The Greater the Online Participation, the Better the Learning Achievement? A Study of Integrating Moodle into Learning

Gary Cheng and Hin Leung Chui

Department of Mathematics and Information Technology
The Hong Kong Institute of Education
10 Lo Ping Road, Tai Po, N.T., Hong Kong SAR, China
{chengks,mikechui}@ied.edu.hk

Abstract. This study aimed to explore the relationship between students' online participation in Moodle and their learning achievement. Participants in the study were 78 undergraduate full-time students who were enrolled in a general education course entitled "Digital Citizenship" at a higher education institute in Hong Kong. They were required to choose from and participate in different types of Moodle activities including information access (e.g., reading online supplementary resources), interactive learning (e.g., running online simulations), networked learning (e.g., discussing in online forums), and materials development (e.g., writing reflective journals). The online participation of a student was measured by the number of completed activities, while the learning achievement of a student was determined by his/her essay grade. This study applied the Partial Least Squares (PLS) method to the collected data in order to identify whether there was a link between online participation and learning achievement. The results indicate that online participation in networked learning or in materials development, but not in information access nor in interactive learning, was positively and significantly related to learning achievement. This finding highlights the importance of social interaction and individual constructivism for effective online learning.

Keywords: online participation, learning achievement, learning management system.

1 Introduction

Moodle is one of the open source Learning Management Systems (LMSs) that provides a wide range of resource and activity modules to support online and blended learning [1]. The resource modules are designed to support the online delivery of learning materials, while the activity modules are used to evaluate students' learning achievement (e.g., through the use of assignment and quiz modules) and facilitate the building of online learning communities (e.g., through the use of forum and wiki modules). According to the statistics from [2], by late April 2014, over 85 thousand active Moodle sites have been registered from 240 countries. The statistics also show that

K.C. Li et al. (Eds.): ICTE 2014, CCIS 494, pp. 136–144, 2015.

there have been over 77 million Moodle users worldwide and over 8 million courses on Moodle. Given the huge user base of Moodle and its continued development as a free, customisable LMS, Moodle has become popular and competitive in education over recent years. It is no surprise that a growing body of blended learning studies has chosen Moodle as a platform for research [3][4]. This study is one example.

LMSs offer tools to support the interactivity between student and content, between student and teacher, and among students [5]. Such interactivity can promote learning in two ways. First, through independent online activities, the interactivity between student and content engenders a shift from teacher-centred to student-centred learning and also fosters constructivist learning [6]. Second, through online learning communities, the interactivity between student and teacher as well as among students encourages students to assume greater learner responsibility and peer collaboration [7][8].

However, despite recognition of their benefits for student learning, LMSs face concerns that may impinge upon their implementation. A major concern relates to the effectiveness of online participation in improving learning achievement. Prior research was carried out to explore this issue, but mixed results were produced. For example, some studies found that there was no significant difference in course grades between students in the face-to-face group and those in the online group, suggesting that no apparent link exists between online participation and learning achievement [9][10]. In contrast, some others showed that online participation (e.g., peer-to-peer discussion in online forums) was significantly correlated with learning achievement [11][12].

Given the mixed results, it remains unclear whether there is a positive impact of online participation on learning achievement. Therefore, this study was designed to explore their relationship. To address the limitations of some previous studies, this study involved a statistically acceptable number of participants, categorised online participation into a range of the commonly used online activities, and provided students with a number of online activities to choose from.

2 Related Work

In his theory of online learning as online participation, Hrastinski emphasised that online learning and online participation are intricately interrelated [13]. He also added that online participation can take different forms, for example, from resources access to knowledge co-construction. Oliver and Herrington identified four common forms of online participation [14]. The first is called information access, which is characterised by the way that students use technology to gain access to online resources such as online video clips. The second is called interactive learning, which means that students are engaged with interactive learning elements such as online self-test tool with automatic feedback. The third one, called networked learning, refers to using technology to support communication and collaboration among students and teachers such as online discussion forums. The last is known as materials development, which means that students use technology as a tool to build and present their own artefacts such as online multimedia presentation.

