THE EFFECT OF LEARNING MANAGEMENT SYSTEM TRAINING ON TEACHERS' ONLINE TEACHING

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Abstract

Universities invest considerable resources in learning management system (LMS) training for their staff. One measure of the effectiveness of this training is participants' post-training behaviour, which can be obtained from LMS usage logs. In this paper we report preliminary analysis of these logs, showing that both teachers who have received LMS training and their students are more active in their online courses compared to those who have not. This preliminary analysis of usage data in conjunction with training information suggests a positive effect of training and can potentially help to provide information to ensure training is targeted and effective.

The Effect of Training on Teachers' Learning Management System Use

Considerable resources are invested by universities in providing eLearning training to staff, particularly in relation to use of their institutional learning management system (LMS). However, training effectiveness is usually measured by post-training surveys where participants provide their views about the training, such as whether they feel it was effective and whether they were satisfied with the training. A more objective method for evaluating training effectiveness is participants' behaviour post-training, one measure of which can be obtained from LMS tracking logs. In this paper we report on preliminary analysis of these logs, which shows that both teachers who have received LMS training and their students are more active in their online courses compared to those who have not.

Utilisation studies of LMS data are not new. A number of studies have been published reporting on students' use of LMS tools derived from data logs within the system (e.g., Jurado, Pettersson, Gomez, & Scheja, 2014; Lam, Lo, & Lee, 2010; Lam, Keing, McNaught, & Cheung, 2006; Morris, Finnegan, & Wu, 2005; Phillips, 2006; Romero, Ventura, & García, 2008). However, with advances in learning analytics, greater attention is being paid to analysing large data sets to understand learner behavior and optimising learning outcomes for students (Reyes, 2015). In addition to improving learning outcomes for students, learning analytics can also assist institutions in gaining valuable insights to inform strategic decision making, particularly in regard to resource allocation (Lam et al., 2006; Macfadyen & Dawson, 2012). In this paper we report on the application of learning analytics to Blackboard usage logs to understand the effects of LMS training on teachers' and students' activity in online courses.

LMS Usage Logs

LMS usage data have been analysed in a number of studies and for various purposes. In one of the earlier reports on analysis of LMS logs, Phillips (2006) reported that the institutional LMS at several universities was being used mainly for providing students with content and information. This type of use was described as teacher-centred and not consistent with an online learning environment designed according to constructivist principles. Classification systems based on tool usage have also been developed for analysing LMS usage data. For example, Montenegro-Marin, Cueva-Lovell, Sanjuan and Nuñez-Valdez (2011) developed an ontology of modules common in learning management system platforms, which included *tools,* consisting of administration, communications, course, curricula design, and productivity, and *users.* Another classification system for LMS features was developed by Jurado and colleagues (2014) where tools are categorised according to purpose: for distribution (e.g., contents page, URL, documents, etc.), communication (e.g., mail, calendar, announcements), interaction (e.g., discussion areas, assignments, surveys, quizzes) or course management (e.g., gradebook, student tracking). Their work has shown that tools for distribution are used far more than tools for communication or interaction, which is consistent with Phillips' finding from eight years earlier.

Analysis of usage data at this level provides useful information. For example, counts of tool use have been shown to be significantly correlated with students' final grades (Macfayden & Dawson, 2010; Morris et al., 2005). In their study of student behavior, persistence and achievement in online courses, Morris and colleagues (2005) report a regression analysis showing that the statistically significant predictors of final grades included number of discussion posts viewed and number of content pages viewed. They also found that students who successfully completed the course engaged with online learning activities with greater frequency and for longer durations than did unsuccessful students who eventually withdrew.

Given these results, we compared LMS usage data for courses taught by teachers who have undertaken LMS-related training with those of teachers who have not to provide insight into the effect of training on LMS use. In doing so, we hoped to obtain important evidence to inform support for the effectiveness of training for promoting LMS usage by both students and staff, as well as to inform future training practice at our institution. Understanding how eLearning training, particularly in relation to an institutional LMS, impacts teaching practice and use of the LMS is important for assessing the effectiveness of training and staff development. To help address the question of impact, we have begun to explore use of LMS data to investigate differences in online behavior of students and teachers between courses taught by staff who have attended LMS-related training and those who have not. The aim was to provide objective data that addresses the question of what changes occur following training and how this impacts students' and teachers' online behaviour. As Picciano (2014) notes, data-driven decision making relies on an appropriate model and valid data. This proof of concept demonstrates that our method for extracting and analysing data results in valid, reliable and useful information that is valuable in decision making relating to both the LMS and staff training related to its use.

