Chapter 93
Next Generation Science Assessment:
Putting Research into Classroom Practice

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ABSTRACT

The recent release of science education documents such as A Framework for K-12 Science Education: Practices, Crosscutting Concepts, and Core Ideas (National Research Council, 2012) marks the transition into a new generation of science education. This transition necessitates a close look at how pre-college science teachers will assess a diverse group of students in ways that are consistent with science education reform. In this chapter, the authors identify current research in science assessment and employ assessment coherence, assessment use, and assessment equity as guiding principles to address the challenges of putting science assessment research into classroom practice. To exemplify these challenges, they describe a study where a research instrument designed to measure scientific reasoning skills was translated into a high school science classroom assessment. The goal of this chapter is to stimulate conversation in the science education community (researchers, assessment developers, teacher educators, administrators, and classroom teachers) about how to put science assessment research successfully into practice and to describe what next steps need to be taken, particularly around assessing diverse student populations.

NEXT GENERATION SCIENCE ASSESSMENT: PUTTING RESEARCH INTO CLASSROOM PRACTICE

Assessment has always been a topic of interest in science education, but its importance is perhaps even more critical now, as pre-college science teachers prepare the next wave of students for economies of the 21st century. The importance of assessment rests on the premise that what *is assessed* often drives what *is taught*, thus, to equip students with the scientific knowledge, skills, and habits of mind called for in science education means that science teachers should also *assess* desirable knowledge, skills, and habits of mind.

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Furthermore, the general role of educational assessment in society has changed considerably over the last few decades due to shifts in how educational researchers view measurement, learning, and the role of education (Shepard, 2000). One outcome of this shift is an emphasis on using assessment for formative purposes, meaning that "activities undertaken by teachers, and by their students in assessing themselves, [provide] information to be used as feedback to modify teaching and learning activities" (Black & Wiliam, 1998, p. 140). This description emphasizes the function and not the form of the assessment; to be formative, "feedback needs to contain an implicit or explicit recipe for future action" (Wiliam & Leahy, 2007, p. 31). Therefore, classroom assessment can serve an instructional role, making it even more important to understand in light of classroom realities.

By science *classroom assessment*, I am referring to the process of finding out what students know and can do in the context of what is being taught in the science classroom. Ideally, assessment informs the teacher and the students themselves, so that decisions could be made, giving a grade or other evaluative mark, diagnosing the students' prior knowledge, or deciding what next steps to take in instruction. In this chapter, rather than answer an empirical research question or review a body of literature, I aim to stimulate a conversation by addressing the challenges of putting science assessment research into classroom practice. I begin by highlighting some of the major reforms and innovations in science assessment over the last twenty years to demonstrate where we are in terms of research. I then describe three assessment principles that can guide how researchers examine the practice of assessing in science classrooms as well as guide science teachers themselves in terms of how they assess. Finally, I will describe my participation in a classroom-based research study that exemplifies the challenges faced when putting science assessment research, centered on assessing scientific reasoning, into classroom practice. The intended audience is primarily science teachers who have the daunting task of translating research into practice and the science education researchers who seek to both study and support science teachers in this endeavor. However, anyone invested in science education, curriculum/assessment developers, administrators, and policy makers, can benefit from the discussion that follows.

WHAT TO ASSESS IN SCIENCE CLASSROOMS? A STARTING POINT

The essence of any science classroom assessment is to elicit and be able to interpret some desirable information about what students are being, or will be, taught. If the desirable information is whether students know the definition of the word "adaptation," then the assessment could ask students to write out the definition of adaptation, or have them select from a list of definitions. However, the next generation of science education is not about preparing students to recite definitions, but rather preparing scientifically literate students. Scientific literacy has been conceptualized in a variety of ways, primarily referring to being "knowledgeable, learned, and educated in science" (Phillips & Norris, p. 224), a conceptualization that, unfortunately, often overlooks reading and writing in science, a fundamental sense of literacy. I appropriate the term scientific literacy broadly to encompass how various science education documents and frameworks describe what is important to learn in science education.

A premise for this chapter is that what is being assessed should resemble what is deemed important to learn in science, thus assessments should inform the teacher about student progress toward becoming scientifically literate. Organizations and committees have published seminal documents, such as *Benchmarks for Science Literacy* (American Association for Advancement in Science, 1993), *National Science Education Standards* (National Research Council, 1996), and