Prior studies were conducted to investigate the relationship between online participation and learning achievement. Some reported that no significant relationship was found between them. Zacharis found in his study that there was no significant difference in course grades between students in the face-to-face group and those in the online group [10]. This finding was consistent with the results of some other studies [9][15]. However, a few recent studies have indicated that online participation was significantly correlated with learning achievement. Huang et al. developed a method to evaluate students' online participation by a set of indicators (e.g., the number of posts created in forums, the number of files viewed, the time spent on browsing non-interactive pages and the number of pages read) [11]. Their results revealed that online participation was positively related to learning achievement in terms of test scores. In a study carried out by Shaw [12], a total of 144 undergraduates enrolled in a computer programming course were involved. He measured learning achievement in terms of examination scores. Moreover, he evaluated online participation based on the number of forum posts created, the number of forum posts viewed and the number of questions asked. The results validated that online participation was significantly associated with learning achievement.

Owing to the inconclusive results obtained in the literature and the multifaceted nature of online participation, more studies are needed to further investigate the connection between online participation and learning achievement.

3 Research Model and Hypotheses

3.1 Research Model

Fig. 1 illustrates the research model of this study. It comprises four types of online participation and learning achievement. As discussed in the previous section, the four types of online participation include information access, interactive learning, networked learning and materials development [14]. Due to the potential that students would get more access to learning resources and receive more learning support from peers in Moodle, it was assumed that online participation would have a positive effect on learning achievement.

3.2 Hypotheses

Previous studies reported mixed results on the relationship between online participation and learning achievement. Morris, Finnegan, and Sz-Shyan argued that the frequency of online participation was important for successful online learning [16]. They found that the number of forum posts and content pages viewed by students were significant predictors for their course grades. By contrast, Palmer, Holt and Bray found that the number of forum posts viewed by students contributed very little to their course grades, suggesting that the link between passive participation in LMSs and learning achievement was weak [17]. Davies and Graff showed that more online participation on a mandatory basis did not necessarily lead to better learning

achievement [18]. To further explore the relationship between online participation and learning achievement, four hypotheses were developed as follows:

Hypothesis 1. Participation in information access is significantly related to learning achievement.
Hypothesis 2. Participation in interactive learning is significantly related to learning achievement.
Hypothesis 3. Participation in networked learning is significantly related to learning achievement.
Hypothesis 4. Participation in materials development is significantly related to learning achievement.

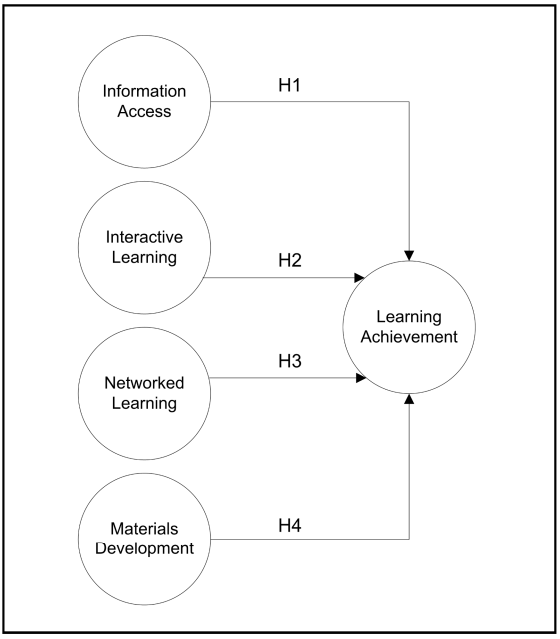

Fig. 1. Research model

4 Research Method

4.1 Context

Participants in the study were 78 undergraduate full-time students who were enrolled in a general education course entitled "Digital Citizenship" at a higher education institute in Hong Kong. The participants were all sophomores in the Bachelor of Education (Chinese Language) programme. Most of them were female and in the age group of 21 to 23 years. The course was delivered via a mix of face-to-face (f2f) sessions and online instructional activities over a period of eleven weeks in the academic year of 2012/13, with each f2f session lasting approximately 2.5 hours. Four major parts

were covered in the course: (i) introduction to digital culture and citizenship, (ii) nine essential elements of digital citizenship, (iii) appropriate use of technology with respect to elements of digital citizenship, and (iv) impact of digital citizenship on the society.

