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Effects of instructional conditions and experience on the adoption of a learning tool

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ABSTRACT

This paper presents the results of a natural experiment investigating the effects of instructional conditions and experience on the adoption and sustained use of a learning tool. The experiment was conducted with undergraduate students, enrolled into four performing art courses (N = 77) at a research intensive university in Canada. The students used the video annotation software CLAS for course-based self-assessment on their performances. Although existing research offers insights into the factors predicting students' intentions of accepting a learning tool, much less is known about factors that affect actual adoption and sustained tool use. The study explored the use of CLAS amongst undergraduate students in four courses across two consecutive semesters. Trace data of students' tool use, graph-based measures of metacognitive monitoring, and text cohesion of video annotations were used to estimate the volume of tool use and the quality of the learning strategy and learning products created. The results confirmed that scaffolding (e.g., graded activity with instructional feedback) is required to guide students' initial tool use, although scaffolding did not have an independent significant effect on the quantity of tool use. The findings demonstrated that the use of the tool is strongly influenced by the experience an individual student gains from scaffolded conditions. That is, the students sustained their use of the learning tool in future courses even when the tool use was not graded nor was instructional feedback provided. An important implication is that students' tool use is not solely driven by motivation – rather, it is shaped by instructional conditions and experience with the tool use.

1. Introduction

Despite the many reported benefits of technology for facilitating student learning and engagement (Chen, Lambert, & Guidry, 2010; López-Pérez, Pérez-López, & Rodríguez-Ariza, 2011), studies have identified that a great majority of students (above 60%) can be classified as limited learning technology users (Lust, Elen, & Clarebout, 2013; Lust, Juarez Collazo, Elen, & Clarebout, 2012). The observed limited use is not simply a function of poor course design. The authors also noted a lack of student engagement with technologies even when learning tools are specifically embedded into course designs that follow pedagogically sound and empirically validated principles (Lust et al., 2013, 2012). Essentially, there is an educational challenge to first motivate students to accept the learning tool and second, to sustain their use of it.

Much research has been undertaken to understand the conditions for promoting student acceptance and long term adoption of learning tools (Cheung & Vogel, 2013; Edmunds, Thorpe, & Conole, 2012; Escobar-Rodriguez & Monge-Lozano, 2012). Most prominent in this area has been the technology acceptance model (TAM). The TAM was first proposed by Davis (1989) and comprises of two primary factors that are perceived to contribute to technology adoption: perceived ease of use and perceived usefulness (Sánchez & Hueros, 2010). The explanatory power of this model is further extended when additional constructs are incorporated such as self-efficacy, enjoyment, and learning goal orientation. These additional constructs provide additional explanatory power beyond that of TAM to better understand student use of technical systems (Yi & Hwang, 2003). However, while there is much to learn from these studies, the adopted constructs tend to explain factors influencing

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students' intentions to accept using learning tools, rather than their actual adoption (Clarebout, Elen, Collazo, Lust, & Jiang, 2013). Moreover, there is limited understanding of the conditions and pedagogical approaches that sustain students' use of educational technology, especially when the use of a certain tool is optional and not assessed.

1.1. Learning tool use as self-regulated learning

Contemporary research investigating student use of education technologies is increasingly situated within the context of self-regulated learning (SRL) (Trevors, Duffy, & Azevedo, 2014). As originally suggested by Azevedo (2005), SRL provides a robust theoretical framework to inform the study of technology-enabled learning (in computer-based learning environments). In this paper, we have adopted SRL as a framework to understand the conditions that sustain students' use of a learning technology. In particular, we incorporated Winne and Hadwin's model of self-regulated learning (Winne & Hadwin, 1998; Winne, 2006). This model considers five elements: conditions, operations, products, evaluations and standards (COPES) – that collectively influence self-regulatory processes of learning (Winne, 1996). According to the COPES model, learners use tools (cognitive, digital or physical) to *operate* on raw information (e.g., watching video recordings of a lecture) in order to construct *products* of their learning (e.g., recall of information introduced in the video recordings). To regulate their learning process, students *evaluate* the products of their learning (e.g., quality of their recall) and the effectiveness of their learning strategies according to internal (e.g., whether video watching results in satisfying information recall within the time budgeted for learning) or external *standards* (e.g., whether they received a passing mark on a quiz that accompanied the video). Consistent with modern educational psychology, the Winne and Hadwin model (1998) deems learners as active agents in the learning process. As active and constructive participants, learners monitor their learning and choose the tools they are going to adopt and the standards they will follow to evaluate the products of their learning (Winne, 1996) as a part of their metacognitive control and monitoring. This decision making process is based on internal (e.g., experience with tools, epistemic beliefs, and prior knowledge) and external (e.g., tasks mandating the use of a tool) *conditions* (Winne & Hadwin, 1998; Winne, 2011). Thus, certain conditions are required for learners to select and regularly use a particular learning tool.

