

**PRE-COLLEGE PROGRAM SEVENTH GRADE STUDENTS'  
DRAWINGS OF A SCIENTIST**

By

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## Abstract

The purpose of this study is to increase the body of knowledge about how students from rural North Carolina perceive scientists. In this study, the researcher explored perceptions of scientists made by 7<sup>th</sup> grade students participating in WCU's NCMSEN Pre-College Program through the use of the Draw-A-Scientist-Test Checklist (developed by Finson, Beaver and Crammond in 1995) and follow-up interviews. Once educators have a better understanding of students' stereotypical images of scientists, they will better be able to teach rural North Carolina students and prepare them for future career opportunities in the sciences at an early age.

## INTRODUCTION

Previous research has highlighted three themes regarding students' drawings of scientists and the relationship between drawings, attitudes, and science educational choices. The first theme links the images students have of scientists with decisions students will make in the future concerning education and careers. The second theme covers the history of the Draw-a-Scientist-Test (DAST) as a means of ascertaining the stereotypical images students have of scientists. The third theme shows that the existing research concerning rural North Carolina students and their perception of scientists is lacking. Therefore, more research is necessary concerning students from this area.

### **Theme 1: Linking images students have of scientists to education and career decisions**

All students have more positive attitudes toward a subject when the subject they are learning seems directly relevant to their lives (Zacharia, 2004). Attitudes about a particular subject influence the choice of school courses. This extends from middle school into post secondary education. Data show that students must choose the science "pipeline" early in their education in order to achieve the training necessary for science careers (Oakes, 1990). The middle school years are often seen as a critical time for students to enter this pipeline (Zacharia, 2004). There are challenges that students from rural areas have to overcome that are often not present for other students.

Underrepresented students, including those living in rural areas, have fewer science educational opportunities and fewer role models in science (Oakes, 1990). Often, it is difficult for young people to relate to a specific career if they do not have consistent role models in that career (Finson, 2003). More importantly, it appears that one of the deterrents of students from entering science careers is the stereotypical image they hold of a scientist (Finson, 2003). If a student cannot picture herself as a scientist, she will most likely not view this as a possible career option (Monhardt, 2003; Finson, 2002).

### **Theme 2: The History of the DAST**

Although 50 years have passed since Mead and Metraux asked high school students to write about what they thought of scientists, the attitudes and images produced by similar studies have been relatively uniform. The stereotypical image that a scientist is "a man who wears a white coat and works in a laboratory" (Mead & Metraux, 1957 pp. 386-387) remains. Between 1966 and 1977, Chambers assessed the drawings of 4807 K-5 students who were asked simply to "Draw a Scientist." This Draw-a-Scientist Test (DAST) was

developed by Chambers (1983) as a way to see when the stereotypic image of the scientist described by Mead and Metraux develops.

To analyze the drawings, seven aspects were chosen as stereotypical scientist image characteristics:

(1) Lab coat (usually but not necessarily white). (2) Eyeglasses (3) Facial growth of hair (including beards, mustaches, or abnormally long sideburns). (4) Symbols of research: scientific instruments and laboratory equipment of any kind. (5) Symbols of knowledge: principally books and filing cabinets. (6) Technology: the “products” of science. (7) Relevant captions: formulae, taxonomic classification, the “eureka”! syndrome, etc. (Chambers, 1983, p. 258).

Chambers found that this standard image of the scientist begins to emerge around 2<sup>nd</sup> grade (1983). A study Fort and Varney published in 1989 found that students continued to draw pictures of scientists as predominately white males. More than 1,600 students from grades 2-12 participated in their study to draw a picture of a typical scientist and write about it. Of these drawings, less than 20 were of minority scientists, and only 165 were of female scientists (Fort & Varney, 1989).

Matkins modified the DAST to see if teachers could affect their students’ perceptions of scientists (1996). She and her team used a different method of scoring to see if students had a more positive or negative perception of scientists by assessing their drawings and by interviewing the students. She administered her DAST-R (Draw-a-Scientist Test Revised) to 90 students, and then had teachers interview the students about their drawings. She found that adding the interviews was helpful for teachers to better ascertain the meaning behind the drawings (Matkins, 1996).

