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Are your users actively involved? A cognitive absorption perspective in mobile training

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ABSTRACT

The advancement of today's mobile technologies makes mobile training possible. However, how to engage users in deep learning in a mobile environment remains a challenge, especially in critical training areas such as road safety training. This study aims to understand the role of five different dimensions of cognitive absorption (CA) (i.e., *temporal dissociation*, *focused immersion*, *heightened enjoyment*, *control*, and *curiosity*) in training outcomes and how affective and cognitive involvements leverage this learning process. In this study, we designed and implemented a mobile multimedia training system for users who need training for their license test in the field. We then conducted a field study with over five hundred road users with pre- and post-questionnaires. The study findings indicate that the cognitive absorption plays a significant role in affecting users' deep involvement, which in turn impacts training outcomes. In addition, all CA constructs apart from control influence perceived technology usefulness, which is also a major contributor to perceived learning. The relationship between CA constructs and perceived usefulness is obtained through cognitive and affective involvement, while cognitive involvement is more dominant in this study context.

1. Introduction

Recent advances in mobile technologies make mobile training possible without time and location constraints. Organizations seek to obtain new training experiences for their training programs that can totally immerse and engage users (Kahwajy, Kemanian, Keys, & Strebel, 2005), so that this type of innovative training may become more powerful in transferring tacit and complex knowledge to employees, compared to traditional forms of information conveyance (Salas, Wildman, & Piccolo, 2009). Recent research indicates that by 2015, more than 50% of organizations will rely on high-involvement technology-based simulations to train individuals and business partners (Goasduff & Pettey, 2011). This is in line with the ongoing discussion on the potential of tablet devices as an educational means, fuelled by the many easily accessible affordances that they potentially offer (Peluso, 2012). Consistent with this trend, educational institutions have taken steps to design training programs that are aimed at increasing learner involvement. Although higher education and the private sectors have started to make an effort to develop mobile multimedia learning/training programs, there is currently a dearth of in-depth studies that focus on understanding the role of user cognitive absorption on user involvement and how this process affects user training outcomes. Moreover, little attention has been paid to mobile training in crucial training areas such as road safety training, which impacts people's lives and our society as a whole.

In the road safety context, increasing road users' situation awareness is a key to safer driving (Underwood, Chapman, Bowden, & Crundall, 2002; Underwood, Chapman, Brocklehurst, Underwood, & Crundall, 2003). Situation awareness (SA) is the perception of elements in the environment within the volume of time and space, the comprehension of their meaning, and the projection of their status in the near future (Endsley, 1995). Most prior research on situation awareness has taken place in dynamic environments such as aviation (Jentsch, Barnett, Bowers, & Salas, 1999; Wickens, 2000) and air traffic control (Endsley & Smolensky, 1998). Experienced drivers may demonstrate their situation awareness by searching for the roadway around them more extensively. As road users increasingly interact with other users over time, their situation awareness develops, and they learn when they need to be especially attentive and increase their safety awareness while

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driving. Accordingly, road users with more extensive and varied experience should develop greater situation awareness through training and practice. Developing an awareness of the situation is often the key to success, particularly in dynamic situations that demand rapid decision making, as in the case of vulnerable motorcyclist on the roads.

In this study, we aim to present an innovative multimedia training program to increase user situation awareness through today's cutting-edge mobile technologies, in that multimedia offers more significant advantages over traditional forms of instructions (Scheiter, Schüler, Gerjets, Hik, & Hesse, 2014). Contemporary research also indicates that the use of multimedia can enhance skills development, and increase learning efficiency. By using cognitive absorption theory as a starting point, which demonstrates the state of the user's interactive IT experiences while being fully engaged, we designed and implemented a mobile multimedia training program which is accessible on different mobile devices. This program enables and supports unique road safety training, in order to increase road users' situation awareness, and to proactively avoid road risks before they take their driver license exam on site. Therefore, our goal in this research is to understand whether cognitive absorption in a mobile training context affects user cognitive and affective involvement and user perception of mobile technology usefulness, and thereby, how these factors ultimately impact training outcomes.

This paper is structured as follows. In the next section, we describe the theoretical background of this research. We then propose a set of research hypotheses. Following a description of the field study design, we present the study results. Finally, we discuss the conclusion, implications, limitations and future research of the study.

