: A Cultural Similarity Perspective", *Science Education International*, 27(1): 136-150.
10. Bilen, K. (2015). Bilim Nedir, Ne Değildir. N. Yenice (Editör). *Bilimin Doğası Gelişimi ve Öğretimi* (s. 1-42). Ankara: Anı Yayıncılık.
11. Bodzin, A. & Gehringer, M. (2001). Breaking Science Stereotypes. Science & Children, 38(4), 36–41.
12. Buldu, M. (2007). Young Children's Perceptions of Scientists: A Preliminary Study. *Educational Research, 48(1),* 121-132.
13. Carli, L. L., Alawa, L., Lee, Y., Zhao, B. & Kim, E. (2016). Stereotypes About Gender and Science: Women≠ Scientists, Psychology of Women Quarterly, 40(2): 244-260
14. Chambers, D. W. (1983). Stereotypic Images of The Scientist: The Draw - A - Scientist test. *Science Education, 67(2),* 255-265.
15. Çepni, S. (2012). Bilim, Fen, Teknoloji Kavramlarının Eğitim Programlarına Yansımaları. S Çepni (Editör). *Kuramdan Uygulamaya Fen ve Teknoloji Öğretimi* (s. 1-11). Ankara: Pegem Akademi.
16. Çermik, H. (2013). Öğretmen Adaylarının Zihinlerinde Canlanan Resimdeki Bilim İnsanı. *Pamukkale Üniversitesi Eğitim Fakültesi Dergisi, 33(1),* 139-153.
17. Demirbaş, M. (2009). The Relationships Between The Scientist Perception and Scientific Attitudes of Science Teacher Candidates in Turkey: A case study. *Scientific Research and Essay, 4(6),* 565-576.

18. Deniş Çeliker, H. & Erduran Avcı, D. (2015). İlkokul Öğrencilerinin Bilim İnsanı Algıları: Öğrencilerin Bilimsel Faaliyetlere Katılması Bilim İnsanı Algılarını Nasıl Etkiler? *Mehmet Akif Ersoy Üniversitesi Eğitim Fakültesi Dergisi*. 36, 90-104.
19. Eyceyurt Türk, G. & Tüzün Ü. N. (2017). Lise Öğrencilerinin Bilim İnsanı İmajları ve Bilimin Doğası Mitleri, *Ahi Evran Üniversitesi Kırşehir Eğitim Fakültesi Dergisi (KEFAD),*18- 2, 19-36.
20. Farland, D. (2003). *Modified draw-a-scientist test*. Unpublished doctoral dissertation. University of Massachusetts, Lowell.
21. Finson, K. D, Beaver, J. B. & Cramond, B. L. (1995). Development and Field Test of a Checklist for the Draw-A-Scientist Test. *School Science and Mathematics.* 95, 195-205.
22. Fung, Y. Y. (2002). A Comparative Study of Primary and Secondary School Students' İmages of Scientists. *Research in Science & Technological Education*, 20(2), 199-213
23. Gonsoulin, W. B. (2001). *How Do Middle School Students Depict Science and Scientist.* Mississippi State University, Curriculum and Instruction, Doctoral Thesis, UMI Number: 3005589.
24. Güler, T. & Akman B. (2006). 6 Yaş Çocuklarının Bilim ve Bilim İnsanı Hakkındaki Görüşleri, *Hacettepe Üniversitesi Eğitim Fakültesi Dergisi*, 31, 55-66
25. Kara, B. & Akarsu, B. (2013). Ortaokul Öğrencilerinin Bilim İnsanına Yönelik Tutum ve İmajlarının Belirlenmesi. *Journal of European Education, 3(1),* 8-15.
26. Kaya, O.N., Doğan, A. & Öcal, E. (2008). Turkish Elementary School Students Images Of Scientists. *Eğitim Araştırmaları-Eurasion Journal of Educational Research*, 32, 83-100
27. Keser, F. F. (2012). Üstün Yetenekli Öğrencilerin Bilim ve Bilim İnsanına Yönelik Görüşlerinin ve Bu Görüşleri Etkileyen Faktörlerin Belirlenmesi. *Yüksek Lisans tezi, Gazi Üniversitesi Eğitim Bilimleri Enstitüsü*, Ankara.
28. Kohen, P. & Bar, V. (2009). Perception of the Image of Scientist by Israeli Student Teachers From Two Distinct Communities in Israel: Arabs and Jews. *Eurasia Journal of Mathematics, Science and Technology Education, 5(4),* 347-356.
29. Korkmaz, H. (2011). The Contribution of Science Stories Accompanied by Story Mapping to Students' Images ofBiological Science and Scientists. *Electronic Journal of Science Education*, 15(1), 1-41.
30. Korkmaz, H. & Kavak, G. (2010). İlköğretim Öğrencilerinin Bilime ve Bilim İnsanına Yönelik İmajları. *İlköğretim Online 9(3),* 1055-1079.
31. Kuhn, T. (1986). *Bilimsel Devrimlerin Yapısı* (Çev: N. Kuyaş). İstanbul: Alan Yayınları, 12-17.

