

Chapter 15

Measuring and Facilitating Highly Effective Inquiry– Based Teaching and Learning in Science Classrooms

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ABSTRACT

For the last decade or so there has been a huge push to incorporate best practice into the classroom. For science, this includes bringing effective inquiry-based instruction into all classrooms as a means to engage the learner. However, all inquiry instruction is not equal in terms of improving student achievement and conceptual development. This chapter explores how four critical constructs to learning (curriculum, instruction, discourse, and assessment) can be effectively measured and then used to guide more effective instructional practice. The Electronic Quality of Inquiry Protocol (EQUIP) is an instrument that can be used to measure and then to frame the discussion regarding the quality of inquiry-based instructional practice. Specifically, this chapter provides an overview of EQUIP, details the reliability and validity of EQUIP, shares a sample lesson that is analyzed using EQUIP, explores ways that EQUIP can help with teacher transformation relative to inquiry instruction, and addresses the relationship of EQUIP scores and student achievement data. There is a very high correlation between teacher performance on EQUIP and the ensuing student growth noted during an academic year.

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Bringing high-quality inquiry-based instructional practice into science classrooms has continued to be central to reform efforts for the last several decades (Bransford, Brown, & Cocking, 2000; National Academy of Sciences, 2007; National Research Council, 1996, 2000, 2012; National Science Teachers Association, 1998). However, merely increasing the quantity of self-reported inquiry instruction is insufficient (Marshall, Horton, Igo, & Switzer, 2009); the quality of inquiry instructional practice must be at such a level that teachers are effective in facilitating rigorous, standards-based, inquiry-based learning. Success in achieving this goal has been largely inconsistent at best in programs across the country. Definitions of inquiry-based instruction may vary somewhat, but clear direction has been given to defining and exemplifying inquiry-based instruction (NRC, 1996, 2000). Even though consistency can be found among many of the definitions and agreement is found in the desire for reform that includes inquiry-based instruction, the implementation remains inconsistent.

As science education looks ahead to the next decade or so of science instruction, *A Framework for K-12 Science Education: Practices, Cross-cutting Concepts, and Core Ideas* (NRC, 2012) has begun to pave the way for a new vision of teaching and learning that is more intentional and more integrated. This framework which serves as the predecessor for the *Next Generation Science Standards* (due out soon) makes clear that inquiry forms of instruction need to integrate cross disciplinary concepts and core ideas into the learning. No longer is it sufficient to teach inquiry as a stand-alone unit and then proceed to learning “the content.” Inquiry helps provide the context for learning major concepts and ideas.

We know that successful inquiry-based instruction is often the result of numerous professional development experiences. For more experienced teachers, these experiences are necessary because transformation of practice is needed to move from prior more teacher-centered paradigms to a more student-centered, constructivist approach where students build on prior knowledge through a series of science learning experiences. For neophyte teachers, inquiry instruction should not be a new concept, but support is often needed to help achieve a significantly inquiry-centered environment. For these beginning teachers, they often have to overcome many of their college experiences, which were typically solely confirmatory experiences as well as overcoming peer, departmental, and/or school structures that may model learning that is counter to inquiry.

Capps, Crawford, and Constanas (2012) conducted an analysis of professional development programs in an effort to see how well aligned to best practices many of the programs currently are. Their findings suggest that most of the analyzed programs generally align with the recommended features of effective professional development (Darling-Hammond & McLaughlin, 1995; Garet, Porter, Desimone, Birman, & Yoon, 2001; Loucks-Horsley, Stiles, Mundry, Love, & Hewson, 2010). The structural features of effective professional development experiences include significant interactions that include extended support through the academic year while providing authentic experiences for teachers. Further, core features of such professional development include many or all of the following: coherence, lesson development, modeled inquiry experiences, reflection, transference of new skills, and content knowledge development. Our work has shown during the past 5 years, that teachers who are engaged in our professional development model associated with Inquiry in Motion are able to raise student achievement higher than the virtual comparison group of similar students (Marshall, Horton, & Edmondson, 2007; Marshall & Horton, 2009).

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