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Extending the technology acceptance model to explore the intention to use Second Life for enhancing healthcare education

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ABSTRACT

Learners need to have good reasons to engage and accept e-learning. They need to understand that unless they do, the outcomes will be less favourable. The technology acceptance model (TAM) is the most widely recognized model addressing why users accept or reject technology. This study describes the development and evaluation of a virtual environment, the online 3D world Second Life (SL), for learning rapid sequence intubation (RSI). RSI is an increasingly frequently used method of acute airway management in healthcare settings. The intention of learners to use the system was explored based on the TAM, with the computer self-efficacy construct as an external variable. Two hundred and six nursing students participated in this study. The findings suggest that the system was perceived as useful, and that the students felt confident working with computers and intended to review RSI in SL as often as needed. However, they remained neutral regarding the ease of use of the system. Strategies were suggested for boosting the students' self-confidence in using the system. Overall use of the TAM in this context was successful, indicating the robustness of the model. The limitations of the study were discussed and further areas of research on the TAM were proposed.

1. Introduction

In recent years, the Internet and technological evolution have brought highly dynamic communication, and enabled e-learning initiatives to grow and meet a wide range of educational needs. e-Learning allows learners to save time by not having to commute, and to take lessons at their own pace and in the sequence that they prefer. Through ubiquitous computing and novel technologies, online courses are becoming more popular as people come to appreciate the innovative e-learning experiences. The impact of information and communication technology (ICT) on teaching and learning has generated research investigating both the extent of ICT usage and the technical aspects of e-learning. However, there is a dearth of research on the reactions of learners towards e-learning and their acceptance of it. Owing to the crucial role that e-learning plays in teaching and learning, it has been suggested that future research should incorporate greater coverage of the determinants that have an impact on e-learning (Teo, 2010). Learners need to have good reasons to engage in and accept e-learning and to understand that, unless they do, the outcomes will be less favourable. A review of prior studies suggests that the technology acceptance model is one of the most frequently used theoretical frameworks in addressing why users accept or reject technology.

2. Technology acceptance model

Substantial theoretical and empirical evidence has accumulated over the decades in favour of the technology acceptance model (TAM) (Davis, 1986, 1989), which has come to be one of the most widely applied theoretical models for explaining and predicting user acceptance of

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specific types of technology (Holden & Karsh, 2010; King & He, 2006; Legris, Ingham, & Collerette, 2003). TAM is predictive in nature and attempts to uncover the constructs that have an impact on the intentions of people to use technology. It conceptualizes that an individual's intention to use a system is determined by two beliefs: perceived usefulness and perceived ease of use. Perceived usefulness is also posited as being directly impacted by perceived ease of use. Numerous studies have found that the model consistently explains a substantial proportion of the variance (typically about 40%) in usage intentions, and that it compares favourably with alternative models such as the Theory of Reasoned Action and the Theory of Planned Behaviour (Venkatesh & Davis, 2000).

TAM has been the instrument in many empirical studies, in part because it is simple to use and easy to understand. Nevertheless, a number of external variables have been introduced into TAM to gain a better understanding of the actions that can be taken to improve the predictability of technology acceptance. For example, researchers have extended TAM by adding perceived enjoyment (Lee, Cheung, & Chen, 2005), system and learner characteristics (Pituch & Lee, 2006), e-learning self-efficacy (Park, 2009), flow concept (Liu, Liao, & Pratt, 2009; Lu, Zhou, & Wang, 2009; Sanchez-Franco, 2010), compatibility (Chen & Tan, 2004), and technical support (Elbeltagi, McBride, & Hardaker, 2005). An extension to TAM that has been studied repeatedly is computer self-efficacy (Celuch, Taylor, & Goodwin, 2004; Ong & Lai, 2006; Tung & Chang, 2008). The construct of computer self-efficacy was proposed by Compeau and Higgins (1995). It emerged from the general concept of self-efficacy, which was founded on the social cognitive theory developed by Bandura (1986). Bandura contended that perceived self-efficacy plays an important role in affecting motivation and behaviour. A person may be more likely to undertake behaviours that he or she believes will result in valued outcomes than those perceived as having unfavourable consequences. In the context of using technology, computer self-efficacy represents a person's perception of his or her ability to use a computer to accomplish a task (Compeau & Higgins, 1995).

