



Contents lists available at ScienceDirect

Computers & Education

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

Can more interactivity improve learning achievement in an online course? Effects of college students' perception and actual use of a course-management system on their learning achievement



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ARTICLE INFO

Article history:

Received 18 August 2014

Received in revised form

15 December 2014

Accepted 18 December 2014

Available online 31 December 2014

Keywords:

Computer-mediated communication

Distance education and telelearning

Interactive learning environments

Post-secondary education

ABSTRACT

This study aims to investigate how interactivity influence learners' use of interactive functions in the course-management system (CMS) and their online learning performance. A two-tier mediation framework is proposed to examine the mediating effects of different actual-use records concerning the CMS's interactive functions. Data are collected from 381 undergraduate students who enrolled in a general-education asynchronous online course from three universities in Taiwan. The results indicate that the relationships among students' self-reported use of interactive functions, students' perceptions of the usefulness of interactive functions, and students' actual-use logs have some direct influences on students' online learning performance (online-discussion scores, exam scores, and group-project scores). In addition, students' actual-use logs (the number of times of log-ins to the online course, the number of times students read learning materials, and the number of postings on the discussion board) have a mediated effect on students' self-reported frequency of logging into the CMS, students' self-reported frequency of using the learner–instructor/learner–learner interactive functions, and online learning performance. The findings and implications could constitute a useful guide for educational practitioners and designers concerned with the effective integration of interactivity into future online courses.

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1. Introduction

Interactivity has been viewed as playing an essential role in the learning process among learners, instructors, and learning content. It is presumed to occur in all learning environments including formal education and informal education (Bernard et al., 2009; Ke, 2013). Learners can interact with peers and instructors to exchange and share their knowledge. Meanwhile, they can construct new knowledge and reorganize prior knowledge from this interaction process (Kang & Im, 2013). As Song and McNary (2011) concluded, students' interaction is always an indispensable and fundamental component of their knowledge acquisition and cognitive development in traditional face-to-face learning settings.

Owing to the rapid expansion of and progress in Internet technology and Internet use, online learning has become more and more popular in today's higher education (Ke & Kwak, 2013; Wei & Chou, 2014). Online learning enables learners and instructors to bypass regular daily or weekly face-to-face encounters, and most, if not all, learning materials are deliverable online. Online learning also enables learners to gain knowledge and skills through synchronous and asynchronous learning applications without time and space limitations (Allen & Seaman, 2013; Kaymak & Horzum, 2013). Therefore, interactivity has been viewed as one of the most important parts of learners' successful learning experiences in an online learning environment (Cho & Kim, 2013; Garner & Bol, 2011; Kang & Im, 2013; Richardson & Swan, 2003; Watson, 2013).

In order to facilitate interactivity in online learning, educators have usually been adopting a course-management system (CMS), such as Moodle or Blackboard, which can facilitate the delivery and management of online-course materials and activities while strengthening students' learning progress (Liaw & Huang, 2013; Malikowski, 2008; West, Waddoups, & Graham, 2007). Whether or not CMSs can provide

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sufficient and effective interactive functions to facilitate students' interactions and learning has become an important research issue (Chou, Peng, & Chang, 2010) and is the focus of the present study.

2. Literature review

2.1. Definitions of interactivity in online learning

What exactly is interactivity in learning assisted by computers or networks? Evans and Sabry (2003) proposed a simple three-way model (computer-initiation, learner-response, and computer-feedback) to address the concept of interactivity in an online multimedia learning environment. This model parallels the common classroom three-step interaction pattern (teacher's initiation, students' response, and teacher's feedback; see Smith, Hardman, & Higgins, 2006). However, in a typical online course, interactivity should not be limited to learner–computer interaction. Chou (2003) and Chou et al. (2010) considered the technology affordance and extended the concept of interactivity in online learning into five interaction types: the learner–self, learner–learner, learner–instructor, learner–content, and learner–interface types. The researchers further proposed a technical framework of interactive functions (e.g., built-in email system, chat rooms, individual-learning records) for each interaction type in the context of CMSs.

