Chapter 13

The Difference between Evaluating and Understanding Students’ Visual Representations of Scientists and Engineers

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ABSTRACT

This chapter is a discussion of multiple tools for analyzing children’s representations of scientists and engineers. Draw-A-Scientist and Draw-An-Engineer protocols have been utilized by science education researchers to investigate learners’ perceptions of scientists and engineers. The chapter discusses the methods for analyzing students’ perceptions of scientists and engineers how aspects of analysis lead to deeper understanding of the visual data. The discussion presented here is framed in the context in which refined protocols and rubrics are tools that uncover ranges of conceptions, and sometimes visual data are best examined by simple evaluation methods and sometimes by a qualitative rubric. The overarching question of this section is how can researchers use analysis of visual data to further what they already know about conceptions of scientists and engineers.

INTRODUCTION

We live in a world today where we are overloaded with visual data. Now more than ever, we have masses of resources and information at our fingertips. But how much of the visual data do we really understand? As teachers, we lean towards thinking of visual data of something that is external, in which our students absorb, or experience in textbooks or learning environments versus representations that our students
create for us to learn more about them. As researchers who have spent the last ten years intrigued by what students were telling educators about their interest in science careers through their representations or visualizations, we have sought a deeper understanding of what these images mean to us, as classroom educators. While analyzing and evaluating these pictures of scientists and engineers is interesting and often enjoyable, the work we do is often haunted by one nagging question: Do these representations of those in science fields really mean anything? How can this visual data be viewed from multiple perspectives and provide deeper meaning? As more visual data become available, rubrics appear to be changing the accepted understanding of the visual data students provide in terms of science and engineering fields.

Science and engineering are two disciplines that are commonly referred to as being comparable in nature. Over the last fifteen years, engineering has made its way into science curriculum at all levels, elementary, middle and high school. The most notable example is in the science standards when the National Research Council created the Next Generation of Science Standards (NRC, 2012) to include engineering practices. The inclusion of engineering practices expands the previous National Science Standards from 1996 to include relevant practices germane to both science and engineering in addition to disciplinary core ideas in the science content areas and crosscutting concepts. Key ideas in science, like, asking questions are not only reinforced as guiding principles of scientific investigations but also are inclusive from the engineering perspective as in asking questions to solve problems and to elicit ideas that lead to the constraints and specifications for its solution. “STEM” programs are becoming increasingly popular to address these engineering perspectives. And so it seems appropriate that we examine visual data of scientists to include the specific field of engineering. However, there seems to be a newer contemporary understanding of how to understand this visual data versus past studies in which only evaluated the what of visual data.

EVALUATING VISUAL DATA FROM STUDENTS ABOUT SCIENTISTS AND ENGINEERS

Well before children are able to express and verbalize which careers may be interesting to them, they are forming opinions and impressions from the world in which they live. Children collect and store ideas about scientists and in some cases engineers as well based on their experiences. For this reason, asking children to complete what science educators frequently term the Draw-A-Scientist Test (DAST) became a popular method for providing insight into how children represent and identify with those in the science fields. In its many forms, visual information and visual data within these illustrations have an important role to play with respect to learning and career choice. These assumptions might exhibit themselves in multiple ways, such as influencing someone’s conceptions or even serving as tools that enable educators to investigate, collect information, and utilize that information to improve their instruction and student learning. The focus of this portion of the chapter is to discuss the analysis of this form of visual data and provide multiple means of evaluation as a way to understand these visual representations.

Students’ images have been the focus of research for decades (i.e., Mead & Metraux, 1957; Chambers, 1983; Finson, 2002) with the consistent consensus of an emerging stereotype including scientists as white men, in lab coats, working alone in laboratories. A number of studies that asked students to