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## Measuring student engagement in technology-mediated learning: A review

Curtis R. Henrie<sup>\*</sup>, Lisa R. Halverson, Charles R. Graham

Brigham Young University, Provo, UT 84602, USA

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### ABSTRACT

Using digital technology to deliver content, connect learners, and enable anytime, anywhere learning is increasing, but keeping students engaged in technology-mediated learning is challenging. Instructional practices that encourage greater engagement are essential if we are to effectively use digital instructional technologies. To determine the impact of innovative instructional practices on learning, we need useful measures of student engagement. These measures should be adaptable to the unique challenges to studying technology-mediated learning, such as when students learn at a distance or in a blended learning course. In this review, we examine existing approaches to measure engagement in technology-mediated learning. We identify strengths and limitations of existing measures and outline potential approaches to improve the measurement of student engagement. Our intent is to assist researchers, instructors, designers, and others in identifying effective methods to conceptualize and measure student engagement in technology-mediated learning.

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### 1. Introduction

Technology-mediated learning experiences are becoming the norm for today's students. Numerous one-to-one tablet and laptop initiatives are promoted by schools and governments around the world (Clarke & Svanaes, 2014; Fuhrman, 2014; Tablet initiatives, 2014). The number of students taking online and blended courses continues to increase (Aud et al., 2012; Parsad & Lewis, 2008; Picciano, Seaman, Shea, & Swan, 2012; Staker et al., 2011; Watson, Pape, Murin, Gemin, & Vashaw, 2014). Grants worth thousands and millions of dollars have been awarded by federal and private institutions for research and development of intelligent tutoring systems, digital educational games, and other systems designed to personalize instruction and engage learners (e.g., D'Mello & Graesser, 2012; Goldsworthy, Barab, & Goldsworthy, 2000; Kafai, Tynes, & Richard, 2014; STEM Grand Challenge, 2012; Woolf, Arroyo, Cooper, Bursleson, & Muldner, 2010).

Helping students engage in learning is an important issue for research in instructional technology. High dropout rates for online courses and MOOCs continue to be a challenge (Jordan, 2014; Patterson & McFadden, 2009; Rice, 2006; Roblyer, 2006). Tools are being developed to try to identify students who may be disengaging from instruction and are thus at risk of dropping out (Bienkowski, Feng, & Means, 2012; Long & Siemens, 2011). Other researchers have studied how innovative instructional practices impact student engagement in technology-mediated experiences (e.g., Chen, Lambert, & Guidry, 2010; Junco,

<sup>\*</sup> Corresponding author.

E-mail address: [curtis.r.henrie@gmail.com](mailto:curtis.r.henrie@gmail.com) (C.R. Henrie).

Heiberger, & Loken, 2011; Liang & Sedig, 2010). Determining how to best use people and technology to engage learners in meaningful and effective learning experiences is an important endeavor for researchers today.

Research that improves the design of instruction needs good measures of student engagement to evaluate the efficacy of instructional interventions. Several publications review methods and identify issues that need to be addressed to improve the measurement of student engagement (Betts, 2012; Fredricks & McColskey, 2012; Fredricks et al., 2011; Samuelsen, 2012). These publications tend to focus on self-report measures of engagement, particularly quantitative scales. But yet to be addressed are ways that student engagement can be measured in relation to the methodological issues unique to technology-mediated learning experiences. For example, observational measures implemented in classrooms where all students are present in one location would be challenging to arrange for an online course in which students learn separately and at a distance. Additionally, technology affords us with new methods to measure student engagement in ways both scalable and minimally disruptive to learning, such as using computer-generated data of user activity with a learning system (Aleven, McLaren, Roll, & Koedinger, 2006; Baker et al., 2012; D'Mello & Graesser, 2012). The purpose of this review is to examine approaches to measuring student engagement in technology-mediated learning experiences and to identify issues needing attention to improve the measurement of engagement in such settings.

