Analyzing Students' Interaction and Performance Based on Moodle Logs

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Abstract

In this paper, we analyzed the data in Moodle logs of University of Computer Studies (Taunggyi) to evaluate the interaction of the students with LMS and to predict performance of the students. In our approach, Moodle logs were downloaded in Microsoft Office Excel format and a simple and effective offline solution using Microsoft Excel tools is provided. Logs relating Faculty of Computer Systems and Technologies (FCST) courses were collected separately for first and second semester during 2017-2018 Academic Year. Students activities within online environment were then extracted and depicted using some graphical representations.

Keywords: Moodle log, LMS, Microsoft Office Excel tools, FCST

1. Introduction

Using log files of learning management systems can help to determine who has been active in the course, what they did, and when they did it [5]. Feedback about the status and the history of the activities in online-courses can be useful to teachers, students, study program managers and administrators. For example it can help in better understanding whether the courses provide a sound learning environment (availability and use of discussion forums, etc.) or show to which extent best practices in online learning are implemented (students provide timely responses, teachers are visible and active, etc.). Learning Management Systems provide some reporting tools that aim to monitor students' and tools' usage, but these are seldom used mainly because it is difficult to interpret and exploit them; the obstacles to interpretation and exploitation are the following:

- Data are not aggregated following a didactical perspective;
- Certain types of usage data are not logged;
- The data that are logged may seem incomplete;
- Users are afraid that they could draw unsound inferences from some of the data.

In the attempt of overcoming these difficulties, new reporting functions of LMS have been added, for instance Moodle now provides reporting tools which enable teachers to evaluate the activity patterns of individual students [4].

Moodle is increasingly used in schools, universities and companies [1]. Moodle analytics allows institutions to accumulate information which can be used for analysing students' behavior within a virtual learning environment [5]. Through these analytics, it would be possible to evaluate students' online behaviour, explore what this behaviour can tell us about how students learn online and identify various departmental pedagogical disciplinary practices [6].

Moodle systems record user behaviours in the form of logs. As the way the data is presented is unstructured, isolated, abstract, and therefore meaningless, non-technical users have great difficulty in utilizing this data to arrive at meaningful conclusions and actionable information which would allow them to customize their applied pedagogy and personalize the student experience [3].

In our work, it is aimed to provide the teachers with useful information regarding the performance of the students in online environment so that they can evaluate their students righteously and can customize their teaching methods.

This paper is structured as follows: In the next section, works related to analyzing Moodle logs are presented. Following this, we expand on the description of our method and examine the application of Microsoft Excel and the developed visualizations. In the final section, we discuss conclusions and lessons learnt and elaborate upon the future steps of our work.

2. Related Works

An approach to analysing the data of users' behaviors that are recorded in the Moodle logs is presented in [3]. This method utilizes the possibility of downloading the logs in Microsoft Excel format and provides a simple and effective offline solution. The development of this method is based on Excel macros and visual basic.

[8] proposes the Vector Space Model approach for processing course log data obtained from Moodle-based blended course in order to visualize patterns of student activity within the online environment Their approach can provide constant monitoring of course progression with minimal effort and enable instructors to determine whether and how the environment actually affects student performance.

[4] proposes a model of the log file analysis called MOCLog derived from didactical principles, and an analysis of user requirements. The approach that MOCLog uses is the analysis of learning activities in online-courses from a didactical point of view (learning process and outcomes), thus going beyond than simply counting and visualizing the numbers of posts and clicks.

[9] develops a student model that can be conducted by learning the interaction patterns of the students' various activities such as participation in forum discussion, how frequently a student is logged into their account, and frequency of reading posted activities, etc.

3. Description of Our Aspproach

In our work, we want to examine how students are interactive with online environment and his concentration on the courses. We cannot determine the students' concentration on a course by examining their quiz attempts and assignment submissions because these actions have to be done by the students as a must. This section explains the process of bringing data from Moodle to Microsoft Office Excel and presents student interactive activities on Moodle.

3.1. Step-by-step Procedures in Processing Logs

Logs relating FCST courses were collected separately for first and second semester during 2017-2018 Academic Year. For first semester, logs from December 2017 to March 2018 were collected, and for second semester, logs were collected for about 3 months starting from July 2018 to Sept 2018. Microsoft Office Excel 2007 was used to analyze the logs as we downloaded them in excel format. Followings are the steps carried out to get the required data for analysis.