In industries outside of healthcare, the usefulness of TAM in predicting technology acceptance has been rigorously validated by empirical research. However, healthcare researchers are noticeably lagging in that regard (Yarbrough & Smith, 2007). The TAM is a model that has been developed for the general population of technology users. Whether TAM is a fitting theory in the healthcare context is worthy of critical examination (Holden & Karsh, 2010). In addition, in a meta-analysis of TAM as applied in various fields, King and He (2006) explored the moderating effects of type of user and type of use. They found that professionals and general users produce quite different results, and that Internet use is different from job task applications, office applications, and general use. Students, who are often recruited as respondents in TAM studies, are not exactly like professionals or general users. The statistical meta-analysis indicates that both user types and usage types significantly influence technology acceptance.

A number of empirical studies claim to have identified the barriers to the acceptance of technology by healthcare providers (Ash et al., 2003; Austin et al., 2006; Karsh, Escoto, Beasley, & Holden, 2006). However, Yarbrough and Smith (2007) have contended that the vast majority of these studies are qualitative and exploratory in nature, and that the degree of acceptance of technology as explained by the determinants cannot be gauged. Additional quantitative research with a large sample size is needed to identify the degree or level of influence that the determinants have on technology acceptance. Furthermore, evaluating TAM using structural equation modelling is recommended because measurement errors are thereby minimized and construct measurement is more rigorous than regression analysis (Yarbrough & Smith, 2007).

3. Second Life

During the past few years, educators from a variety of backgrounds have started using the online 3D world *Second Life (SL)*, created by the US company Linden Lab, to support their teaching and learning activities. Many articles have also been written by these educators on the advantages of using SL to support education (Grassian, Trueman, & Clemson, 2007), convincing ever-increasing numbers of, for example, universities to explore the possibilities of using SL in their teaching and learning activities (Herold, 2009, 2010; Jennings & Collins, 2007). The result has been glowing reports about the future of SL in higher education (Atkinson, 2008).

One of the prominent areas of education in which SL has been used is *medical and health education*. As early as 2007, this use of SL was widespread enough to warrant the publication of general review articles discussing the different projects then underway in the virtual environment (Boulos, Hetherington, & Wheeler, 2007; Skiba, 2007). SL and similar virtual environments have proven especially attractive to educators in medical faculties. This is because their need to provide opportunities for students to *practise* their learned knowledge without endangering other people (e.g., patients, nurses, doctors, etc.) constitutes an important driver in the development of 'safe', virtual environments (Lee & Berge, 2011).

Simulations of healthcare situations in SL, while highly complex and at times difficult to set up, have been used to the great advantage of their students by a growing number of educators (Phillips, Shaw, Sullivan, & Johnson, 2010; Schmidt & Stewart, 2010; Stewart et al., 2010). SL allows educators to design specific problem-based scenarios in which, for example, nursing students can practise their skills in realistic simulations (Rogers, 2009). The flexibility of the virtual world even makes it possible for educators to simulate both the highly computerized and technology-laden environment of a modern hospital (Skiba, 2009; Skiba, Connors, & Jeffries, 2008) and the stress, chaos, and unpredictability of real hospital wards so as to better prepare trainee nurses for their later professional lives (Kilmon, Brown, Ghosh, & Mikitiuk, 2010).

The attempt to use SL in the teaching of rapid sequence intubation (RSI) to nursing students, as discussed in this study, has to be seen in this context. The aim of using SL to teach RSI was to provide students with the possibility of applying what they had learned about the procedure in a realistic setting without endangering the lives of patients. It was thought that a simulated ward, with a simulated doctor and a simulated additional nurse, would give trainee nurses an adequate and safe way of preparing for a potential future need to employ the RSI techniques in a real situation.

4. Simulating rapid sequence intubation in Second Life

Rapid sequence intubation involves the rapid administration of a sedative agent and a neuromuscular blocking agent to induce unconsciousness and motor paralysis for tracheal intubation. This is particularly important, since patients may have a full stomach in emergency situations and are at a much greater risk of vomiting and aspiration (Benger, Nolan, & Clancy, 2008). Of course, in the event of