Chapter 45
Engaging Students in Conducting Data Analysis:
The Whole-Class Data Advantage

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ABSTRACT

Computer Supported Collaborative Science (CSCS) is a teaching pedagogy that uses collaborative web-based resources to engage all learners in the collection, analysis, and interpretation of whole-class data sets, and is useful for helping secondary and college students learn to think like scientists and engineers. This chapter presents the justification for utilizing whole-class data analysis as an important aspect of the CSCS pedagogy and demonstrates how it aligns with the Next Generation Science Standards (NGSS). The chapter achieves this end in several ways. First, it reviews rationale outlined in the NGSS science and engineering practices for adapting 21st century technologies to teach students 21st century science inquiry skills. Second, it provides a brief overview of the basis for our pedagogical perspective for engaging learners in pooled data analysis and presents five principles of CSCS instruction. Third, we

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offer several real-world and research-based excerpts as illustrative examples indicating the value and merit of utilizing CSCS whole-class data analysis. Fourth, we postulate recommendations for improving the ways science, as well as other subject matter content areas, will need to be taught as the U.S. grapples with the role-out of new Common Core State Standards (CCSS) and NGSS. Taken together, these components of CSCS whole-class data analysis help constitute a pedagogical model for teaching that functionally shifts the focus of science teaching from cookbook data collection to pooled data analysis, resulting in deeper understanding.

INTRODUCTION

Science education in the United States is about to undergo one of the most significant shifts since it was overhauled in response to the Soviet Union's launching of Sputnik I in 1957. After Sputnik, our nation's science curricula were renovated to meet the evolving needs of a technologically threatened society. As we entered the 21st century, it was recognized that the U.S. was once again behind in the teaching and learning of the core concepts needed to build a strong foundation in life-long learning including in science (NCES, 2013). The problems in science education in this country are all too familiar. Conditions have hardly changed since the 1989 report "Science for All Americans" (AAAS, 1990). Science classes are often still taught by underprepared teachers in a highly didactic manner that does little to promote understanding of science or the nature of scientific knowledge (McNeill & Krajcik, 2008; Newton, 2002). These issues might contribute to the fact that American students still lag far behind other leading countries in science achievement, which will inevitably result in a looming shortage of science/technical workers in the U.S. (Augustine, 2007; OECD, 2010). The majority of American students are still taught in large urban schools that often lack adequate science instructional resources and tend to have low student expectations (Tal, Krajcik, & Blumenfield, 2006). The need to update 21st century teaching in the U.S. has led to the introduction of the Common Core State Standards (CCSS) and the Next Generation Science Standards (NGSS). These standards are already changing the *way* teachers will be required to teach as well as the *what* they will need to teach. With such mandated changes quickly approaching, increasing effort is being invested in *how* teachers will be required to teach students 21st century skills. This chapter focuses on the *how* of the new standards implementation by bringing cloud technology to K-20 science classrooms to teach NGSS and CCSS through the use of collaboration and whole-class data analysis as it is gathered in inquiry based classrooms.

Recognizing that science is the systematic study of the structure and behavior of phenomena in the physical and natural world through observation and experimentation, it is clear that there should be an emphasis on inquiry. This should be modeled in the classroom as it would be practiced in a research laboratory setting. The National Science Education Standards were developed by the National Research Council to "promote a scientifically literate citizenry". The Standards frequently encourage the use of *inquiry* in the science classroom, defining it as:

A multifaceted activity that involves making observations; posing questions; examining books and other sources of information to see what is already known; planning investigations; reviewing what is already known in light of experimental evidence; using tools to gather, analyze, and interpret data; proposing answers, explanations, and predictions; and communicating the results. Inquiry requires identification

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