3.1.1. Collecting Logs for Courses

In Moodle, we followed these steps: Site Administration > reports > logs, where we got the logs upon all actions and all events conducted by all participants relating each FCST course. Part of the logs for CST-303, which is one of the courses offered by FCST can be seen in Figure 1, where actions of both teacher and students were logged together.

3.1.2. Eliminating (Reducing) Duplicate Data

After obtaining the log files for the required courses, the files must be prepared for analysis which involves both manual and automatic processes. The first step was to open each respective file via Excel to sort the rows to distinguish the entries between the teachers and the students, since both were active in the Moodle during the coursework.

	Time	User full name	Affected	Event cont	Compo	Event name	Descrip	Origin	IP address
1	9/01/18, 13:20	dr nangkaythihlair	-	Course: 3(	System	Course viewed	The use	web	172.16.50.1
2	9/01/18, 13:19	dr nangkaythihlair	-	Course: 3(	System	Course viewed	The use	web	172.16.50.1
3	9/01/18, 13:15	dr nangkaythihlair	-	Quiz: MCQ	Quiz	Course module viewed	The use	web	172.16.50.1
4	9/01/18, 13:15	dr nangkaythihlair	-	Course: 3(	System	Course viewed	The use	web	172.16.50.1
5	8/01/18, 15:43	ma nangmaoo	ma nang	Quiz: MCQ	Quiz	Quiz attempt submitted	The use	web	172.16.90.103
6	8/01/18, 15:43	ma khinmyatmoe	ma khin	Quiz: MCQ	Quiz	Quiz attempt submitted	The use	web	172.16.90.99
7	8/01/18, 15:43	ma hsinthsintwai	ma hsin	Quiz: MCQ	Quiz	Quiz attempt submitted	The use	web	172.16.90.110
8	8/01/18, 15:43	ma khinmyatmoe	ma khin	Quiz: MCQ	Quiz	Quiz attempt viewed	The use	web	172.16.90.99
9	8/01/18, 15:42	ma htwehtwethein	ma htwe	Quiz: MCQ	Quiz	Quiz attempt submitted	The use	web	172.16.90.107
10	8/01/18, 15:42	ma hsinthsintwai	ma hsin	Quiz: MCQ	Quiz	Quiz attempt viewed	The use	web	172.16.90.110
11	8/01/18, 15:42	ma khinmyatmoe	ma khin	Quiz: MCQ	Quiz	Quiz attempt viewed	The use	web	172.16.90.99
12	8/01/18, 15:42	ma hsinthsintwai	ma hsin	Quiz: MCQ	Quiz	Quiz attempt viewed	The use	web	172.16.90.110
13	8/01/18, 15:42	ma hsinthsintwai	ma hsin	Quiz: MCQ	Quiz	Quiz attempt viewed	The use	web	172.16.90.110
14	8/01/18, 15:42	ma eieiphyo	ma eieip	Quiz: MCQ	Quiz	Quiz attempt submitted	The use	web	172.16.90.138
15	8/01/18, 15:42	ma hsinthsintwai	ma hsin	Quiz: MCQ	Quiz	Quiz attempt viewed	The use	web	172.16.90.110
16	8/01/18, 15:42	ma hsinthsintwai	ma hsin	Quiz: MCQ	Quiz	Quiz attempt viewed	The use	web	172.16.90.110
17	8/01/18, 15:42	ma khinmyatmoe	ma khin	Quiz: MCQ	Quiz	Quiz attempt viewed	The use	web	172.16.90.99
18	8/01/18, 15:42	ma htwehtwethein	ma htwe	Quiz: MCQ	Quiz	Quiz attempt viewed	The use	web	172.16.90.107
19	8/01/18, 15:42	ma hsinthsintwai	ma hsin	Quiz: MCQ	Quiz	Quiz attempt viewed	The use	web	172.16.90.110
20	8/01/18, 15:42	ma htwehtwethein	ma htwe	Quiz: MCQ	Quiz	Quiz attempt viewed	The use	web	172.16.90.107
21	8/01/18, 15:42	ma hsinthsintwai	ma hsin	Quiz: MCQ	Quiz	Quiz attempt viewed	The use	web	172.16.90.110
22	8/01/18, 15:42	ma eieiphyo	ma eieip	Quiz: MCQ	Quiz	Quiz attempt viewed	The use	web	172.16.90.138
23	8/01/18, 15:42	ma htwehtwethein	ma htwe	Quiz: MCQ	Quiz	Quiz attempt viewed	The use	web	172.16.90.107
24	8/01/18, 15:42	ma khinmyatmoe	ma khin	Quiz: MCQ	Quiz	Quiz attempt viewed	The use	web	172.16.90.99
25	8/01/18, 15:42	ma hsinthsintwai	ma hsin	Quiz: MCQ	Quiz	Quiz attempt viewed	The use	web	172.16.90.110
26	8/01/18, 15:42	ma htwehtwethein	ma htwe	Quiz: MCQ	Quiz	Quiz attempt viewed	The use	web	172.16.90.107
27	8/01/18, 15:42	ma eieiphyo	ma eieip	Quiz: MCQ	Quiz	Quiz attempt viewed	The use	web	172.16.90.138
28	8/01/18, 15:42	ma htwehtwethein	ma htwe	Quiz: MCQ	Quiz	Quiz attempt viewed	The use	web	172.16.90.107
29	8/01/18, 15:42	ma eieiphyo	ma eieip	Quiz: MCQ	Quiz	Quiz attempt viewed	The use	web	172.16.90.138
30	8/01/18, 15:42	ma htwehtwethein	ma htwe	Quiz: MCQ	Quiz	Quiz attempt viewed	The use	web	172.16.90.107