Jones and Bangert (2006), drawing from Matkins’ findings, also had students draw scientists and added interviews for clarification. Their convenience study of 265 7<sup>th</sup>, 9<sup>th</sup>, and 11<sup>th</sup> grade Montana students found that the 7<sup>th</sup> grade female students drew more female scientists than in previous studies. Some interviewed students cited CSI or similar shows as possible contributors to their mental image of scientists. Jones and Bangert (2006) may be correct in thinking that 7<sup>th</sup> grade students drew more female scientists due to the CSI effect, but more research needs to be done about this topic.

Film has proven to have an effect on students’ images of a scientist. Fort and Varney cite the portrayal of the scientist Doc in the movie *Back to the Future* as a strong contributor to the student drawings (1989). In Monhardt’s DAST study involving Navajo children, she found that their drawings were greatly influenced by the National Geographic video shown in science class the week before (2003).

Finson (2002), in his work, “Drawing a Scientist: What We Do and Do Not Know After Fifty Years of Drawings,” describes a change in the stereotypical scientist based on the changing media. The early drawings included many “mad scientists” reminiscent of Frankenstein and Jekyll and Hyde. He suggests that teachers should help the students learn to analyze the media in order to be aware of the negative stereotypes scientists receive (Finson, 2002).

### **Theme 3: Rural North Carolina students and the DAST**

The body of research involving rural North Carolina students and the DAST is very limited. The researcher was able to find several studies involving rural students from elsewhere in the United States, but none from rural North Carolina. Herzog & Pittman

(1995), in “Home, family, and community: Ingredients in the rural education equation,” surveyed Western Carolina University students, many who grew up in the surrounding counties. Their interviews reflected a generally positive view of rural community closeness. However, there was the sense in many of the student comments that their rural education left them a little unprepared for college (Herzog & Pittman, 1995).

In the 2007 Rural School and Community Trust Policy Program report entitled, “Why Rural Matters,” the data about North Carolina is disheartening. Only five other states have poorer rural high school graduation rates. According to this report, North Carolina is also in the “Urgent” category in the “Socioeconomic Challenges Gauge” due to the percentage of rural families in poverty (15.9%) and other socioeconomic indicators including “percentage of rural students eligible for free or reduced meals, (45.2%)” (Johnson & Strange, 2007).

Students in rural North Carolina do not have access to as many rigorous science courses in middle and high school as their urban peers. Rural students also have more limited access to role models in the science field. Due to this, it is possible that the view of scientists held by rural North Carolina students is driven mostly by the media. By identifying how these students perceive scientists, educators will be better able to address some of the stereotypes and empower more rural students to pursue careers in science.

## **METHODS**

### **Participants**

The nineteen 7<sup>th</sup>-grade students involved in the study were all participants in Western Carolina University’s NC-MSEN Pre-College Program. Of the students who participated, nine were female and ten were male. According to their 2007-2008 Year Report, the Pre-College Program at WCU served 160 students in grades 6 – 9. Their student enrollment for that year included, “24% minority students, 60% females, 80 % first generation college or low-income students” (p. 2). The curriculum of the Pre-College Program includes science, technology, math, and communications. Students participate in academic enrichment activities during Saturday Academies (one per month), and Summer Scholars Camp, both held on campus at WCU (McManus, 2009).

### **Setting**

The students included in this research study all attend public school in rural Western North Carolina in the following counties: Graham, Haywood, Jackson, Cherokee, Swain and Macon. The two Pre-College Saturday Academies at which this research was conducted occurred on the campus of Western Carolina University on January 24<sup>th</sup> and February 21<sup>st</sup>, 2009.

