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Experience beyond knowledge: Pragmatic e-learning systems design with learning experience ☆

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ABSTRACT

With the growing demand in e-learning system, traditional e-learning systems have dramatically evolved to provide more adaptive ways of learning, in terms of learning objectives, courses, individual learning processes, and so on. This paper reports on differences in learning experience from the learner's perspectives when using an adaptive e-learning system, where the learner's knowledge or skill level is used to configure the learning path. Central to this study is the evaluation of a dynamic content sequencing system (DCSS), with empirical outcomes being interpreted using Csikszentmihalyi's flow theory (i.e., Flow, Boredom, and Anxiety). A total of 80 participants carried out a one-way between-subject study controlled by the type of e-learning system (i.e., the DCSS vs. the non-DCSS). The results indicated that the lower or medium achievers gained certain benefits from the DCSS, whilst the high achievers in learning performance might suffer from boredom when using the DCSS. These contrasting findings can be suggested as a pragmatic design guideline for developing more engaging computer-based learning systems for unsupervised learning situations.

1. Introduction

No man's knowledge here can go beyond his experience (John Locke, An Essay Concerning Human Understanding, 1690)

Electronic learning (e-learning) or computer-based learning is widely seen as a key mode of pedagogy in higher education and professional training today, given the convenience and flexibility offered by these systems in comparison to traditional face-to-face learning activities (Song, Singleton, Hill, & Koh, 2004). Though this popularity seems to demonstrate the utility of computer-based learning systems, this seems to be in stark contrast to some assessments of usability or effectiveness (Chiu, Hsu, Sun, Lin, & Sun, 2005; Georges, Alfred, Catherine, Ben, & John, 2003; Hubona & Blanton, 1996).

Of course, there have been constant improvements in the usability of e-learning systems, but in essence they are still compared relatively poorly with traditional face-to-face learning activities (Allen, Bourhis, Burrell, & Mabry, 2002; Bernard et al., 2004; Levenberg & Caspi, 2010) thanks to the nature of unsupervised learning. This issue becomes the driving force of learners' needs, by which they seek to experience more enjoyable, easy-to-use, and effective learning tools. The on-going needs have prompted the evolution of introducing new e-learning systems and/or pedagogical theories, for instance, from simple electronic books (e-books) to game-based learning and adaptive learning systems.

Despite these advances, it seems that the assessment of these new e-learning systems has primarily been made by measuring the knowledge acquired through them, employing learning performance data such as retention (Packham, Jones, Miller, & Thomas, 2004; She & Chen, 2009) or transfer tests (Harskamp, Mayer, & Suhre, 2007; Mayer, 1997). Even some studies on game-based learning (e.g., Ebner & Holzinger, 2007) have adopted learning performance data to examine the effects of the game-based learning activity, aiming to show equal learning performance outcomes to traditional face-to-face learning. Contrary to this approach, Liu et al. (2009) and Sun, Tsai, Finger, Chen, and Yeh (2008) contended that learner's psychological satisfaction should be the ideal alternative measure of any e-learning systems, rather than learning performance, since this would have significant effects on the learner's ongoing intention to use e-learning systems in the future (Chiu et al., 2005; Lee, 2010; Lin, 2011).

Indeed, learner's psychological satisfaction has been to a greater extent included in many recent studies (Liaw, 2008; Lin, 2011; Paechter, Maier, & Macher, 2010; Sun et al., 2008), user satisfaction

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and learning experience having been interchangeably used in the context of usability (Chiu et al., 2005; Lee, 2010; Liaw, 2008; Sun et al., 2008). Lee (2010), for instance, claimed that usability, including the user's perception of learning experience, would be the essential factor in measuring the success of e-learning, but its subjective variance would make it hard to embed the necessary quality in e-learning systems design. Further, Alexander and Golja (2007) examined that the very quality of the e-learning system is the user experience that comes from the holistic perception of the system given throughout every learning activity including usability (e.g. easy of use, effectiveness) and usefulness (in terms of learning outcomes).

These perspectives suggest that the learner's experience with e-learning systems should be one of our primary research interests. Note that learning performance, which is related to learner's knowledge or skill level, can be measured in a quantitative way; in comparison, its corresponding learning experience, which generally involves user's learning conditions and internal cognitive states whilst engaging in learning activities, is still open to question about whether it can condition learning performance.

