Draw a Scientist Revisited: The Influence of Outdoor Experiences on Children's Idea of a "Scientist"

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Background

The Draw a Scientist activity has been used in a variety of contexts to examine student beliefs and perceptions about scientists and science (Cavallo, 2007; Losh et. al., 1983). Most often, we seek to examine racial or ethnic stereotypes (Chambers, 1983, Finson, 2002). Here, we used the Draw a Scientist activity to determine whether exposure to field-based activities would alter student perceptions about what being a scientist entails, and who can become a scientist. Students were sixth graders who participated in a program at the National Aquarium in Baltimore titled "What Lives in the Harbor." The program is integrated into the Baltimore City Schools curriculum and satisfies a portion of the Maryland State Department of Education's required Meaningful Watershed Educational Experience (MWEE). The MWEE experience begins with classroom activities meant to provide students with content background and context for the investigation that will take place at the aquarium. Students view a series of videos introducing the history of Baltimore's Inner Harbor and the economic and ecological significance of the Chesapeake Bay. Also prior to the field experience, middle school students research species potentially living in the harbor and create a set of species cards with the typical living parameters for each animal. Teachers also lead an activity in which their sixth graders determine how a scenario would affect the species they researched. Students end the issue definition phase by viewing videos about equipment use and safety information for the field experience. During the outdoor investigation at the aquarium students rotate through three stations, where they collect water quality readings. Students also collect quantitative data that help them determine which organisms from their species cards would be able to survive in the harbor. The data are sent to classroom teachers for use in synthesis and conclusion activities that subsequently take place in the classroom. The data can also be used to inform action projects.

Figure 2:

Data Collection

The Draw a Scientist student artifacts were collected from Baltimore City 6th grade students participating in a Meaningful Watershed Educational Experience (MWEE) focusing on Chesapeake Bay water quality at the National Aquarium. These students were asked to complete the draw a scientist template at the start of the MWEE unit, and again upon completing the outdoor field experience at the National Aquarium. The template that was provided asked students to:

1. Draw a picture of a scientist
2. Where is the scientist working? What is the scientist doing?

Students were all given crayons as an option to use in their drawings, but students had the choice to use pencil or pen as well.

Data Findings

The "Draw a Scientist" data was coded using 16 criteria applied to pre and post student artifacts. The findings from the coding of 369 student artifacts include:

1. More students developed images of scientists in outdoor environments in the POST images.

Explanation: After the experience at the aquarium students included more scientists working outdoors, specifically in the Chesapeake Bay or outdoor aquatic environment in their drawings. This result could be attributed to students themselves completing, collecting and analyzing data in this environment through the MWEE outdoor experience. Their firsthand experiences conducting science investigations outdoors influenced students to realize that science does not always have to take place in an indoor laboratory setting.

2. More students included scientists of minority ethnicities in the POST images.

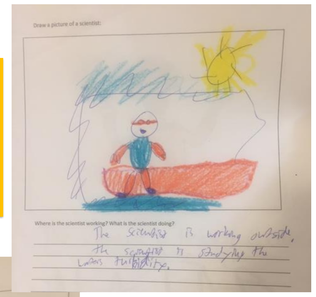
Explanation: After the experience at the aquarium students included more minority scientists in their drawings. This could be attributed to students being exposed to African American female scientists during the preliminary MWEE classroom activities that took place prior to the outdoor experience. During the MWEE outdoor component, the lead "scientists" were students from a Historically Black University and a majority Caucasian university. These students were also of different genders and ethnicities. Seeing that people of both genders and different ethnicities could "be scientists" could have influenced students to realize that anyone can be a scientist, and that in turn could have influenced their drawings post-experience.

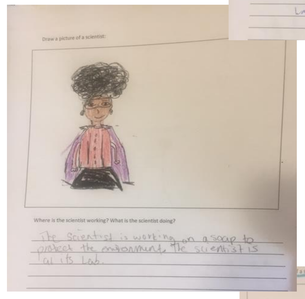
3. More students developed images of male scientists in Pre and Post images.

Explanation: Even after exposure to female scientists both during the preliminary classroom activities and during the outdoor experience at the National Aquarium, many students still provided the image of a male scientist in their drawings. This indicates that gender stereotypes may still exist in science.

Student Examples

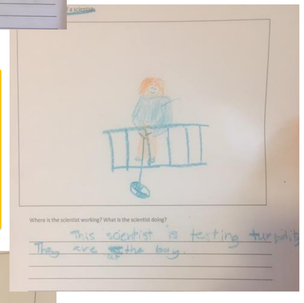
"The scientist is working outside. The scientist is studying the waters turbidity."

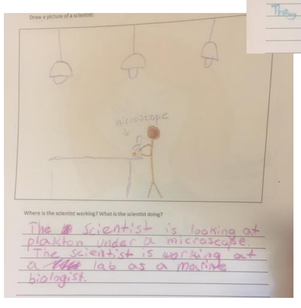




"The scientist is working on a soap to protect the environment. The scientist is at its lab."

"This scientist is testing turbidity. They are at the bay."





"The scientist is looking at plankton under a microscope. The scientist is working at a lab as a marine biologist."

Data Table

Criteria	Pre	Post
Caucasian ethnicity	47.47%	27.34%
Other ethnicity displayed or undetermined	52.73%	72.06%
Indoor environment or lab	64.24%	54.90%
Outdoor environment (Chesapeake Bay or outdoor aquatic environment).	3.64%	18.14%

** Data only includes observable data in the student artifacts, if the criteria was not visible in the image drawn or the description then it was not included into the data**

Discussion

Of the list of stereotypical attributes first described by Chambers (1983), very few of our students included "middle aged male", "lab coat", or "eyeglasses" in either of their drawings. We also see an increase in the number of students drawing people of color in the post-test. These are both encouraging outcomes, as in many instances, children's drawings do contain these attributes, and the scientist drawn is most often Caucasian, regardless of the race of the child (Odell et. al.; 1993). However, the subjects in this study did draw mostly male scientists. This result indicates that gender stereotypes still exist in science, and that they are difficult to dispel. Most researchers attribute these results to the media- scientists are still largely portrayed as male figures in television shows, movies, cartoons, and even in many advertisements (Miller et. al.; 2018). It is important for educators to demonstrate to students that females can become successful scientists, to point out important contributions of female scientists, and to give students opportunities to interact with females with careers in the sciences (as we did in this study).

Finally, our results indicate that exposure to outdoor field experiences may lead to young students realizing that not all science is conducted indoors. After their field experiences at the National Aquarium, more students drew their scientist conducting research or otherwise working outdoors. This is significant because, over the past few centuries, depictions of scientists have almost completely moved away from the "naturalist in the field"- common in the 18th and 19th centuries- to the stereotypical laboratory scientist (Chambers, 1983). Our data suggests that repeated exposure to outdoor science investigations and experiences might remedy this situation.

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