### **Procedure**

During the January 24<sup>th</sup> Saturday Academy, the students were given colored pencils and blank paper and asked to draw a scientist. The researcher reassured anxious students that they would not be judged on artistic ability and would not be receiving a grade for the assignment. During the next Saturday Academy, the researcher interviewed a representative sample of 7<sup>th</sup> grade students. The informal interviews began with the researcher prompting, “Tell me about your drawing.” If any aspect of the checklist was

unclear in the drawing, the researcher would ask about the checklist item. For example, a specific follow-up question asked was, “Is your scientist indoors or outdoors?”

## Data Analysis

The drawings were analyzed using the DAST-Checklist developed by Finson, Beaver & Crammond in 1995. The researcher compared the drawings, the DAST-Checklist scores and the transcribed interviews based on gender, ethnicity, and attendance in Pre-College Program activities. The Pre-College DAST-Checklist results were also compared to results from the Pretest and Posttest of Finson et al. (1995) in order to determine if any trends emerged.

## RESULTS

As found in prior research using the DAST, most drawings produced by the Pre-College Program students were of Caucasian, male scientists, wearing lab coats, working indoors. The matrix below shows a composite look at results generated by the researcher, using Finson, Beaver, and Crammond’s 1995 DAST-Checklist.

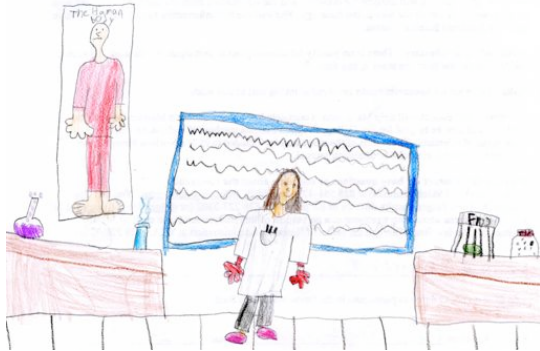


Table 1

Scientist Drawing Stereotypical Features	Total N = 19	% of drawings
Interview	14	74%
Attended Pre-College Summer Camp	15	79%
1. Lab Coat	11	58%
2. Eyeglasses	10	53%
3. Facial Hair	2	11%
4. Symbols of Research	16	84%
5. Symbols of Knowledge	6	32%
6. Technology	3	16%
7. Relevant Captions	4	21%
8. Male Gender	13	68%
9. Caucasian	18	95%
10. Indications of Danger	7	37%
11. Presence of lightbulbs	0	0%
12. Mythic Stereotypes	5	26%
13. Indications of Secrecy	2	11%
14. Scientist Indoors	15	79%
15. Middle Aged or Elderly	4	21%
DAST-Checklist Results from Pre-College Program 7th grade student drawings		

After transcribing and coding the interviews, two trends emerged. Nine of the fourteen students interviewed had a mostly positive image of scientists as reflected by comments relating either to scientific innovation, or the idea that anyone can be a scientist.

Positive quotes from students relating to scientific innovation:

- "...to cure different kinds of cancers or some types of diseases"
- "She has been figuring out new chemicals."
- "He's mixing chemicals... to test an experiment."
- "They can discover a lot of really cool and new things."
- "My scientist is testing some element she is trying to discover."

Positive quotes from students relating to the theme that anyone can be a scientist:

- "There's whole different kinds of scientists."
- "Then I drew a stick figure 'cause that could be anybody."
- "I believe that women should be scientists, and not only men."
- "A scientist can be like anyone and they can do anything they want."



Of the five students with a negative scientist image, they mostly described stereotypes of nerdy or insane scientists.

Student quotes that reflected a negative scientist image:

- "Loser's Magazine"
- "Crazy Monsters,"
- "He has to go to his lab and create some crazy concoction of chemicals and boil stuff."
- "I think of like the crazy ones with crazy hair and they stay up all night."
- "He's evil."



After looking at the Pre-College students' drawings, listening to their interviews, and scoring the drawings using the checklist, the researcher saw the following trends: 95 % of drawings were of Caucasian scientists. A large number of scientists were working indoors (79%), with symbols of research such as test tubes and beakers (84%), and wearing lab coats (58%). In general, most drawings seemed to be of chemists working in labs.