Of course, it is the case that learning performance with e-learning systems is the most important learning outcome; thereby it cannot be overlooked entirely. However, some studies (Mitchell, Chen, & Macredie, 2005; Koehler, Thompson, & Phye, 2011; Kopcha & Sullivan, 2008) have shown that some user groups (i.e., those who have relatively high skills or knowledge in the learning subject domain) tend not to take in e-learning systems, partly because of the lack of flexibility but mostly because of boredom whilst using them. Hence, a disclaimer of this article is that learning performance alone might not tell the full story. Instead, learning experience in conjunction with learning performance might indicate how to assess an e-learning system, and as a consequence, the designer could find an integrated way to embody both performance and experience quality into a computer-based learning system, and know what should be considered in this multi-dimensional process.

That being said, the primary aim of this article is to empirically demonstrate this issue, from the well-known perspective of optimal '*flow*' experience theory as suggested by Csikszentmihalyi (1990). A generally accepted definition of '*flow*' is a holistically controlled feeling where one acts with total involvement or engagement with a particular activity. Prior research on e-learning systems (Roca, Chiu, & Martínez, 2006) has proven that students who had enjoyed a good e-learning experience would readily adopt the computer-based or mobile-based technology and intend to use the learning application again in the future. In this article, the optimal flow experience theory in conjunction with learning performance is applied on the assumption that it can establish a solid approach to analyse computer-based non-formal and unsupervised learning processes.

As to the context of e-learning system, it is noted that few studies have considered an individual's optimal learning experience against his or her learning performance. This issue seems to be important due to the fact that a learner would have rather different learning experiences as their knowledge or skill level grows. Entry-level learners might have great interest in an e-learning system that is adaptable to their limited understanding, but experts might show a preference for an e-learning system that enables them to easily navigate through the system to selectively learn what they need. In this regard, the experiment in this present study takes into consideration a *dynamic content sequencing system* (DCSS), which is capable of self-organising learning content depending on learning performance or skill level. This dynamic content sequencing system fits well into the focus of our study in that it can reveal how different learning experiences might relate to levels of learning performance.

Yet, this paper does not intend to comprehensively investigate all the possible benefits of learning activities with e-learning systems, since this is rather too broad a scope. Instead, we narrow down our study to explore the benefits and limitations of an adaptive e-learning system, comparing it with a more traditional e-learning system activity. This will give an insight into how effectively the adaptive e-learning environment may cope with learning experience, extending the unsupervised learning experience and helping e-learning designers to make explicit the assumptions they are making when specifying how a user should interact with e-learning content.

2. Learning experience in computer-based learning

The nature of interaction and experience in learning activity has been advanced with the advent of computer-mediated communication. For instance, interaction modes adapting to computer-based learning are seen as learner–content, learner–teacher, and learner–learner interaction, respectively (Moore, 1989). The notion of community also comprises learning experience in conjunction with cognitive presence, teacher presence, and social presence together (Garrison, Anderson, & Archer, 2001). Both perspectives emphasize the importance of interactions among learners and between learners and teachers, as integral to the development of an effective learning experience (Buraphadeja & Dawson, 2008).

However, many studies in the area of computer-based learning have tended to focus on the development of courses and tend to emphasise what could be done online by teachers and what students would get from the computer-based learning application (Alexander, 2001). In contrast, our empirical study examined learner experience with a dynamic content sequencing system (DCSS) from learner's perspectives to see if it led to different learning outcomes against a non-dynamic system. If learning outcomes are not in parallel between DCSS and its counterpart, it would be interesting to further explore how to deal with individual's learning experience against his or her learning performance. The possible learning experience is outlined here for purposes of discussion.

2.1. Learning experience in the optimal flow channel

In previous literature about e-learning experience, learning experience has been examined two distinct perspectives. On the one hand, for instance, Deepwell and Malik (2008) investigated the experience of e-learning from the perspective of e-learning providers; so their main concerns were not for the students but for the teachers, addressing issues such as the technical usability and how the technology might support processes of pedagogical transition in higher education. On the other hand, as Paechter et al. (2010) claimed, the e-learning experience should be subject to the e-learning users, and it is imperative to consider the learner's experience of course content, interaction with the instructors, interaction with peer students, individual learning processes and course outcomes. Likewise, Liaw (2008), Song et al. (2004) and Sun et al. (2008) also saw how a learner perceives the design of a course, user interface, interaction with tutors, interaction with other students, learning processes and learning outcomes would be more important than what teachers would perceive.

Indeed, the studies mentioned above give a broad definition of *learner's experience*, but a more specific definition is needed for correct usage in this article. We relate learning experience to some cognitive states or conditions which a learner might undergo during individual computer-based learning processes and interactions. This would be examined by collecting their learning conditions and internal cognitive states whilst engaging in a learning activity, in particular assessing *how much an individual learner engages in a*