Figure 1. Raw data of Moodle's action logs for CST 303

The entries relating to the teachers were removed using "remove duplicates" data tool of Excel that leaves only the rows which hold the students, Figure 2. The same process was applied to the rest courses.

	Time	User full name	Affecte	Event cor	Com	Event name	Descri	Origi	IP address
2	8/01/18, 15:43	ma nangmaoo	ma nan	Quiz: MCC	Quiz	Quiz attempt submitted	The us	web	172.16.90.103
3	8/01/18, 15:43	ma khinmyatmoe	ma khi	Quiz: MCC	Quiz	Quiz attempt submitted	The us	web	172.16.90.99
4	8/01/18, 15:43	ma hsinthsintwai	ma hsi	Quiz: MCC	Quiz	Quiz attempt submitted	The us	web	172.16.90.110
5	8/01/18, 15:43	ma khinmyatmoe	ma khi	Quiz: MCC	Quiz	Quiz attempt viewed	The us	web	172.16.90.99
6	8/01/18, 15:42	ma htwehtwethei	ma htw	Quiz: MCC	Quiz	Quiz attempt submitted	The us	web	172.16.90.107
7	8/01/18, 15:42	ma hsinthsintwai	ma hsi	Quiz: MCC	Quiz	Quiz attempt viewed	The us	web	172.16.90.110
8	8/01/18, 15:42	ma khinmyatmoe	ma khi	Quiz: MCC	Quiz	Quiz attempt viewed	The us	web	172.16.90.99
9	8/01/18, 15:42	ma eieiphyo	ma eie	Quiz: MCC	Quiz	Quiz attempt submitted	The us	web	172.16.90.138
10	8/01/18, 15:42	ma htwehtwethei	ma htw	Quiz: MCC	Quiz	Quiz attempt viewed	The us	web	172.16.90.107
11	8/01/18, 15:42	ma eieiphyo	ma eie	Quiz: MCC	Quiz	Quiz attempt viewed	The us	web	172.16.90.138
12	8/01/18, 15:42	ma sisimon	ma sisi	Quiz: MCC	Quiz	Quiz attempt submitted	The us	web	172.16.90.115
13	8/01/18, 15:42	ma thinthinhtwe	ma thir	Quiz: MCC	Quiz	Quiz attempt submitted	The us	web	172.16.90.113

Figure 2.Action logs after removing duplicates

3.1.3. Tests and Results

In Moodle, course viewed action takes place whenever any user logins to Moodle and accesses any course. But course module viewed action takes place only when the user accesses the resources (references for that course) or quiz or assignment file submission.

