Chapter 6

Assessing Science Inquiry:
A Case Study of the Virtual Performance Assessment Project

Jody Clarke-Midura
Harvard University, USA

Jillianne Code
University of Victoria, Canada

Nick Zap
Simon Fraser University, Canada

Chris Dede
Harvard University, USA

EXECUTIVE SUMMARY

Science inquiry is a cognitive process that depends upon the active engagement of students and is something that students do and is minds-on. However, given its active nature, assessing science inquiry process skills remains a challenge for educators. In this chapter, the authors describe research being carried out to develop Virtual Performance Assessments (VPAs) that measure science inquiry practices. They provide a case study of how VPAs are being used to design summative assessments that measure middle school students' scientific inquiry aligned with national standards. The goal is to provide educators with a model of how they can assess science inquiry skills in their classrooms.

DOI: 10.4018/978-1-4666-0068-3.ch006

INTRODUCTION

Inquiry into authentic questions generated from student experiences is the central strategy for teaching and assessing in science (NRC, 1996). The National Science Education Standards (NSES) state that "authentic assessment exercises require students to apply scientific knowledge and reasoning to situations similar to those they will encounter in the world outside the classroom, as well as to situations that approximate how scientists do their work" (NRC, 1996). As a result of activities in grades 5 through 8, all students should develop the skills and abilities necessary to conduct scientific investigations (NRC, 2006). Thus, science inquiry is a cognitive process that depends upon the active engagement of students, is something that students do, and is *minds-on*. Science inquiry, as a *minds-on* process, entails theorizing, questioning and hypothesizing, investigating, analyzing and synthesizing (White, Collins, & Frederiksen, in press). While inquiry is described as an active process, most inquiry assessments are de-contextualized and tend to focus on definitions of terms or rely on a lot of text to set up a context. The literature suggests that existing methods for assessing science inquiry learning are limited (Haertel, Lash, Javitz, & Quellmalz, 2006; Quellmalz & Haertel, 2004; Quellmalz, Kreikmeier, DeBarger, & Haertel, 2006). To date, assessing science inquiry process skills remains a challenge for educators (Clarke-Midura & Dede, 2010; Marx, et al., 2004).

Advances in technology are creating new possibilities for assessing science inquiry (Behrens, 2009; Pellegrino, Chudowski, & Glaser, 2001). One such possibility is through the use of Virtual Performance Assessments (VPAs); 3D immersive technologies that aim to situate students in an environment that promotes inquiry and sets the context for assessment. VPAs are immersive three-dimensional (3D) environments, either single or multi-user, where participants engage in virtual activities and experiences. Such immersive environments support student experimentation and scientific reasoning in a virtual context by allowing students the ability to walk around an environment, make observations, gather data, and solve a scientific problem in context. Each participant takes on the identity of an avatar, a virtual persona that can move around the 3D environment. VPAs enable the creation and measurement of authentic, situated performances that are characteristic of how students conduct inquiry (Bransford, Brown, & Cocking, 1999). Further, these environments enable the automated, invisible, and non-intrusive collection of students' actions and behaviors during the act of learning (Pellegrino, et al., 2001). Rather than rely on student responses to questions about their knowledge, VPAs enable the capture and assessment of inquiry *in situ*.

The purpose of this chapter is to provide a case study of how VPAs have been used to design summative assessments that measure middle school students' scientific inquiry aligned with national standards (College Board, 2009; NRC, 1996). Our

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