The focus on actual behaviour is an important aspect of this approach - research by Saks and Burke (2012) showed that self-report transfer of training is significantly predicted by training evaluation, but only if the evaluation includes analysis of behaviour and outcomes. In particular, they found that organisations report higher rates of transfer of training where more frequent evaluation of training in terms of behaviour and results is conducted. In terms of evaluating LMS training effectiveness, usage data can be used as measures of behaviour and results and represents a new approach to assessing training outcomes. This is important, because, as Weaver (2006) notes, training of staff to support them in using the LMS needs to continually evolve to promote discussion and adoption of best practice, to cater to different staff requirements and to keep up with changes in the LMS itself as well as changes to other elearning tools.

Method

The LMS used at our university is Blackboard. It is a proprietary system and understanding the activity logs in the database (DB) is not an easy task, even though there is an online resource describing each of the tables in the DB. However, as Blackboard notes on its website, no guarantee can be provided in terms of accuracy. Since accuracy is essential for data analysis, we conducted a series of experiments that mimicked the behavior of students and teachers within the LMS and generated logs of the actions to test their accuracy. Using an isolated system was necessary because, under the university's current data security policy, direct access to the live LMS DB is not permitted. Additionally, there are hundreds of thousands of activity logs recorded in the live database every second. To overcome this limitation, an LMS testing server maintained by our department was developed for this study, which served as an isolated system.

Using this static DB of LMS data usage, a methodology for tracking the activities of both teachers and students from the Blackboard LMS web application log (called the Activity Accumulator Table) was developed. This methodology was used to generate a dataset that showed users' access history, which could then be used to conduct analyses to produce custom-made indicators and reports better suited to different stakeholders' wants (e.g., educators and management).

Three semesters (i.e., one academic year) of retrospective data from the university's LMS were obtained for analysis. In addition, data from the training participation information system was used to identify staff who had undertaken LMS-related training conducted by the Univesity in the last four years and those who had not. The retrospective training data and the activity logs recorded in LMS database were copied to a new database, which is protected by the university's Administrative Firewall Registration System to align with the data security policy. Inside the LMS database, information from the 'Accumulator table' recording all activity was used to generate the dataset for analysis. While the dataset can be used to obtain a range of different measures, for this paper we report on click counts as a basic measure of activity in a course, for both students and teachers.

Results

The first step in analysing the usage data was to clean the data set. This included deleting data related to guest accounts and courses that were temporary or test sites. Next, courses related to non-standard subjects, such as "thesis," "practicum," "work integrated education" or "field work," were deleted. Finally, courses with no instructors, no students or both were deleted, along with courses with student enrolments of fewer than 11, as these were considered atypical of subject enrolments at the university. This left a total of 4520 Blackboard courses with usage logs for the 2014/15 academic year with at least one instructor and more than ten students enrolled in the course.

Overview of Blackboard Usage

For each of these 4520 courses, the average clicks per student in the course was calculated. A plot showing the percentage of all Blackboard courses at specific values for average clicks was produced (see Figure 1). As shown in Figure 1, 70 percent of all courses had an average number of clicks per student greater than or equal to 30, while around 20 percent of courses had an average number of clicks per student of between 0 and 20. At the higher end of the scale, less than 30 percent of courses had an average of 100 or more clicks per student.