As previously posited by Winne (2006) and empirically validated in several studies conducted by Clarebout et al. (2013), there are generally four main conditions that influence learners' decisions regarding tool selection and use. First, learners need to be aware of the value of the tool and its availability in their learning environment. Second, learners need to recognize that the tool can be applied to the specific task at hand. Third, even if the learners are cognizant of the benefits of the tool for the assigned task, they need to have sufficient skills to utilise the selected tool effectively. Finally, learners need sufficient motivation to invest the time necessary to use the tool. These conditions can explain why certain tools are not always adopted by learners despite having a positive prior experience (Sarfo, Elen, Clarebout, & Louw, 2010). In this context, Clarebout et al. (2013) proposed that learners first need to have some prior experience with a tool before their conceptions of it can be used as a predictor of future use.

1.2. Instructional conditions for the sustained use of a learning tool

In this paper, we accept and extend Clarebout et al.'s (2013) proposition to further suggest that for a tool to have sustained use, learners must first be exposed to the learning tool; and second, gain a level of proficiency in its use. In the absence of any previous experience with a tool or if a learner is only familiar with it in alternate contexts (i.e., transfer across contexts can be challenging (Perkins, 1985)), it is unlikely that learners will be able to recognize the value of the tool. That is, two of the conditions suggested by Winne (2006), value and awareness of a tool, are not met. *We posit that in order to meet these conditions and facilitate learners' ability to effectively use a tool, a level of scaffolding is required to guide learners in their initial use of the tool and how it can be applied to a particular learning task* (Azevedo & Hadwin, 2005; Beed, Hawkins, & Roller, 1991). The effects of the instructional conditions on learners' decision making and technology acceptance is well-documented in the literature (Azevedo, Moos, Greene, Winters, & Cromley, 2008; Cho & Kim, 2013; Garrison & Cleveland-Innes, 2005; McGill & Klobas, 2009; Trigwell, Prosser, & Waterhouse, 1999). Based on this literature, we suggest that *a learner's initial experience with a tool, should:*

- *have at least one task where the use of the tool is required to complete a course task and the task assessed (mandated in the course design); and*
- *be accompanied with guidance and feedback on how the student can use the tool effectively in order to complete the assigned learning tasks.*

To establish a sustained level of use of a particular tool, additional conditions need to be met. First, as recognized by the research on educational technology acceptance and illustrated by TAM, learners need to perceive the tool as easy to use and useful in order to preserve their intention to use the tool in the future (Sánchez & Hueros, 2010). This is particularly important when the use of a tool is optional. In other words, a tool must be intuitive to use without an extensive learning curve or extraneous cognitive load that could create an added layer of complexity impeding a student's ability to complete an assigned task (Devolder, van Braak, & Tondeur, 2012; Kirschner, Sweller, & Clark, 2006).

Second, learners need to be able to transfer the use of a tool to new contexts (Salomon & Perkins, 1989). As suggested by Winne (2006), learners need to be able to recognize when a tool can be appropriately applied to complete a new task. If a student's previous experience with a tool is similar to the new task, they are more likely to adopt the tool again to complete the requested task. However, if the context is significantly different, then the student's selection of the same technology is less likely. Winne (2006) describes this as a mediation deficiency. That is, a situation when learners are "unable to assemble bridging information between tools and to-be-learned information" (Winne, 2006, p. 7). The study reported in this paper focuses on the sustained tool use in similar tasks rather than on the transfer across different contexts.

1.3. Measurement of the use of educational technology

Studies on the adoption and effects of educational technology on self-regulated learning have primarily been based on measures of learner *operations*, as defined in the COPES model (Winne, 1996, 2006). These measures have tended to rely on learners' self-reports of their perceptions; use, and degree of use of a particular tool or learning approach (Clarebout et al., 2013; Lust, Collazo, Elen, & Clarebout, 2012; Sánchez & Hueros, 2010; Yi & Hwang, 2003). While SRL studies have often relied on self-report methodologies (e.g., think aloud protocols and surveys), alternate options are rapidly emerging such as the analysis of captured trace data from learners' interactions with educational technology (Azevedo, 2015).

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