Chapter IX

Assessing Science Competence Achieved at a Distance

As in the case of all branches of art, success depends in a very large measure upon individual initiative and exertion, and cannot be achieved except by dint of hard work.

– Anna Pavlova (1881-1931)

Assessment of student learning is integral to design of curricular experiences, a reality which is often purported to be more complex in online learning environments (Wijekumar, Ferguson, & Wagoner, 2006) and characteristic of constructivist praxis (Comeaux, 2005-2006; Segall, Doolen, & Porter, 2005). However, the framework within which evaluation occurs—with assessment as one form of evaluation, unique to the learning environment—is constant (Williams, 2004). Moreover, learning assessment was a meaningful topic pre-constructivism and assessment literature in online learning is nearly identical to that of assessment in general, especially as computerized assessment methods become more popular for all learners (Holtz & Radner, 2005; Robles & Braathen, 2002). There are differences and specific challenges; however, in practice those challenges need not be onerous. This chapter describes current practices in online learning assessment, notes similarities in on-site and online methods and explores the differences and how those differences are or can be addressed for online science learning.
Assessment Standards and Science Assessment

Assessment in online learning actually increases accountability for real learning, simply because the controls that instructors typically use (e.g., face-to-face monitoring, synchronicity) are, at best, ephemeral in online learning (Holtz & Radner, 2005; Lorenzetti, 2003). Routine, surface assessments, while nowhere near ideal, may be employed in both environments, but need not occur in distance any more so than classroom-based.

To review briefly, learning assessment is categorized as formative or summative. Formative assessment is ongoing and serves to inform both the instructor and the student where the student stands, in terms of achievement of course objectives (e.g., quizzes, laboratory reports). Summative assessment is the penultimate evaluation of the student’s achievement throughout the course (e.g., final exam, project or paper) (Holtz & Radner, 2005). Wiggins and McTighe (1998) maintain that the use of both formative and summative assessment remains standard best practice (after Bloom, Hastings, & Madaus, 1971), although the authors have both experienced science courses where summative assessment was not used.

Perhaps the most important idea for the typical instructor to remember is that learning assessment is a well-developed field of study in itself, with substantial literature, an extensive knowledge base and specialized vocabulary. While some readers may consider these characteristics self-evident, default educators—those who teach within their field of specialty without the benefit of formal education theory-to-practice background—often assess as they were assessed, simply because those techniques are what they know and because they are unaware of the options (Holtz & Radner, 2005).

Yet, in Against Method, Feyerabend (1993) maintains that rigid adherence to a canon, tenet, or ideology often impedes knowledge development and nowhere is this more obvious than in assessment of science learning. Aikenhead (2000), elaborating on Ryan (1988, in Aikenhead) summarizes the approach to assessment of science learning as traditionally empirical, although unnecessarily so. Empirical-analytic assessment is essentially positivistic, quantitative and focused on the product—that is, student work—negating the process of product development, wherein interpretive assessment is more process-oriented, as Aikenhead describes.

It embraces nonquantitative assessment techniques, such as rubrics, concept mapping, check lists, and authentic assessment (Black, 1993, 1997). The critical-theoretic paradigm gives special attention to the social or cultural context in which assessment takes place, a context that greatly influences both the process and the product of a student’s work (Roth & McGinn, 1998). The critical-theoretic paradigm focuses on the product, process, and context of student learning (Aikenhead, 2000, p. 79).

Aikenhead could have added iterative to this description, as assessment theorists from Bloom to the present have advocated providing students with multiple opportunities for demonstrating eventual understanding within a given term (Holtz & Radner, 2005).

Clearly and understandably, assessment appears to echo learning theories’ increasing movement toward student-centeredness with a distinct parallel between the critical-theoretic model and constructivism (Aikenhead, 2000). However, the influence of less radical proponents of constructivism have been heard (Edelson, 2002; Sherin, Reiser, & Edelson, 2004), as has
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