Since the time for each f2f class was limited, online activities was designed to strengthen and extend students' understanding of several important concepts that were not discussed in detail during class. Students could choose and participate in their preferred online activities after class. Specifically, four types of online activities were developed in Moodle every week: (i) information access - students were asked to access online materials and write a summary about the materials, (ii) interactive learning - students were asked to participate in an interactive quiz or webpage, (iii) networked learning - students were asked to create a post and give someone a reply in a discussion forum or to update a group wiki page twice, and (iv) materials development - students were asked to write a reflective journal or prepare a multimedia presentation using MS PowerPoint.

In the course, there were three assessment items: online participation, group presentation and individual essay. The items constituted 10%, 30% and 60% of the overall course grade, respectively. In order to obtain a full score of online participation, students were required to complete a minimum of four activities, each from a different topic. Figure 2 illustrates different types of online activities designed for a topic called "Digital Commerce". Eight other topics featured the same number and type of online activities.

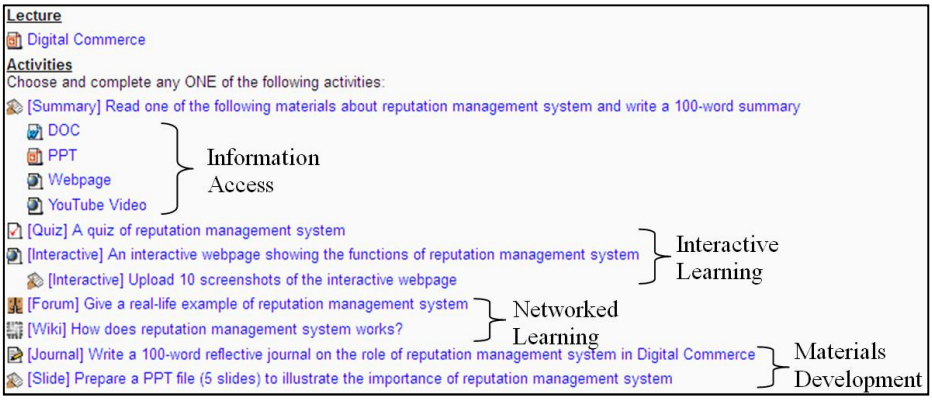

Fig. 2. Different types of online activities

4.2 Measures for Online Participation and Learning Achievement

Table 1 summarises a list of indicators used for online participation and learning achievement in this study. Online participation was measured by the frequency of student participation in online activities. Specifically, the number of summaries written about online study materials was used as an indicator to measure participation in information access. To measure participation in interactive learning, the number of

online quizzes taken and the number of interactive webpages accessed were used as the indicators. To measure participation in networked learning, the count of forum postings (i.e., one post and one response were expected in the same forum for each count) and the count of wikis updated (i.e., a wiki should be updated twice for each count) were used as the indicators. Lastly, to measure participation in materials development, the number of reflective journals created and the number of presentation files completed were used as the indicators.

At the end of the course, students were required to submit an individual essay of 2,000 words on discussing the characteristics of digital citizenship and its impact on our society. A marking scheme was developed to cover a number of assessment areas including introduction, evidence and analysis, concluding remark, style and use of references. Based on the marking scheme, all essays were marked by the course instructor. To ensure consistency of marking, a sample of the marked essays with high, medium and low grades were reviewed by another teacher with experience in teaching the same course. The essay grade was used as an indicator of learning achievement.

