

Lessons Learned and Best Practices of Stealth Assessment

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ABSTRACT

Stealth assessment provides an innovative way to assess and ultimately support knowledge, skills, and other personal attributes within learning and gaming environments without disrupting students' flow. In this paper, the authors briefly discuss two challenges they encountered during the development of stealth assessments in two past projects (i.e., utility issues related to log files and validation issues related to in-game measures). They also present successful examples of designing and testing stealth assessments and describe the steps they are taking to apply the lessons they have learned to the ongoing development of a stealth assessment for problem solving skills. The authors conclude with suggestions for future research.

Keywords: 21st Century Skills, Bayesian Networks, Evidence-Centered Design, Game-Based Learning, Log File Analysis, Stealth Assessment

1. INTRODUCTION TO EVIDENCE-CENTERED DESIGN AND STEALTH ASSESSMENT

Today's students are expected to develop 21st century skills, such as problem solving, creativity, and critical thinking (Partnership for 21st Century Learning, 2012). Such higher-order skills are necessary to be successful and productive in school, work, and life in general. It is thus important for educators to be able to accurately assess students on these complex skills. Assessments can help educators determine not only students' current levels of these competencies, but also their strengths and weaknesses on particular facets of the skills. This information can assist educators in supporting their students to develop 21st century skills, as well as other important competencies such as content knowledge and dispositions. However, traditional formats for assessing learning and achievement, such as multiple-choice tests, often measure superficial skills and are stripped of the context in which knowledge and skills are applied (Shute, Leighton, Jang, & Chu, in press). Thus, an ongoing problem in education involves finding more authentic and valid, yet efficient, ways to assess students on these complex competencies. Stealth assessment

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(Shute, 2011) has been proposed as one of the most promising methods for assessing complex skills. It is the process of embedding assessments seamlessly into a computer-based learning or gaming environment such that the learner is unaware he or she is being assessed.

Researchers generally agree that the development of an assessment has to follow a principled assessment design framework (AERA, APA, NCME, 1999; Kane, 2006) to be valid and reliable. Some leading principled assessment design frameworks include evidence-centered design (ECD), cognitive design system (CDS), and assessment engineering (AE). These three design frameworks are similar in their end goals, but vary in the processes they use to arrive at the goals (Shute, Leighton, Jang, & Chu, in press). In this paper, we discuss the hurdles we faced when using the evidence-centered design framework to implement stealth assessment and how we overcame those hurdles. Based on these hurdles, we make recommendations for stealth assessment best practices. We also present an ongoing project in which we are applying the lessons we have learned to more effectively and efficiently develop and implement stealth assessment.

Evidence-centered design (ECD; Mislevy, Steinberg, & Almond, 2003) is a framework that can be used to design valid assessments for measuring students' knowledge, skills, and other attributes. The framework is made up of three main models that work together: the competency model, the evidence model, and the task model (see Figure 1). The competency model contains the variables that characterize the competency of interest. Beliefs about students' status on the variables are represented by probability distributions that can be updated whenever new information is acquired. When a competency model is instantiated with data relating to a student's performance, it is called the student model. The task model specifies features of the tasks that students will undertake to provide evidence about target competencies. The features include the materials to be presented to students and the work products expected from them. The competency model and the task model are both connected to the evidence model, which provides a statistical link between the two. The evidence model consists of (a) evidence rules that convert the work products to observable variables, and (b) the statistical model that defines the statistical relationships between the observable variables and competency variables. In this way, evidence about the observable variables will update the competency model so that it accurately reflects the student's knowledge, skills, or other attributes at any time and at a fine grain size. The focus on the evidentiary link between the claims made about an examinee's competency and the collected evidence is the main feature of ECD that distinguishes it from other leading principled assessment design frameworks. Thus, creating an assessment using ECD allows one to evaluate the performance data that results from engaging in various tasks and, in turn, make inferences about various competencies (e.g., problem solving skills). Furthermore, coupling ECD with technology-enhanced environments (e.g., games), allows one to collect copious amounts of data and make valid inferences relative to the competencies.

Over the past decade, we have been using games as our preferred vehicle for assessing higher-order competencies. There are two main reasons for this choice. First, video games are becoming increasingly popular, especially among teenagers (Lenhart et al., 2008). The vast majority of teenagers play games in their free time, as they find the activity engaging and enjoyable. The meaningful contexts provided by games allow the embedded assessment engine to obtain solid, cohesive, and detailed information about players' competencies. Moreover, players may not be aware of the fact that they are being assessed, which frees them from the anxiety commonly associated with traditional tests. Second, Gee (2003) and other scholars have suggested that games can help students develop problem-solving skills, as well as other valuable 21st century competencies. In a well-designed game, players need to apply these competencies to complete the goals of the game. At the same time, games provide immediate feedback in the form of scores

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