From the above-mentioned literature, it became clear that, in a CMS, the five interaction types of online learning proposed by Chou (2003) and Chou et al. (2010) did cover all CMSs' functions. These functions were mainly designed to address various interactive needs for online learning. However, due to the highly overlapped CMSs' interactive functions in the learner–learner interaction and learner–instructor interaction, we merged these two interactive types into one human–human interaction.

In sum, we proposed a revised structure with four interaction types to further discuss students' interactions in an online learning environment. However, few studies have investigated the relationship between the noted interactive functions and students' use of or perceptions of interactive functions in online learning courses. Therefore, it seems warranted to incorporate log-in records, in addition to self-reported data about their use of interactive functions, to facilitate understanding of students' actual use of interactive functions, and to study the relationships among students' perceptions of, as well as actual use of, these interaction functions and the students' learning performances.

2.2. Interactivity and online learning achievement

As mentioned above, interactivity in online learning has been classified into multiple categories (Bannan-Ritland, 2002; Chou, 2003; Hillman, Willis, & Gunawardena, 1994; Moore, 1989; Soo & Bonk, 1998) which are believed to be significant for learners' learning experience and possible achievement in online learning. Previous studies have focused mainly on ways of improving the quality of interactivity in online learning environments (Kaymak & Horzum, 2013; Tremayne, 2005; Woo & Reeves, 2007) and on learners' perceptions of interactivity in online learning environments (Kioussis, 2002; Liaw & Huang, 2013; Sun & Hsu, 2013; Thorson & Rodgers, 2006). Not much past research has explored the interactivity involved in learning achievement. Among the few studies that have, Evans and Sabry (2003) documented evidence that students in a more interactive system had outperformed and required less time than those in a non-interactive system when taking problem-solving tests. Therefore, the two researchers concluded that more interactivity facilitates deep learning (understanding) by actively engaging the learner in the learning process. However, in their study, only three interactive functions (pace-control, self-assessment, and interactive simulation) were available to students. In other words, even in the interactive-system group, students had only limited, pre-set interactivity for carrying out their learning activities.

Similarly, some studies found that, in online learning, learners perceiving a high degree of interaction with instructors and peers tended to perceive higher learning outcomes than learners perceiving a low degree of interaction (Garrison & Cleveland-Innes, 2005; So & Brush, 2008). Kang and Im (2013) examined which factors in online university learners' perception of learner–instructor interaction (regarding such areas as guidance and learning assistance, social intimacy, instructional communication and Q&A, instructor presence, instructional support) could predict the learners' perception of learning outcomes and the learners' perception of satisfaction in online learning environments. Results showed that factors related to instructional interaction significantly predicted learners' perception of learning achievement and learners' perception of satisfaction. Furthermore, Kang and Im pointed out that instructor presence in learners' perception of learner–instructor interaction could be an important predictor of learners' perception of satisfaction in an online learning environment. By contrast, Eom, Wen, and Ashill (2006) found no support for a positive relationship between students' perception of interaction with instructors and peers and the students' perception of learning outcomes. Therefore, we can conclude that the relationship between interaction types and learning outcomes has not yet been consistently established, and thus merits further study.

Pascual-Miguel, Chaparro-Peláez, Hernández-García, and Iglesias-Pradas (2010) used students' logs to analyze the relationship between interaction and academic performance. The results provide at best only partial evidence and at worst no evidence at all that interaction indicators influence students' final course grades (such as total number of interactions, chats, or forums). In other words, there seems to be no relationship between students' platform-based activity and their final academic performance. The non-significant results might be rooted in the limitations of the small sample (48 students), the short duration of the course (2–9 weeks), and the mixed instructional context (a regular face-to-face class and an online distance class). Nevertheless, this study considered computer logs as one valid and useful data source with which to supplement students' self-reported data.

2.3. Lessons learned from past studies and research questions

The brief review of the above-mentioned studies provides a foundation for understanding interaction's role as an important component of and research issue in online learning. Past studies have shed light on the following themes.

- (1) Scope and definition: Different studies have various definitions or classifications of interactivity in online-learning contexts. The present study has reached a conclusion that, in addition to human–human interaction (student–self, student–teacher, and student–student) in

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