Computers & Education 57 (2011) 2135–2144

Contents lists available at ScienceDirect

Computers & Education

journal homepage: www.elsevier.com/locate/compedu

Tool-use in a blended undergraduate course: In Search of user profiles

Griet Lust [a,*], Mieke Vandewaetere [a,b], Eva Ceulemans [c], Jan Elen [a], Geraldine Clarebout [a,b]

[a] Centre for Instructional Psychology and Technology, Dekenstraat 2, Box 3770, 3000 Leuven, Belgium
[b] Interdisciplinary Research on Technology, Education & Communication, E. Sabbelaan 53, 8500 Kortrijk, Belgium
[c] Center for Methodology of Educational Research, A. Vesaliusstraat 2, Box 3672, 3000 Leuven, Belgium

ARTICLE INFO

Article history:
Received 11 January 2011
Received in revised form
13 May 2011
Accepted 16 May 2011

Keywords:
Distributed learning environments
Pedagogical issues
Learning strategies
Media in education

ABSTRACT

The popularity of today's blended courses in higher education is driven by the assumption that students are provided with a rich toolset that supports them in their learning process. However, little is known on how students actually use these tools and how this affects their performance for the course. The current study investigates how students use the entire toolset at their disposal, whether tool-use patterns can be found and if these patterns affect performance for the course. Logging students ($n = 156$) actions throughout the content management system and registering students' use of the face-to-face support in an undergraduate course, the study reveals large student differences and an underuse for some tool-types. Further to this, K-means cluster analysis reveals three distinct tool-use patterns or user profiles: the no-users, the intensive users and the incoherent users. These patterns are characterized by different tool-choices and even different use intensity among students. Evidence is retrieved that these tool-use differences are problematic since multivariate analysis of variance reveals significant performance effects. Hence, these results imply that not all students seem to profit from the learning affordances that are provided. Similar as evidence in controlled settings, the results suggest that learner control in using tools cannot be taken for granted. Consequently, this study legitimates more research into the influencing (student and context) variables that can explain these differences.

1. Introduction

Today's higher educational area is characterized by an increased integration of Content Management Systems (CMSs) such as Blackboard, Moodle and WebCT (Dabbagh & Kitsantas, 2005) and this often into a traditional face-to-face constellation. The popularity of these blended learning environments is driven by the assumption that students are provided with a rich toolset that supports them in their learning process (Rivera, Mc Alister, & Rice, 2002). In most cases, these tools are non-embedded, which implies that using a specific tool is the learner's decision. Despite the widespread assumption that this unsupervised use of CMS tools provides adaptive support (Nutta, 2001) and stimulates a deeper and self-directed learning (Malikowski, Thompson, & Theis, 2007), it is not clear whether all students are good judges of their own learning and of the tool functionalities.

Evidence in similar learning environments with total student control reveals that not every student profits from the affordances of the learning environment (e.g. Beal, Qu & Lee, 2008; Clarebout & Elen., 2009; Lumpe & Butler, 2002). Hence, this evidence suggests that learner control in using tools might not always be beneficial. Although this evidence is mainly obtained in controlled settings characterized by non-embedded learning tasks and short time learning effects (Grabinger, 2008), it raises questions on how students use tools in ecological settings such as an undergraduate blended course. The current study addresses this concern.

1.1. Students' tool-use in a blended undergraduate course

Despite the popularity of blended courses, little seems to be known on how students deal with this blended experience i.e., how they profit from the combination of face-to-face and online instruction because most of the instructional technology based research is focused on

* Corresponding author. Tel.: +32 16 32 62 47; fax: +32 16 32 62 74.
E-mail address: griet.lust@ped.kuleuven (G. Lust).

0360-1315/$ – see front matter © 2011 Elsevier Ltd. All rights reserved.
doi:10.1016/j.compedu.2011.05.010

the online part (Buzetto-More & Sweat-Guy, 2006). A qualitative study of Ellis, Marcus, and Taylor (2005) stresses the need for more research into the blended experience. In their study, they revealed that alignment between the online and the face-to-face tools is problematic i.e., a lot of participants were unsure of how to approach the online tools in ways that are likely to maximize the learning benefits in blended experiences. This interpretation is in line with the findings of Yen and Lee (2011) focusing on students' study behavior in a blended problem solving task. Taking into account the frequency of using digital and classroom support, they revealed three types of learning behavior; 1) the hybrid-oriented group, 2) the technology-oriented group, and 3) the efficiency-oriented group. Students in the hybrid-oriented group used all the available support but in a passive way, they did not reflect on the functionality of each 'tool'. In addition, students in the technology-oriented group were focused on the digital support but merely because of the novelty of these tools. Finally, the efficiency-oriented group used all the available support as supposed to; they used the classroom moments to reflect on the retrieved knowledge and the digital support to expand their current knowledge. Hence, these two studies indicate that although a blended learning environment provides a rich toolset, not all students are capable of using these tools in relation to each other. Although these studies are not focused on an undergraduate course, they stress the need for expanding technology based research with the face-to-face part. The current study addresses this need by investigating students' tool-use in a blended course, capturing the online and the face-to-face tools.