In this work, we focused on "Event name" and "Description" columns as can be seen in Figure 2. We extract the combination of course module viewed action under "Event name" column and resource viewed activity under "Description" column. We separated "resource viewed" activity from other activities such as "quiz view", "assignment submission", "forum", and so on [Table 1]. Visualizations are developed by comparing the resource viewed action outcome with total events from which we can easily examine percentage of students who did self-study upon related courses by accessing resources such as reference books, lecture slides, lab manual, and so on.

Table 1. Processed data for the first term courses

First Term Courses	Total Event	Resource Viewed	Others (Quiz / Assignment)
203	5322	147	5175
303	1737	199	1538
304	1310	0	1310
305	1015	121	894
306	388	0	388
403	500	0	500
405	573	0	573
406	674	28	646
502	569	51	518
504	366	48	318

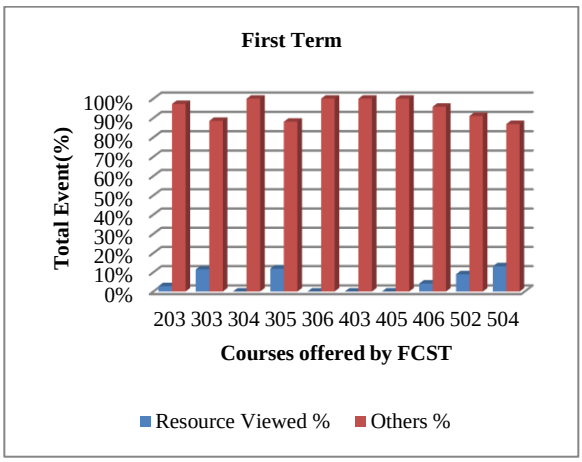

Figure 3.Students activities in the first term courses

The same data extraction process was applied to the second term courses. Extracted data obtained were tabulated in Table 2. Comparison between resource viewed action and total events was depicted as graphical representation in Figure 4.

Table 2. Processed data for the second term courses

Second Term Courses	Total Event	Resource Viewed	Others (Quiz / Assignment)
101	674	0	674
303	1129	587	542
304	412	0	412
306	418	0	418
403	47	31	16
405	118	0	118
406	404	0	404

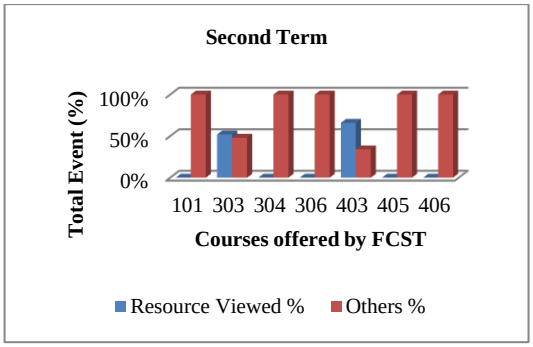

Figure 4.Students activities in the second term courses

From Table 1, Table 2, Figure 3 and Figure 4, it can be summarized that students participated more events ("quiz view" "assignment submission" "forum") other than "resource viewed". In some courses there is no resource viewed activity which may be not because of the student action but because of the lack of uploaded resources. To sum up, the students should be feedbacked regarding their actions and persuaded to do self-learning by accessing the uploaded resources.

3.2. Performance prediction based on quiz activity

We also examined performance of students based on their time duration spent in taking quiz test. Teachers usually upload quiz as the chapter end test and every student must take this quiz test. So, only some students who concentrated on their studies could finish the quiz test easily. Although teachers can see their students quiz result report and grade, teachers cannot judge their performance correctly without knowing if they finished the test properly by using their own ability or not.

We examined which students did well in their quiz test by exploring their quiz result. So, some quiz results for 26 students were collected for analysis purpose. In this analysis, the teacher gives 35 minutes for 25 quiz. So, average time taken per quiz is 1 min 24 secs. For a well-studied student, less than 1 min per quiz may be minimum time for him and may be greater than 1 min for maximum.