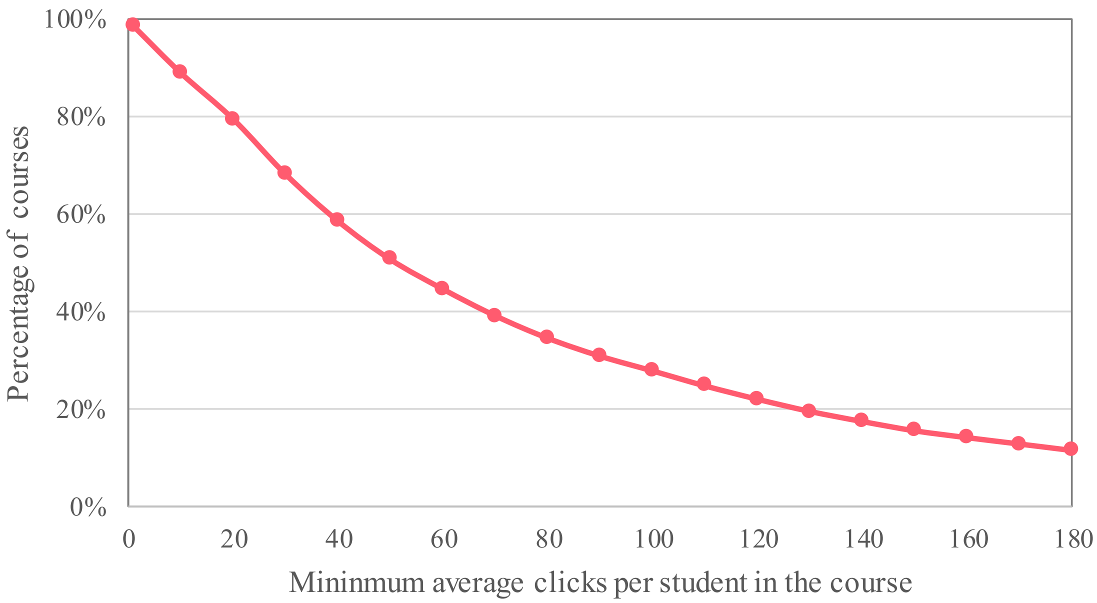

Figure 1. Percentage of Blackboard courses with average number of clicks per student.

Based on the distribution of average student clicks, four activity categories were created: inactive (average number of clicks per student less than 1, *n*=62); low ($1 \leq$ average clicks ≤ 30, *n*=1377); medium ($31 \leq$ average clicks ≤ 100, *n*=1827) and high (average clicks >100, *n*=1254).

Activity Classification and Training in the LMS

From the university's training database, all teachers teaching courses that academic year who had undertaken training in the LMS (i.e., through the workshop program the university offered) from 2010/11 – 2013/14 were identified, and this information was mapped to the teachers in each Blackboard course for the academic year being analysed (2014/15). After mapping teachers who had participated in LMS training to the dataset, a total of 1578 courses with at least one teacher who had participated in at least one LMS training workshop were identified, with the remaining 2942 courses having no teachers in the course who had participated in LMS training offered by the university.

The percentage of courses for each activity level with trained and untrained teachers is shown in Table 1. A chi-square analysis was conducted to determine if there is an association between whether or not a course has at least one teacher with LMS training and the level of student activity in the course. This analysis showed that the percentage of courses with different levels of student activity differed according to whether or not the course had at least one trained teacher, $\chi^2(3, N = 4520) = 121.39$, $p = .000$. While the proportion of courses classified as having a medium level of student activity did not differ in terms of the percentage with at least one trained teacher, there were more courses with teachers who attended at least one LMS training workshop classified as having a high level of student activity.

Table 1

Percentage of Courses at Each Activity Level With and Without at Least One Trained Teacher

Trained Teacher	Activity Level				
	Inactive	Low	Medium	High	Total
With none	1.7%	34.9%	40.2%	23.2%	100%
With at least 1	0.8%	22.2%	40.9%	36.1%	100%

To better understand how training and activity level in a course are related, the dataset was refined to only include courses with one instructor and no other teachers in the course. This reduced the number of courses to 2074, of which 563 (27.15%) had an instructor who had undertaken LMS training and 1511 (72.85%) who had not.

Descriptive statistics for the two types of courses (trained teacher and no trained teacher) are shown in Table 2 for the average number of clicks by both students and teachers.

Table 2

Average Clicks for Courses With and Without at Least One Trained Teacher

Trained Teacher	Average Clicks Per Course	
	Student	Teacher
With none (n=1511)	56.17	118.06
With at least 1 (n=563)	71.31	187.70

Regardless of whether or not the teacher had participated in training or not, the average number of clicks by students was significantly correlated with the average number of clicks by teachers (r=0.592, p=.000, N=2074). This suggests that the more active a teacher is in a course, the more active their students are.

