Physical and social presence in 3D virtual role-play for pre-service teachers

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ABSTRACT

Numerous studies have explored the affordances of 3D virtual worlds. Although previous studies indicated that virtual worlds would be helpful for experiential and collaborative learning through enhancing physical and social presence, few studies have investigated what determines physical and social presence and what are their roles in learning and teaching in virtual worlds. The current study investigates the influences of individual differences such as age, gender, and epistemological beliefs on physical and social presence. This study also investigates the influences of physical and social presence on situational interest and perceived achievement in virtual role-play. The role-play activity allowed pre-service teachers ($n = 151$) to teach their peers in realistic classroom contexts within Second Life and to reflect on their language use as teachers. This study found that pre-service teachers' age and epistemological beliefs significantly influenced their physical and social presence in the virtual world. This finding implies that physical and social presence are influenced not only by the representational fidelity of virtual worlds but also by individual differences. In addition, physical and social presence positively influenced situational interest and perceived achievement. More attention should be paid to the roles of physical and social presence in teaching and learning in virtual worlds.

1. Introduction

A number of studies in recent years have explored the educational affordances of 3D virtual worlds (VWs) like Second Life and Active Worlds for innovative learning and teaching activities (Bronack, Riedl, & Tashner, 2006; Dalgarno & Lee, 2010; Wang & Burton, 2013). VWs have been effectively used for experiential learning (Jamaludin, Chee, & Ho, 2009), problem-based learning (Omale, Hung, Luetkehans, & Cooke-Plagwitz,, 2009), and role-play (Gregory & Masters, 2012). Downey, Mohler, Morris, and Sanchez (2012) found that the visual affordances of VWs enabled learners to "identify speakers better, focus and organize information better, and feel a stronger sense of connection with others" (p. 1416) when compared to 2D online learning environments. Given the wide use of VWs, we need to deepen our understanding of the educational affordances provided by them so as to design meaningful learning activities in immersive virtual learning environments.

An important affordance of the VWs is to increase physical presence (i.e., a sense of being there) and social presence (i.e., a sense of being with another) through 3D avatars in an immersive environment. Both
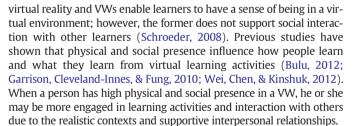
virtual reality and VWs enable learners to have a sense of being in a virtual environment; however, the former does not support social interaction with other learners (Schroeder, 2008). Previous studies have shown that physical and social presence influence how people learn and what they learn from virtual learning activities (Bulu, 2012; Garrison, Cleveland-Innes, & Fung, 2010; Wei, Chen, & Kinshuk, 2012). When a person has high physical and social presence in a VW, he or she may be more engaged in learning activities and interaction with others due to the realistic contexts and supportive interpersonal relationships.

However, the roles of physical and social presence in virtual learning activities have not been sufficiently investigated, although a number of researchers have asserted that the physical and social presence are the most prominent affordances of VWs (Dalgarno & Lee, 2010; de Freitas, Rebolledo-Mendez, Liarokapis, Magoulas, & Poulovassilis, 2010; Downey et al., 2012; Warburton, 2009). Although a few empirical studies (Bulu, 2012; Lee, Wong, & Fung, 2010; McCreery, Schrader, Krach, & Boone, 2013) have provided significant insights into how physical and social presence influence learning activities in VWs, there is a critique that presence in VWs does not play an important role in meaningful learning and sometimes imposes a cognitive load that is detrimental to the construction of knowledge (Moreno & Mayer, 2004; Whitelock, Romano, Jelfs, & Brna, 2000). In addition, more attention should be paid to the individual differences that determine the physical and social

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presence. Even in the same 3D virtual environment, some learners are more likely to experience presence than others (Ausburn & Ausburn, 2008; Ling et al., 2013; Wallach, Safir, & Samana, 2010).

2. Literature review

2.1. Physical presence in virtual worlds

Physical presence[1] (also known as 'presence') is used to indicate a sense of being in a virtual environment (Bulu, 2012; Slater, McCarthy, & Maringelli, 1998; Witmer & Singer, 1998). According to Witmer and Singer (1998), physical presence refers to "the subjective experience of being in one place or environment, even when one is physically situated in another" (p. 225). When learners carry out a task in a VW, they can pay attention to events in their physical world as well as in the VW. The degree of physical presence depends on how much learners focus on what is happening in the VW instead of the real world (Witmer & Singer, 1998). In addition, learners are more likely to have the sense of being in the VW when the environment is vivid and immersive and when learners can interact with objects and characters in the VW (Schifter, Ketelhut, & Nelson, 2012; Slater et al., 1998; Steuer, 1993). Physical presence can be enhanced by representational fidelity, including realistic display of the environment, smooth change of views, sounds providing directional or distance cues, and avatars representing users (Dalgarno & Lee, 2010).