Table 1. Indicators for online participation and learning achievement

Construct	Indicator
Information Access (IA)	IA1. Number of summaries written about documents
	IA2. Number of summaries written about slides
	IA3. Number of summaries written about static web page
	IA4. Number of summaries written about videos
Interactive Learning (IL)	IL1. Number of quizzes taken
	IL2. Number of interactive web pages accessed
Networked Learning (NL)	NL1. Number of forum posts and replies created
	NL2. Number of wikis updated
Materials Development (MD)	MD1. Number of reflective journals created
	MD2. Number of presentation files completed
Learning Achievement (LA)	LA1. Essay grade

5 Results and Discussion

A variance-based structural equation modeling (SEM) technique called Partial Least Squares (PLS) was used to explore the research model illustrated in Fig. 1 [19]. PLS estimates the path relationships in a model with the objective of minimising the residual variance of all dependent variables rather than explaining the covariation, so it was widely used for theory development and prediction of key constructs [20][21]. In this section, the results of PLS are discussed in terms of the relationship between online participation and learning achievement (i.e., the path coefficient) and the impact of online participation on learning achievement (i.e., the effect size). The results are shown in Table 2.

Table 2. Results of PLS

Hypothesis	Path	Path coefficient	f^2 effect size	t-value	Hypothesis supported?
H1	IA → LA	.078	.009	0.848	No
H2	IL → LA	.012	.000	0.106	No
H3	NL → LA	.408	.194	3.253 ***	Yes
H4	MD → LA	.355	.159	2.907 ***	Yes

*$p < .10$, **$p < .05$, ***$p < .01$

Hypotheses 1 to 4 suggested that students' participation in online activities was significantly associated with their learning achievement. As shown in Table 2, hypotheses 3 and 4 were supported by the data while hypotheses 1 and 2 were not. In other words, online participation in networked learning was significantly related to learning achievement (H3, $p < .01$), and online participation in materials development was significantly related to learning achievement (H4, $p < .01$). An analysis of the effect sizes of networked learning ($f^2 = .194$) and materials development ($f^2 = .159$) indicates that their impact on learning achievement was medium [22]. The results suggest that students' learning achievement was influenced by their frequency of online participation in networked learning or in materials development.

In this study, networked learning (e.g., online discussion and wiki development) required students to interact with peers through comments about and references to ideas of each other. This kind of social interaction was recognised as a key factor contributing to the cognitive and intellectual growth of individuals [23] as well as to deep learning and understanding [24]. Our results are consistent with the finding of [16], highlighting the importance of social interaction to learning achievement in LMSs.

Unlike networked learning, materials development focused on individual activities such as creating one's own digital artefacts in forms of reflective journal and multimedia presentation. It involved students in a learning process to collect, select, organise, and present their understanding. Such a process was underpinned by the constructivist learning theory, in which learning is perceived as a process of constructing meaning and students learn best when they construct their knowledge in an active way [23]. In this regard, our results add evidence to support the positive impact of individual constructivism on learning achievement in LMSs.

6 Concluding Remarks

To recapitulate, this study was designed to explore the relationship between online participation in Moodle and learning performance in a blended learning course using the Partial Least Squares (PLS) method. Participants in the study were 78 undergraduate full-time students who were enrolled in a general education course entitled "Digital Citizenship" at a higher education institute in Hong Kong. The participants were required to choose from and participate in different types of Moodle activities including information access (e.g., reading online resources), interactive learning

(e.g., running online simulations), networked learning (e.g., discussing in online forums), and materials development (e.g., writing reflective journals). The online participation of a student was measured by the number of online activities completed, while the learning achievement of a student was determined by his/her essay grade.

The results of the PLS analysis indicate that online participation in networked learning or in materials development, but not in information access nor in interactive learning, was positively and significantly related to learning achievement. In the study, networked learning required social interaction among students while materials development required individual construction of artefacts. With theoretical and empirical support, both social interaction and individual constructivism have an impact on fostering deep learning. Our findings further illuminate the importance of social interaction and individual constructivism for effective online learning.

Several limitations of this study can be identified. First, the sample was taken from a general education course only. In order to generalise the findings, more research should be conducted in various courses. Second, the results of this study were derived from the frequency of online participation and the essay grade, but the quality of online participation was not taken into account. In future research, both the quantity and quality of online activities should be evaluated to gain a fuller understanding of online participation.

Acknowledgement. This research was financially supported by the departmental small research grant from the Hong Kong Institute of Education (Ref: MIT/SRG02/12-13).