32. Matthews, B. & Davies, D. (1999). Changing Children's Images of Scientists: Can Teachers Make a Difference? *School Science Review*, 80(293), 79–85.
33. Mead, M. & Metraux, R. (1957). Images of Scientist Among High School students. *Science,* New Series, Vol. 126, 384-390.
34. Medina-Jerez, W., Middleton, K. V. & Orihuela-Rabaza, W. (2010). Using The Dast-C to Explore Colombian And Bolivian Students' Images of Scientists. *International Journal of Science & Mathematics Education.* 9 (3), 657-690.
35. Merriam, S. B. (1988). *Case study research in education: A qualitative approach.* San Francisco: Jossey-Bass.
36. Millford, T. & Tippett, C.D. (2013). Preservice Tecahers' Images of Scientists: Do prior Science Experiences Make a Difference? *Journal of Science Teacher Education*. 24: 745-762.
37. Monhardt, R. M. (2003). The Image of the Scientist Through the Eyes of Navajo Children. *Journal of American Indian Education, 42(3),* 25-39.
38. Narayan, R., Park, S. & Peker, D. (2009). Sculpted by Culture: Students' Embodied Images of Scientists. 3rd International conference to review research on Science, Technology and Mathematics Education. 5-9 January, Mumbai, India.
39. Nath, S. & Thomas, S. (2013). Student's Image About a Scientist at Work: A Phenomenographic Study of Drawings. *International Journal of Educational Science and Research (IJESR),* 3 (1), 41-54.
40. Newton, D.P. & Newton, L.D. (1992). Young Children's Perceptions of Science and the Scientist. *International Journal of Science Education, 14, 331-348.*
41. Nuhoğlu, H. & Afacan, Ö. (2011). İlköğretim Öğrencilerinin Bilim İnsanına Yönelik Düşüncelerinin Değerlendirilmesi. *Ahi Evran Üniversitesi Eğitim Fakültesi Dergisi, 12(3),* 279-298.
42. Özsoy, S. & Ahı, B. (2014). Images of Scientists Through the Eyes of the Children. *Necatibey Eğitim Fakültesi Dergisi, 8(1),* 204-230.
43. Öcal, E. (2007) *İlköğretim 6,7,8. Sınıf Öğrencilerinin Bilim İnsanı Hakkındaki İmaj ve Görüşlerinin Belirlenmesi.* Yayımlanmamış Yüksek Lisans Tezi. Gazi Üniversitesi, Eğitim Bilimleri Enstitüsü.
44. Rodari, P. (2007). Science and Scientists in the Drawings of European Children, *Journal of Science Communication*, 6(3), 1-12.
45. Ruiz-Mallén, I. & Escalas, M.T. (2012). Scientists Seen by Children: A Case Study in Catalonia, Spain. *Science Commutation*, 34(4), 520-545.
46. Schibeci R.A. & Sorensen I. (1983). Elemantry School Children's Perceptions of Scientists. *School Science and Mathematics*, 83 (1), 14-19
47. Song, J. & Kim, K.S. (1999). How Korean Students See Scientists: The Images of the Scientist. *International Journal of Science Education, 21, 957-977.*

