Effects of High-Fidelity Virtual Training Simulators on Learners’ Self-Efficacy

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ABSTRACT

Perceptions of one’s ability to perform a task, or self-efficacy, is one aspect of the multifaceted nature of an individual’s identity. It is generally accepted that having a high perceived self-efficacy about a certain task can lead to positive performance outcomes. Bandura (1977) has suggested that efficacy influences and expectations can come from four sources: personal performance accomplishments; vicarious experiences; verbal persuasion; and emotional arousal. Trainers and training agencies use a variety of simulations and simulators to provide learners with valuable and necessary training experiences. This mixed methods study explored the influence of one high-fidelity virtual training simulator on the learners’ self-efficacy. Participants in this study were recruits enrolled in a law enforcement academy. Data were collected through pre- and post-simulation-use surveys that combined general self-efficacy questions (Schwarzer & Jerusalem, 1995) and task-specific self-efficacy questions (Bandura, 1977, 1997, 2006; Bandura, Adams, Hardy, & Hovells, 1980), observations of participants using the simulator, and post simulator interviews. The most prominent theme that emerged from the data was emotional arousal due to the realism of the virtual environment. Emotional arousal seemed to impact both their perceived self-efficacy and task performance; yet, despite the variety of emotional arousal they experienced, the participants perceived their training in the high-fidelity virtual training simulator as valuable.

Keywords: Emotional Arousal, High-Fidelity, Identity, Self-Efficacy, Virtual Simulator

INTRODUCTION

Self-efficacy is an important aspect of the multifaceted characteristics of individuals’ identity. Learners’ self-efficacy, as Bandura (1997) explained, is concerned with one’s perceptions of personal capabilities in task performance. As human beings we draw from our self-efficacy in order to complete seemingly minute tasks. What, then, are the best ways of going about increasing learners’ self-efficacy so they may master skills and perform desired outcomes successfully? Bandura (1977) has suggested that efficacy influences and expectations can come from four sources: personal performance accomplishments; vicarious experiences; ver-
bal persuasion; and emotional arousal. The use of training simulations and tools is one means by which learners can practice the skills needed to perform necessary tasks (Gagné, 1954; Kameg, Howard, Clochesy, Mitchell, & Suresky, 2010). Empirical studies have shown that media such as simulators are learning tools that aid in the transfer of knowledge and skills (Gee, 2007; Halverson, 2005; Oblinger, 2006; Peirce, Conlan, & Wade, 2008; Salen & Zimmerman, 2003; Schwabe & Göth, 2005; Wilson, 2009), as well as provide opportunities for experiential learning that enhance learner self-efficacy (Bandura, 1971, 1977; Boydell, 1976). Through a mixed methods exploratory study, the researchers examined the influence of using a high-fidelity virtual training simulator in a learning environment and its influence on users’ perceived self-efficacy. The findings were based upon learners’ self-reports on perceived self-efficacy response scales, observations, and open-ended interviews of learners who experienced the simulator as a part of their law enforcement academy training.

THEORETICAL FOUNDATION

Many empirical studies regarding simulations have labeled their simulations as “high-fidelity” (e.g. Carron et al., 2011; Dobranich & Blanchat, 2008; Havighurst, L. E. Fields, & C. L. Fields, 2010; Mahvash & Hayward, 2004; Perumalla & Sundaragopalan, 2004). Fidelity is subjective. In its subjectivity, the concept of fidelity becomes increasingly complex (see Perumalla & Sundaragopalan, 2004). Gray (2002) suggested that something with a high fidelity is “intended as a substitute for the real thing” (p. 206). Bowman and McMahan (2007) described high-fidelity simulations as having the ability “to produce a realistic experience for the user that effectively places the user in the simulated environment” (p. 37). Carron, Trueb, and Yerson (2011) explored various research studies in order to describe high fidelity as “an interactive and extremely realistic environment” (p. 149) in which training across multiple domains can take place. Carron et al. elaborated by explaining that high-fidelity simulations can encompass individuals as well as teams of people under “virtual conditions as close to a real situation as possible” (p. 149).

In their mixed methods empirical study, Havighurst, Fields, and Fields (2010) described high fidelity as including “materials and equipment” that simulate the task that the learner is expected to perform. Their study described low fidelity as simulations that incorporate “materials and equipment that are less similar [emphasis added] to what is used on the job” (p. 2). In the IEEE’s standards (IEEE Standards Board, 1990; IEEE, 2007), fidelity is defined as a “description” of a model or simulation (IEEE Standards Board, 1990). The level of the description, called high or low, represents the model or simulation’s capabilities in terms of resolution, precision, immersion, etc.. The degree of representation in real-world objects is also considered as high or low. In appraising the level of fidelity, the IEEE also took into consideration “features and conditions for learning” (IEEE Computer Society, 2010). This is comparable to the “materials and equipment” discussed in the Havighurst, Fields, and Fields study (2010).

A review of literature shows that simulators and simulations can lead to effective learning (Gagné, 1954; Issenberg et al., 2005; Larew et al., 2006) by teaching knowledge and procedures (Carron et al., 2011; Hunter & Ravert, 2010; Murray, 1972) through practical instruction (Gallagher & Satava, 2002) and models of complex real-world situations (Gredler, 1996). Furthermore, simulators and simulations are one way to provide experiences that are consistent with Bandura’s self-efficacy theory (See Table 1).

Bandura (1977) defined self-efficacy as the belief in one’s capabilities to perform a specific task. Perceived self-efficacy has an important presence in learning (Bandura, 1977, 1993; Feltz, 1982; Goldenberg et al., 2005; Kavanagh & Bower, 1985; Schunk & Pajares, 2002; Usher, 2009). Having a high-perceived self-efficacy about a certain task can lead to positive performance outcomes (Bandura, 1977, 1997;
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