### 1.1. Background

Student engagement has been defined as investment or commitment (Marks, 2000; Newmann, 1992; Tinto, 1975), participation (Kuh, Kinzie, Buckley, Bridges, & Hayek, 2007), or effortful involvement in learning (Astin, 1984; Pekrun & Linnenbrink-Garcia, 2012; Reschly & Christenson, 2012; Terenzini, Pascarella, & Lorang, 1982). Researchers have used various terms to define this idea, including *student engagement*, *academic engagement*, *school engagement*, and *learner engagement* (Reschly & Christenson, 2012). Some would argue that each of these terms takes on different nuances in definition. For example, learner engagement could be considered a broad term that includes learning both in and outside of formal academic settings, whereas student engagement would focus solely on academic learning. We use the term student engagement, as our interest is in academic learning.

Student engagement has been studied at the level of learning within a single activity, focusing on what is happening in the moment, to the level of a student's whole school experience. Skinner and Pitzer (2012) developed a model that best explains the levels at which student engagement has been studied, as well as the general outcomes of interest at those levels. At the broadest level is institutional engagement, which focuses on activity in social institutions in general, such as school, family, and church. Outcomes of this level of engagement are character development and pro-social orientation. Moving deeper, research can focus on engagement in all school-related activities, such as involvement in clubs, sports, or other student organizations and activities as well as academic work in the classroom. The outcomes of this engagement are a sense of belonging in school and lower risks of dropout. Engagement can then be focused on involvement in a specific course, or even on a specific learning activity, the outcome being academic achievement and learning. Skinner and Pitzer's framework of student engagement is useful for identifying the purpose and scope of various measures of engagement, from factors specific to a single learning activity to broader institutional concerns. For instance, the National Survey of Student Engagement (Kuh, 2001) is best suited for studying institution-level engagement, with questions focused on learners' general experience in school. Institution-level measures would be inadequate to identify insights as to how a specific learning activity affected learner engagement in a course.

Many researchers view student engagement as a meta-construct that includes different types of engagement or other theoretical constructs, such as motivation and self-regulation (Fredricks, Blumenfeld, & Paris, 2004; Reschly & Christenson, 2012). Fredricks et al. (2004) described what have become the common sub-constructs or types of engagement: behavioral, emotional, and cognitive engagement. According to Fredricks et al. (2004), behavioral engagement includes the observable behaviors necessary to academic success, such as attendance, participation, and homework completion. Emotional engagement includes both feelings learners have about their learning experience, such as interest, frustration, or boredom, and their social connection with others at school. Cognitive engagement is the focused effort learners give to effectively understand what is being taught, including self-regulation and metacognitive behaviors (Fredricks et al., 2004). Cognitive engagement and behavioral engagement center on actions by the learner. Cognitive engagement differs from behavioral engagement because it focuses on the less observable effort expended in the mind (Appleton, Christenson, Kim, & Reschly, 2006). As student engagement includes both self-perception and behavior, self-reported and observable indicators can be appropriate.

Research has linked behavioral, cognitive, and emotional engagement to important educational outcomes, such as student persistence in learning (Berger & Milem, 1999; Fredricks et al., 2004; Kuh et al., 2008), satisfaction (Filak & Sheldon, 2008; Zimmerman & Kitsantas, 1997), and academic achievement (Fredricks et al., 2004; Hughes, Luo, Kwok, & Loyd, 2008; Kuh et al., 2007; Ladd & Dinella, 2009). Despite these findings between academic outcomes and the various engagement constructs, comparing and confirming findings from different studies is difficult (Fredricks & McColskey, 2012; Janosz, 2012). The findings of two studies relating student engagement with positive outcomes may conflict due to differences in definition or construct conceptualization. The future success of research relating sub-constructs of engagement to specific outcomes relies on consensus of definitions and measures of engagement.

While student engagement is important in any learning context, our review focuses on student engagement in technology-mediated learning experiences: which includes any interaction of the learner with instructors, other

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