Using log data to investigate the impact of (a)synchronous learning tools on LMS interaction

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This paper presents exploratory examination of LMS log data from ten undergraduate business courses that differ in terms of learning activity design. Data were derived from the Unit Statistics and User Activity functions on Blackboard versions 8 and 9.1, which report the number of student hits across the various LMS applications. The research identifies obstacles encountered when using log data. Findings suggest that the design of learning activities has substantial impact upon levels of student interaction with the LMS. Furthermore the greater the amount of asynchronous learning activities, versus synchronous ones, may generate increased student interaction not just with the interactive applications but with the LMS overall. This outcome is particularly relevant given the correlation between LMS interaction and student results reported in other studies. The research confirms the potential of log data to inform online teaching practice, highlights some of challenges involved and outlines avenues for future research.

Keywords: log data, LMS, synchronous, asynchronous, e-learning.

Introduction

The past five years have seen dramatic growth in online education in Australia, as well as the surrounding Asia Pacific (APAC) region. As illustration, Open Universities Australia (OUA) enrolments increased from 38,133 in 2005 to 130,976 in 2010 (OUA, 2011). Many other well known universities have also joined the e-learning bandwagon, delivering online and blended teaching not only in Australia but to other APAC countries as well. The international delivery mode frequently takes the form of collaborative ventures with locally based institutions such as Kaplan in Singapore.

With the growing use of learning management systems (LMS) in online education (Weaver, Spratt & Nair, 2008) an apparent correlation between level of LMS student interaction and the assessment grade achieved has been inferred by some researchers using log-in statistics (Beer et al., 2009; Macfadyen & Dawson, 2010). Log data provide an indicator of user interaction with the LMS and have the advantage of being non intrusive, readily available and free. However, the downsides include the time it takes to prepare the data into a format

ready for appropriate analysis (Black et al., 2008), as well as the fact that log data never fully describe how users interact with the LMS, nor reveal insights into the users experience, both of which may influence the depth and quality of interaction with the learning site (Beer et al. 2008). Furthermore log data do not necessarily track frequency of reading / interacting with learning materials since some students, perhaps those with connection problems or those who prefer paper, may work with downloaded materials. While few institutions have used student access data obtained from the LMS system logs to inform decision making (Beer et al., 2009), the potential for extracting pedagogically meaningful data is becoming more widely recognised (Macfadyen & Dawson, 2010; Yang et al., 2010).

One potential avenue for log data research concerns the ongoing debate about the use of synchronous versus asynchronous approaches in online education (e.g., Cheung & Hew, 2010). Synchronous live online chats are structured by a moderator and may be text based discussion threads, as well as audio or video discussion using software such as Elluminate. Recordings of the live debate can be posted onto the LMS after the synchronous session to provide students unable to attend the opportunity to observe the interactions. Advantages of these live chats have been discussed widely (e.g., Luck & Whiteley-De Graaf, 2004). They are perhaps most popular since they provide instant responses and feedback between students and teachers.

Many researchers and educators view asynchronous online discussions as playing a crucial role in online learning. Asynchronous discussions are mainly text based. The key advantage over synchronous tools, is that they do not require a presence at a particular 'time' and 'place' and hence students may revisit this environment as often as they like at their own convenience. Kim and Shaw (2009) conclude that online discussion promotes collaborative problem solving and discovery-oriented activities. Another advantage is the ability to foster student-peer interaction (Rochester & Pradel, 2008). According to Lee (2005) use of discussion boards also helps students to learn to respect and appreciate the opinions of other participants. Birch and Volkov (2005) found that the use of discussion boards allowed students to achieve a range of cognitive and social learning outcomes, and to develop some important graduate skills.

Given the strengths of synchronous and asynchronous approaches supporters and detractors can be found for each; both among teaching staff and students. Some online educational researchers recommend utilising both delivery formats (e.g., Greenland & Ho, 2010; McDonald, 2006). This paper describes exploratory research examining LMS log data from business undergraduate units that employ varying degrees of synchronous and asynchronous learning activities. After presenting the methodology and results, the potential implications for pedagogy design, as well as LMS service providers are discussed.

Methodology

Data were derived from the Unit Statistics function on Blackboard 8 and the Summary of User Activity function on Blackboard 9.1, which report the number of user hits on the various LMS applications. Units examined in this exploratory research ran between 2009 and 2011. Those selected vary in terms of the degree of asynchronous and synchronous learning activities involved in weekly lesson activities. They are classified as being either synchronous (using text based live chat as the main learning activity), asynchronous (using text discussion threads as the main learning activity), or as combining a mixture of synchronous and asynchronous activities. To serve as a constant one unit was run in the three different learning activity modes across different study periods. For units using synchronous discussion recordings of the transcripts were posted to the LMS after each live chat session.

Challenges of using Blackboard log data

The log data downloaded from Blackboard enable the mean number of hits per student to be calculated for each of the selected units. While such data are fairly simplistic in nature a number of challenges were encountered in their retrieval and are outlined below:

With the Blackboard LMS, if user interaction and the number of hits are to be recorded, the track statistics

option must be manually set for the various applications for each unit. While this was done for the units investigated in this paper, if a unit convenor does not do this when constructing the unit learning site, or simply forgets to set this option for just one of the applications, then the data are rendered unusable and cannot be compared against other units. Ideally an LMS should have tracking statistics enabled automatically for all applications; otherwise potentially valuable information is lost.

While log data remain available for the duration of the unit, the Blackboard LMS purges log entry data shortly after the unit is complete. Consequently if data are not downloaded immediately after the unit is finished then the information is lost.