References

1. Moodle: What is Moodle? (2014), https://moodle.org/about/ (retrieved April 25, 2014)
2. Moodle: Moodle Statistics (2014), https://moodle.org/stats (retrieved April 25, 2014)
3. Escobar-Rodriguez, T., Monge-Lozano, P.: The acceptance of Moodle technology by business administration students. Computers & Education 58(4), 1085–1093 (2012)
4. Lambropoulos, N., Faulkner, X., Culwin, F.: Supporting Social Awareness in Collaborative E-learning. British Journal of Educational Technology 43(2), 295–306 (2012)
5. Lonn, S., Teasley, S.D., Krumm, A.E.: Who needs to do what where?: Using learning management systems on residential vs. commuter campuses. Computers & Education 56(3), 642–649 (2011)
6. Lonn, S., Teasley, S.D.: Saving time or innovating practice: Investigating perceptions and uses of Learning Management Systems. Computers & Education 53(3), 686–694 (2009)
7. Garrison, D.R., Kanuka, H.: Blended learning: Uncovering its transformative potential in higher education. The Internet and Higher Education 7(2), 95–105 (2004)
8. Naveh, G., Tubin, D., Pliskin, N.: Student satisfaction with learning management systems: a lens of critical success factors. Technology, Pedagogy and Education 21(3), 337–350 (2012)

9. Brittan-Powell, C., Legum, H., Taylor, E.: The relationship between student learning style, selection of course delivery format, and academic performance. International Journal of Instructional Technology and Distance Learning 5(5), 41–46 (2008)
10. Zacharis, N.Z.: The effect of learning style on preference for web-based courses and learning outcomes. British Journal of Educational Technology 42(5), 790–800 (2011)
11. Huang, E.Y., Lin, S.W., Huang, T.K.: What type of learning style leads to online participation in the mixed-mode e-learning environment? A study of software usage instruction. Computers & Education 58(1), 338–348 (2012)
12. Shaw, R.-S.: A study of the relationships among learning styles, participation types, and performance in programming language learning supported by online forums. Computers & Education 58(1), 111–120 (2012)
13. Hrastinski, S.: A theory of online learning as online participation. Computers & Education 52(1), 78–82 (2009)
14. Oliver, R., Herrington, J.: Teaching and learning online: A beginner's guide to e-learning and e-teaching in higher education. Edith Cowan University, Western Australia (2001)
15. Buerck, J.P., Malmstrom, T., Peppers, E.: Learning environments and learning styles: nontraditional student enrollment and success in an Internet-based versus a lecture-based computer science course. Learning Environments Research 6(2), 137–155 (2003)
16. Morris, K.V., Finnegan, C., Sz-Shyan, W.: Tracking student behavior, persistence, and achievement in online courses. Internet and Higher Education 8(3), 221–231 (2005)
17. Palmer, S., Holt, D., Bray, S.: Does the discussion help? The impact of a formally assessed online discussion on final student results. British Journal of Educational Technology 39(5), 847–858 (2008)
18. Davies, J., Graff, M.: Performance in e-learning: online participation and student grades. British Journal of Educational Technology 36(4), 657–663 (2005)
19. Wold, H.: Systems analysis by partial least squares. In: Nijkamp, P., Leitner, H., Wrigley, N. (eds.) Measuring the Unmeasurable, pp. 221–252. Martinus Nijhoff, Dordrecht (1985)
20. Chin, W.W.: The partial least squares approach to structural equation modeling. In: Marcoulides, G.A. (ed.) Modern Methods for Business Research, pp. 295–336. Erlbaum, Mahwah (1998)
21. Hair, J.F., Hult, G.T.M., Ringle, C.M., Sarstedt, M.: A Primer on Partial Least Squares Structural Equation Modeling (PLS-SEM). Sage, Thousand Oaks (2013)
22. Cohen, J.: Statistical power analysis for the behavioral sciences. Lawrence Erlbaum, Mahwah (1988)
23. Vygotsky, L.: Mind in Society. Harvard University Press, Cambridge (1978)
24. Donnelly, R.: Online learning in teacher education: Enhanced with a problem-based learning approach. AACE Journal 12(2), 236–247 (2004)