The influence of physical presence on learning and task performance is not conclusive (Lee et al., 2010; Schuemie, Van Der Straaten, Krijn, & Van Der Mast, 2001; Welch, 1999). Lee et al. (2010) investigated how desktop virtual reality influences learning outcomes in a secondary school science lesson, using a structural model. They found that features of 3D virtual reality, including representational fidelity and immediacy of control, positively influenced the sense of physical presence, which in turn significantly improved learning outcomes. This finding supports the claim that increased physical presence in an immersive virtual environment leads to active participation and meaningful learning (Dalgarno & Lee, 2010; Witmer & Singer, 1998). Witmer and Singer asserted "Because many of the factors involved in learning and performance also increase presence, it would be very surprising indeed if positive relationships between presence and performance were not found" (p. 238).

However, Merchant et al. (2012) did not find a significant relationship between physical presence and learning outcomes in an undergraduate chemistry course, although they found that VW features had an indirect influence on physical presence. Moreno and Mayer (2004) also found that an immersive virtual environment (i.e., head-mounted display) increased physical presence but did not lead to better learning outcomes in terms of retention and transfer. They argued that immersive virtual environments might increase extraneous cognitive load, which in turn distracts learners from knowledge construction. It is possible that learners unnecessarily pay attention to immersive stimuli that are not closely related to meaningful learning tasks.

2.2. Social presence in virtual worlds

Social presence refers to a sense of being with another in a virtual environment (Biocca, Harms, & Burgoon, 2003). Short, Williams, and Christie (1976) defined social presence as "the degree of salience of the other person in the interaction and the consequent salience of the interpersonal relationships" (p. 65). Based on this tradition, Biocca et al. (2003) redefined social presence as "the sense of 'being together with another,' including primitive responses to social cues, simulations of 'other minds,' and automatically generated models of the

intentionality of others" (p. 459). In this definition, the others that learners experience in VWs are usually representations of an instructor, other learners, or artificial intelligence technologically mediated via 3D avatars, text, images, video, and virtual human agents (Biocca et al., 2003).

Although there are diverse approaches to social presence, literature of online learning and VWs has emphasized three key concepts: co-presence, intimacy, and immediacy (Bulu, 2012; Garrison & Arbaugh, 2007; Wei et al., 2012). Co-presence refers to a sensory awareness of another being in the same virtual space, and the sense of being together is enhanced when learners are mutually aware each other (Biocca et al., 2003; Goffman, 1959). In addition, social presence requires psychological involvement, including intimacy and immediacy, beyond the mere awareness of another (Biocca et al., 2003). Even if learners see a 3D avatar that is standing near their own avatar in a VW, they may not have the sense of being together if the avatar does not move, make gestures, talk with other avatars, or show any intelligent behaviors. Interpersonal relationships develop based on a sense of intimacy (i.e., perception of a close, bonded, and comfortable relationship with others) and immediacy (i.e., perception of intensity and directness in interaction with others), which are influenced by verbal and non-verbal behaviors as well as the quality of communication technologies (Bulu, 2012; Short et al., 1976; Wei et al., 2012).

It is highly plausible that learners will actively engage in interactive learning activities in a VW when the level of social presence is high in a group of learners. Garrison et al. (2010) found that social presence positively influenced aspects of cognitive presence, such as learning and inquiry process. Wei et al. (2012) also found that aspects of social presence, such as co-presence, intimacy, and immediacy, positively influenced learning interaction, which in turn determined learning outcomes in online classrooms. In the study by Bulu (2012), social presence, which was found to be positively correlated with physical presence, significantly influenced satisfaction with virtual role-play (VRP). These findings support the assertion that social presence plays an important role in learning processes and outcomes as well as learners' satisfaction.

However, Omale et al. (2009) found that VWs were beneficial only for social presence, not cognitive presence, in problem-based learning. From their analysis of learning process transcripts, they found three times more social presence themes (68%) than cognitive presence themes (22%). The VW provided a more relaxing context that allowed students to share their personal experience and ideas but distracted attention from the learning task. Students rarely discussed possible solutions to finalize their plan beyond simply sharing their ideas. The increased social presence in the VW did not enhance the cognitive presence that was crucial for meaningful learning. These mixed results show that more attention should be paid to how social presence influences interactive learning processes and outcomes.

2.3. Individual differences in virtual learning activities

VWs have affordances to increase physical and social presence that can be helpful for interactive learning (Dalgarno & Lee, 2010). However, the features of VWs do not influence learning in isolation. Learners may experience different levels of physical and social presence and participate in virtual learning activities in a different way (Ausburn & Ausburn, 2008; Salzman, Dede, Loftin, & Chen, 1999; Schuemie et al., 2001). Literature of virtual environments showed that physical presence is closely related to individuals' characteristics, like immersive tendencies (Bulu, 2012; Schuemie et al., 2001; Witmer & Singer, 1998). The current study is particularly interested in learners' gender, age, and epistemological beliefs, the influences of which have not been sufficiently investigated in regard to physical and social presence in VWs.

Ausburn and Ausburn (2008) found that age played an important role in learning from 3D virtual reality. The benefits of the virtual reality for task performance and confidence were larger for the younger age group (18–35 years old) than for the older age group (36–60 years

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[1] In this paper, physical presence is interchangeable with presence. Although previous studies used the term of presence more frequently than physical presence, this study intends to use consistently the latter in order to distinguish it from social presence.