Currently the unit statistics relating to interaction with the LMS are separate from the grade centre. If analysis of LMS student interaction against student performance is required then two separate data sets must be merged manually. This adds significantly to the time required and hinders investigation of this rich data resource.

Another limitation with the Blackboard log data reporting system is not being able to drill down into and separate the information. The user activity data include those for non student users such as tutors, administrative and IT staff, as well as students who enrolled but did not actually complete the unit. For this study the data therefore had to be manually cleaned or filtered in order to examine LMS activity specific to students who had completed each unit. While non student users can be deselected during the data download process, enrolled students who had not completed the unit had to be first identified by matching against the separate grade centre output and then manually deleted from the data file. This is time consuming, especially so for larger units with several hundred or more students.

The validity of Blackboard's log data is open to debate. Data presented in Table 1 in the results section are from Blackboard 8 only. With this version there are minor inconsistencies within the unit reports for the total number of hits recorded. Total hits vary depending upon which section of the unit statistics report is used. As illustration for unit F the total number of hits reported in the initial "Access / Application" section of the output is 21365. However a later section of the output report "Access / Day of Week" gives a total number of hits as 22488. For the Blackboard 8 unit statistics, examined in this research, variations of between 2% and 5% were observed in the total hits across all the units studied. Blackboard does insert the following caveat at the top of the unit statistics report "Due to the way statistics are collected, not all totals are consistent", but offers no further explanation. For the sake of consistency, in this research only the hits within the "Access / Application" section were examined for each unit. Nevertheless, any apparent inconsistencies in the statistics reporting function of Blackboard raises concern about the validity of using these LMS log data.

There are significant differences between Blackboard 8 and 9.1 and this year Swinburne University adopted the upgraded version, which offers greater functionality to users. This research had planned to include a greater number of courses using additional 2011 unit data. However, comparison of the output from the two Blackboard versions reveals that 9.1 reports a much higher levels of user interaction with the LMS. This is perhaps logical given its greater functionality and also explains the much greater time that it takes for the 9.1 LMS to perform the unit statistics analysis and produce the output; over 20 minutes for units with several hundred students. Given the apparent higher levels of LMS interaction we cannot yet make valid comparison between levels of unit use across the different versions Blackboard. However, this may be possible once data have been established across a larger number of units. A more significant reason for not reporting any Blackboard 9.1 log statistics in this paper is the much greater inconsistencies observed between the total number of hits reported in different sections of the user activity reports. As illustration across five 2011 Blackboard 9.1 units examined, the number of hits reported in the "Access / Application" varied by between 20% and 60% compared to the total hits in the "Access / Day of Week" section. While discrepancies of the order of a few percent may be more easily overlooked clearly differences of this magnitude cannot be. Furthermore, the unit activity reports from Blackboard 9.1 do not include the caveat regarding inconsistencies in the totals. At the time of writing feedback from Blackboard on this issue is still pending.

Results and discussion

Table 1 presents the log entry details for over 1200 students taking ten online business units. The average or mean number of hits per student has been calculated for different applications for each unit.

Online course or unit	Live chat main learning activity	Thread & live chat activities	Thread only learning activity	Total students	Total hits interactive application areas**	Mean hits interactive application areas**	Total hits all application areas	Mean hits all application areas
A - SP2	✓			53	2536	49	NA	NA
B	✓			15	751	50	2197	146
C	✓			31	803	26	4622	149
D	✓			19	1380	72	3705	195
A - SP3		✓		176	19988	114	32311	183
E		✓		77	11823	154	20195	262
F		✓		81	12547	154	21365	263
A - SP4			✓	85	17833	210	25589	301
G			✓	410	78016	190	193273	471
H			✓ *	343	161910	472	215377	628

* Assessment component linked to participation in thread discussions
** Collaboration & discussion board application hits combined for interactive application hits

Table 1: Log statistics for student hits by unit and learning activity delivery mode

The 'mean hits' columns in Table 1 suggest that the level of online unit interaction varies considerably depending on whether synchronous or asynchronous communication tools are used. Indeed the frequency of student visits to learning sites is much higher for asynchronous than synchronous tutorial discussion. This higher frequency of hits is also evident across most areas of the learning sites, and not just those in threaded discussions. As a constant, unit A was run using each of the three different learning activity modes across

different study periods. This is perhaps therefore the strongest indicator that the (a)synchronicity of a unit's learning activities determines the level of student LMS interaction. Intuitively this outcome makes sense in that students would use asynchronous activities more often since this is a major affordance of this approach. Furthermore when students enter the LMS to check development in the thread discussions they are also likely to visit other applications.

Conclusion

While the total number of students studying the units examined in this exploratory research is large, the sample of different courses involved is narrow. Nevertheless, the log data analysis supports the hypothesis that course activity design in the virtual learning environment has a strong influence on how students interact with the learning management system. Furthermore, it appears that units with more asynchronous learning activities may correspond with greater levels of interaction. This increased access appears to occur not only with the interactive areas of the LMS but across all application areas. Given that others studies confirm links between level of LMS interaction and results, this finding could have important implications for teaching practitioners wishing to design courses that encourage maximum student interaction with the LMS, and thereby contributes to the ongoing debate on online education surrounding synchronous versus asynchronous delivery.

This study is specific to one LMS, but underlines the potential for, as well as some of the challenges of, using Blackboard log data to inform teaching practice. The study may therefore assist e-learning teachers, as well as LMS service providers in terms of prioritising the development of more effective log data reporting capabilities. Further research involving a larger sample of units, as well as using other LMS platforms such as Moodle, might seek to confirm or otherwise the tentative findings and patterns discussed in this exploratory study.

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