Table 3 shows the percentage distribution for each activity category broken down by training status (teacher attended training, teacher did not attend training). Chi-square analysis of courses with teachers who were either trained or not trained by activity level confirmed that more courses classified as having high student activity were taught by teachers who had participated in training ($\chi^2(3, N = 2074) = 23.48, p = .000$).

Table 3

Percentage of Courses With Only One Instructor at Each Activity Level by Training Status

Training Status	Activity Level				
	Inactive	Low	Medium	High	Total
Teacher has not attended training	3.1%	40.8%	39.7%	16.3%	100%
Teacher has attended at least one training workshop	2.3%	32.2%	40.9%	24.5%	100%

A comparison of average number of clicks for students and teachers between the two types of courses (trained teacher and no trained teacher) was made using two separate independent samples *t*-tests. The results showed that the average number of clicks by students in a course was significantly higher for courses where the teacher had participated in training compared to those courses where the teacher had not ($t(2072)=4.307$, $p=.000$). Similarly, where the course was taught by a teacher with training, the average number of clicks by the teacher was significantly greater than for courses taught by teachers who had not participated in training ($t(2072)=5.265$, $p=.000$).

Discussion

Data from online courses taught in one academic year were compared for two groups of teachers – one where teachers had participated in LMS-related training run by the university and one where the teachers had not. Average clicks per student and teacher were used as measures of level of activity in the course and were compared between the two groups. The results showed that regardless of whether teachers had previously attended LMS training or not, the more active a teacher was in a course, the more active their students were. Furthermore, a higher proportion of courses classified as having high levels of student activity were taught by a teacher who had attended LMS training. Given that teachers who have attended training are more active than those who have not, promoting attendance at training seems to be an effective strategy for increasing online activity of both students and staff.

That training is associated with higher levels of online activity suggests that participants have transferred what they learned into practice – after training, participants should have a better understanding of the technical aspects of using the LMS and how to use tools in their online teaching. The greater number of average clicks by teachers who attended training is consistent with this. However, why students are more active remains to be answered.

There are a number of reasons that could explain why students' level of online activity increases with the activity level of their teacher. For example, after training teachers may put up more content for students to access, or they may increase the number of announcements or discussion forums, both of which would result in higher levels of activity by students. However, analysis of average clicks does not provide this level of detail, so these questions cannot be addressed using the analyses we have conducted. This in turn highlights that another measure is needed to conduct fine-grained analysis of what students and teachers are doing online.

To do this more detailed analysis, we intend to look at both number of clicks and time spent for each of the different tools available in Blackboard. However, the accuracy of the data in the Accumulator Table still needs to be confirmed by controlled experiments which mimic specific behaviours (e.g., reading a discussion post, replying to a discussion posting, starting a discussion thread). Once this is complete, we will be able to conduct further analysis at the level of tools. This will allow many more questions to be addressed, including those relating to the effect of specific types of LMS training on subsequent LMS use. For example, our university offers training on using Blackboard's communication features, the effectiveness of which we hope to be able to assess by analyzing usage logs of participants pre- and post-training to determine how their online behavior and that of their students' changes following training.

Our analysis showed that there were a small number of courses taught by teachers who had not attended training that were classified as having high levels of student activity. In terms of understanding training effectiveness and delivery, it would be useful to know why these teachers have not participated in training and whether their use of the LMS could be enhanced if they did. However, these questions and others like them will most likely only be answered by supplementing analysis of data logs with other measures, such as interview or survey data. Just as mapping training information to the usage data provided insights about the effect of training on LMS use, we expect that including measures such as student grades and student ratings of teachers and teaching will greatly enhance the quality and usefulness of the information that can be obtained from analyzing this data.

Preliminary analysis of LMS usage logs presented in this paper suggests that where staff receive LMS training, both students and teachers are more active in Blackboard courses. Although the measure used for the analyses reported here was quite coarse, it still provided useful information and raised many questions that can be explored through further analysis of the dataset. So, while it is time consuming to extract and clean data from the usage logs and then to make sense of the data, once this is done the dataset can be used to answer many questions about the online behavior of teachers and students without having access individual course sites.

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