2. Theoretical background

2.1. Multimedia training

Learning becomes more effective when information is processed through multiple sensory input stimuli (i.e., verbal and non-verbal) (Paivio, 1986). Multimedia engages learners in the multiple sensory input information process in learning. According to Reed (2006), such a process often leads to improved comprehension, and consequently, an improved performance in learning, due to its multiple presentations of information, which provide learners with better flow experiences. Scheiter et al. (2014) provide further evidence for the validity of the multimedia effect on performance. Multimedia training calls for the higher reengagement of trainees. Video researchers (Cowley, Charles, Black, & Hickey, 2008) and educational researchers (Rathunde & Csikszentmihalyi, 2005; Shernoff, Csikszentmihalyi, Schneider, & Shernoff, 2003) have used flow assessments to measure engagement. Meanwhile, longitudinal data from Shernoff et al. (2003) revealed that students feel significantly more engaged when they are challenged, and in control of their learning.

Flow refers to an optimal experience in which a person is fully immersed in an activity, due to a feeling of energized focus, full involvement and success in the process of the activity (Csikszentmihalyi, 1990). Previous researchers have studied flow in technology-mediated learning environments. Cooper (2010) reviewed studies of such environments and concluded that there was a positive relationship between flow and learning in technology environments. Researchers have also used flow as a measure of student engagement with educational computer application (Inal & Cagiltay, 2007), the effect of multimedia design on learning (Scheiter et al., 2014) and most recently, mobile learning applications (Admiraal, Huizenga, Akkerman, & Ten Dam, 2011; Park, Parsons, & Ryu, 2010). With the growing popularity of massively open online courses (MOOCs), Merkt and Schwan (2014) reported on the advantage of the interactivity features provided by multimedia for acquiring knowledge. More specifically, the importance of using videos was highlighted as an essential means of attracting learner attention. Since attention is considered to be critical in achieving situation awareness (Endsley, 1995; Tsang & Vidulich, 2006), multimedia training has the potential to support the development of situation awareness in order to achieve better decision making. This assumption would appear to be congruent with a training approach that focuses on situation awareness training (Burkolter, Kluge, Sauer, & Ritzmann, 2010).

2.2. Cognitive absorption

Cognitive absorption (CA) is regarded as the state of engagement and involvement that a user can experience during a training intervention (Guo & Ro, 2008). This cognitive absorption state is crucial to effective training, because it leverages individual intrinsic motivation during the learning process and is beneficial to learning outcomes (Benbunan-Fich & Hiltz, 2003; Druskat & Kayes, 2000; Tharenou, 2001). Multimedia training provides a holistic CA experience with technology. The notion of CA derives its theoretical bases from work in individual psychology, and notably, research related to a trait dimension called absorption (Tellegen, 1982; Tellegen & Atkinson, 1974), the state of flow (Csikszentmihalyi, 1990), and the notion of cognitive engagement (Webster & Ho, 1997). Since our focus is on the implications of user experiences during mobile training, the concept of CA provides a way of conceptualizing the optimal user experience through mobile technologies.

Drawing on a synopsis of dimensions comprising flow experience in the context of IT usage, Agarwal and Karahanna (2000) introduced the concept of CA to describe user's holistic experience with IT. CA is a positive, highly enjoyable experience which occurs when a user is fully immersed in the interaction with IT, characterized by total attention and engagement, a sense of control and a feeling of heightened enjoyment and curiosity, such that nothing else seems to matter, and time no longer seems to pass the way it ordinarily does (Agarwal & Karahanna, 2000).

CA is an intrinsic motivation variable which is important in studying technology use behavior, because it serves as a key antecedent to salient beliefs about information technology. Thus, CA has been mainly applied to investigate the patterns of user behavior, such as formation of user beliefs and intention to use, in organizational or work-related settings involving utilitarian information systems. The present research focuses on assessing how different dimensions of CA impact users' training outcomes through affective and cognitive involvement in a mobile road safety training context. Prior mobile training studies in this area are very scant, and a mobile multimedia training can expose road users to various crucial situations, during which they may be involved in their initial steps on the road, so it is important to provide them with a better ability to handle road risks before their license test in the field.

More specifically, Agarwal and Karahanna (2000) defined cognitive absorption as "a state of deep involvement with software" that is exhibited through five dimensions:

(1) *Temporal dissociation*, the inability to register the passage of time while engaged in interaction.
(2) *Focused immersion*, the experience of total engagement, where other attentional demands are, in essence ignored.
(3) *Heightened enjoyment*, the pleasurable aspects of the interaction.
(4) *Control*, the user's perception of being in charge of the interaction.
(5) *Curiosity*, the experience arouses an individual's sensory and cognitive curiosity.