### **Comparison Data**

Finson et al., in their 1995 pilot study, used the DAST-Checklist as a pretest and a posttest to survey 24 rural eighth grade students who participated in a program involving school-year research projects and internships in the science field. Students worked with science faculty from a local university. The study authors describe the program in this way, "The treatment program was designed to purposely expose students to alternative images of scientists: Females, representatives of various cultural groups, and those working in natural settings" (Finson et al., 1995 p. 197).

Because the Finson, Beaver, & Crammond study involved rural middle school students participating in a college-based science enrichment program, it makes a fairly close comparison for WCU's Pre-College Program. The researcher used the same checklist in order to compare the data. Compared with Finson Beaver and Crammond's 1995 study, it appears that the Pre-college students drew scientists who were less stereotypical than the (1995) Finson et al. Pretest data, and more stereotypical than the Posttest 1 data, in most categories.

**Table 2**

Comparison of DAST-Checklist Data from Pre-College Study and Finson et al. Study (1995)			
Stereotypical Feature	Pre-College 7 <sup>th</sup> grade students N = 19	Finson et al. Study 8 <sup>th</sup> grade students Pretest N = 24	Finson et al. Study 8 <sup>th</sup> grade students Posttest 1 N = 24
1. Lab Coats	57.9%	72.2%	31.9%
2. Eyeglasses	52.6%	61.1%	47.2%
3. Facial Hair	10.5%	1.3%	13.8%
4. Symbols of Research	84.2%	52.7%	52.7%
5. Symbols of Knowledge	31.6%	43.0%	26.3%
6. Technology	15.8%	0.0%	6.9%
7. Relevant Captions	21.1%	66.6%	4.2%
8. Male Gender	68.4%	83.1%	65.3%
9. Caucasian	94.7%	95.9%	95.9%
10. Indications of Danger	36.8%	0.0%	0.0%
11. Presence of Light Bulbs	0.0%	4.1%	0.0%
12. Mythic Stereotypes	26.3%	11.1%	8.3%
13. Indicators of Secrecy	10.5%	0.0%	0.0%
14. Scientist Doing Work Indoors	78.9%	95.9%	97.3%

The category of note in which the Pre-College students ranked lower was indoor scientists. In the Pre-College study, the outdoor scientists were doing a number of different things in the drawings. One was talking with Einstein, another was feeding an animal, a third was represented by a stick figure, and the fourth appeared to be recording observations about a bird in a tree. All four students who drew outdoor scientists attended the Pre-College Program Summer Scholars Camp in 2008. It is possible that participation in outdoor science activities with Pre-College impacted the students' drawings.

## DISCUSSION

### Limitations

Limitations to this study include the lack of a control group of students, and the comparison of data from a study published 14 years previously, involving a program in another part of the country.

## Implications

In their 2008 program brochure, WCU's Pre-College Program states, "The NC-MSEN Pre-College Program is designed to broaden the pool of students who graduate from high school with sufficient preparation to pursue mathematics and science programs of study at the university level and to move into careers in science, mathematics, technology, engineering, and teaching" (p. 1). This group is a significant population in which to evaluate scientist stereotypes since one of their main goals is to increase the number of students in the science educational pipeline discussed earlier (Oakes, 1990).

While results of this study are specific to the conceptions of scientists, middle school students may have stereotypical images of other careers and other content areas. Educators can help students examine these stereotypes using similar Draw-A-Profession activities. With knowledge gained from this study, teachers working throughout rural North Carolina can address the negative stereotypes some students have regarding scientists.

Teachers can incorporate resources that highlight the innovations of female and non-Caucasian scientists. Educators can also facilitate activities in which students engage in hands-on, inquiry-based study, so that more students see themselves as scientists. By broadening the scope of middle school science experiences, rural educators may be able to assist students in their journey on the science education pipeline, and better prepare the scientists of tomorrow.

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