48. Steinke, J., Lapinski, M. K., Crocker, N., Zietsman - Thomas, A., Williams, Y., Evergreen, S. H., & Kuchibhotla, S. (2007). Assessing Media İnfluences on Middle School - Aged Children's Perceptions of Women in Science Using Draw - A Scientist - Test (DAST). *Science Communication, 29(1),* 35-64.
49. Stone P J., Dunphy D. C., Marshall S. S. & Ogilvie D. M. (1966). *The General Inquirer: A Computer Approach to Content Analysis*, The M.I.T. Press, Massachusetts.
50. Türkmen, T. (2008). Turkish primary students' perceptions about scientist and what factors affecting the image of the scientists. *Eurasia Journal of Mathematics, Science and Technology Education, 4(1),* 55-61.
51. Toğrol, A. (2000). Öğrencilerin Bilim İnsanı İle İlgili İmgeleri. Eğitim ve Bilim. 25(118), 49-56.
52. Taylor, A. R., Jones, M. G., Broadwell, B. & Oppewal, T. (2008). "Creativity, Inquiry, or Accountability? Scientists' and Teachers' Perceptions of Science Education", Science Education, 92(6): 1058-1075.
53. Vural R.A. & Cenkseven F. (2005). Eğitim Araştırmalarında Örnek Olay (Vaka) Çalışmaları: Tanımı, Türleri, Aşamaları ve Raporlaştırılması. Süleyman Demirel Üniversitesi, *Burdur Eğitim Fakültesi Dergisi*, 6 (10),126-139.
54. Yin, R. K., (2003). *Applications of Case Study Research,* sage. (2nd edition), CA: Thousand Oaks.

Appendix 1: m-DAST *(It was taken from Farland, D. (2003)).*

Imagine that tomorrow you are going on a trip (anywhere) to visit a scientist in a place where the scientist is working right now. Draw the scientist busy with the work this scientist does. Add a caption, which tells what this scientist might be saying to you about the work you are watching the scientist do. Do not draw yourself or your teacher. I am a boy/girl; was the scientist you drew a man or woman? was the scientist you drew working outdoors or indoors? What was the scientist doing in your picture?

Appendix 2: *mDAST Rubric (It was taken from Farland, D. (2003)).*

Appearance:

Illustrations that score a "0" in appearance can be referred to as "can't be categorized". These drawings may contain a stick figure, a historical figure, no scientist, or a teacher or student. Illustrations that score a "1" in appearance can be referred to as "Sensationalized." These drawings contain a man or a woman who may resemble a monster or who has a clearly odd or comic book appearance. Illustrations that score a "2" in appearance can be referred to as "Traditional". These drawings contain an ordinary-looking white male. Illustrations that score a "3" in appearance can be referred to as "Broader than Traditional". These drawings include a woman or minority scientist.

Location:

Illustrations that score a "0" in location can be referred to as "cannot be categorized". The scene of these drawings may be difficult to determine or that of a classroom. Illustrations that score a "1" in location can be referred to as "Sensationalized". These drawings contain a location that resembles a basement, cave or setting of secrecy, scariness or horror, often with elaborate equipment not normally found in a laboratory. Illustrations that score a "2" in location can be referred to as "Traditional". The setting of these drawing is a traditional laboratory with a table and equipment (and possibly a computer) in a normal-looking room. Illustrations that score a "3" in location can be referred to as "Broader than Traditional". These drawings include a scene that is not a basement laboratory and different from a traditional laboratory setting.

Activity:

Illustrations that score a "0" for activity can be referred to as "difficult/unable to determine". Illustrations that score a "1" in activity can be referred to as "Sensationalized". These drawings reveal an activity that may include scariness or horror, often with elaborate equipment not normally found in a typical laboratory. Drawings that include fire, explosives or dangerous work also are included in this

category. Illustrations that score a "2" in activity can be referred to as "naïve or Traditional". These drawings reveal an activity that the student believes may happen, but in truth the activity is highly unlikely to occur. This category also includes drawings where the student writes, "this scientist is studying . . . or trying to. . .", but does not show how this is being done. Illustrations that score a "3" in activity can be referred to as "Broader than Traditional". These drawings portray realistic activities that reflect the work a scientist might actually do with the appropriate tools needed to perform these activities. A student may write, "this scientist is studying… or trying to…" and shows how this is being done.