1.2. Students' tool-use in a content management system

As for CMS tools, theoretically they provide different kinds of support (Dabbagh & Bannan-Ritland, 2005) and stimulate a deeper and self-directed learning (Dabbagh & Bannan-Ritland, 2005; Malikowski, Thompson & Theis, 2007; Nutta, 2001). Nevertheless, these assumptions regularly get falsified. With respect to using *communication tools* such as a discussion board, multiple studies reveal student differences in the amount of items post and items read (Hammoud, Love, Baldwin, & Chen, 2008; Hoskins & Van Hooff, 2005; Huon, Spehar, Adam, & Rifkin, 2007; Woods & Kemper, 2009). Results are conclusive that only active use i.e., posting messages, is beneficial for students' learning in contrast to passive use i.e., reading messages (Hammoud et al., 2008; Hoskins & Van Hooff, 2005). Similar results are retrieved with respect to using *knowledge modeling tools* such as practice quizzes (Hoskins & Van Hooff, 2005; Huon et al., 2007; Macfayden & Dawson, 2010). It appears that although a majority of students used this kind of tools, only a minority spend effort in completing them. Only the latter was beneficial for learning (Macfayden & Dawson, 2010). In a twofold study by Grabe and Christopherson (2005; 2008) student differences were found in the moment students used *information tools* that gave the basic course content (e.g., outline notes, web lectures). Without taking the moment of use into consideration, both studies found a positive relationship between students' use of notes and their performance.

Hence, the above studies stress that even in ecological learning environments it cannot be assumed that students take the opportunities offered to them (Perkins, 1985). Furthermore, the distinct performance effects imply that not all students are likely to profit from the opportunities that are provided in CMSs. Despite these important insights, contemporary research on CMS use is mainly focused on students' use of a specific tool. It is still unclear how students use the tools simultaneously. Since a broad toolset is at students' disposal in an undergraduate course and since students are active agents, it is possible that students will make choices in using different tools and will differ in their use dependent on a specific tool.

1.3. Research questions

In addition to existing evidence on students' use of CMS tools, the current contribution investigates how students use the blended toolset at their disposal. Further to this, the study looks not only for tool-use differences but investigates whether these differences reflect distinct tool-use patterns or profiles. Specifically, the study addresses the following research questions:

- Do tool-use differences among students reflect distinct tool-use patterns or user profiles?

It can be expected that students will differ in their *diversity* of tool-use (Liu & Bera, 2005; Liu, Bera, Corliss, Svincki, & Beth. 2004) i.e., the choices that they make. Based on the literature we expect at least three groups of users, a) the *no-users* as the ones that do not use the available tools, b) the *incoherent users* as the ones who use the face-to-face tools and only those CMS tools with a clear link to the face-to-face context e.g., course material outlines (Ellis et al., 2005), and c) the *intensive users* as these students that use all the available tools. Additionally, it can be expected that differences in students' *activeness* of tool-use can be found as well (Bera & Liu, 2006; Liu & Bera, 2005; Liu et al., 2004). In line with previous evidence on using CMS tools, it can be expected that differences will exists among intensive users in the frequency and the intensity of their tool-use.

- What are the learning effects of students' tool-use patterns?

2. Methods and materials

2.1. Participants

Participants were 156 of the 175 first year Educational Sciences undergraduates (90%) at the Katholieke Universiteit Leuven. There were 151 woman and 6 men. Most of the students were 18 years (73.2%). The distributions in gender and age represent the demographics of the whole cohort of 175 and are typical for Flemish Educational Sciences courses.

2.2. The blended course unit

At the university of Leuven (KUL), 'Learning and Instruction' is a first year bachelor course at the department of Educational Sciences.

Additional to the lectures, a CMS was provided and a team of support staff was at students' disposal. The support staff organized three learning support sessions that students could attend voluntarily. The first session supported students in making an exercise as preparation