Table 3. Time duration of quiz activity for each student

No of Student	Time duration > 18 mins 45 secs	No of Student	Time duration < 18mins45secs
1	35 mins 3secs	1	17mins 11secs
2	24 mins 20secs	2	14 mins51secs
3	25 mins 19secs	3	13 mins 4secs
4	25 mins 51secs	4	8 mins 3secs
5	23 mins 25secs	5	1 min 46secs
6	22 mins 54secs	6	7 mins 51secs
7	26 mins 20secs	7	3 mins 46secs
8	22 mins 44secs	8	3 mins 23secs
9	23 mins 50secs	9	8 mins
10	22 mins 28secs	10	5 mins 30secs
11	22 mins 40secs	11	3 mins 29secs
12	20 mins 29secs		
13	20 mins 24secs		
14	18 mins 54secs		
15	26 mins 23secs		

Here we set a threshold value for the time taken to answer per quiz as 45 secs. Thus it would take a total of 18 min 45 secs for 25 quiz. We differentiated the students by comparing that

threshold with their time duration collected from the quiz result. We got 15 out of 26 students who took time longer than the threshold and the rest 11 students took less than the threshold. The results obtained from our analysis are tabulated and depicted in Table 3 and Figure 5, respectively.

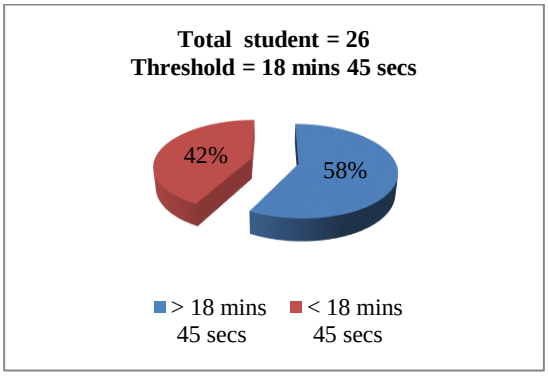

Figure 5. Quiz activity time duration vs Threshold

It can be concluded that some students did not take the test properly. They took the time less than threshold value to finish their quiz test. As we mentioned before, even a well-prepared student took about 1 min minimum per quiz and a total of about 25 mins for given 25 quiz. According to the result in Figure 5, more than half of the total students took their test properly. But the rest ones did not take the test properly as they took less time than threshold value. May be they copied the other's result and submitted their quiz test without even knowing or thinking about what the quiz meant. The reasons for why they did like that may be their lack of concentration on their studies or their absence in lecture time. So teachers should feedback and consult those students or may be she could change her teaching method to get the student concentration.

4. Discussion and Future Work

In this work, students' interactions with different courses on Moodle were studied based on activity logs. Different activities of the students within online environment can be seen clearly on the graphical representations. We also examined the performance of students regarding their quiz activity. With our approach, teachers can judge their students easily and can improve their teaching methods appropriately.

This work can be extended with the use of more advanced data mining and processing methods to get more precise evaluation upon students interaction and performance prediction.

References

[1] Dierenfeld, H. & Merceron, A., "Learning Analytics with Excel Pivot Tables," proceedings of the 1st Moodle Research Conference (MRC2012), Retalis, S. & Dougiamas, M. (Eds), 115-121.

[2] Sharkey, M. (2011), "Academic analytics landscape at the University of Phoenix," proceedings of the 1st International Conference on Learning Analytics and Knowledge (LAK '11). ACM, New York, NY, USA, 122-126.

[3] Konstantinidis, A. and Grafton, C., "Using Excel Macros to Analyse Moodle Logs," proceedings of 2nd Moodle Research Conference, Sousse, Tunisia, OCT, 4-6, 2013, 33-39

[4] Mazza, R., Bettoni,M., Faré, M., Mazzola, L., "MOCLog: Monitoring Online Courses with log data," proceedings of 1st Moodle Research Conference, Heraklion, Crete-Greece, SEPT, 14 - 15, 2012, 132-139

[5]Romero, C., Ventura, S. & Garcia, E., "Data mining in course management systems : Moodle case study and tutorial", *Computers & Education*, Volume: 51, Issue: 1. Elsevier, 2008, 368-384.

[6] Martín-Blas, T., & Serrano-Fernández, A., "The role of new technologies in the learning process: Moodle as a teaching tool in Physics," *Computers & Education*, 52(1), 2009, 35-44.

[7] Mazza, R. & Botturi, L., "Monitoring an Online Course with the GISMO Tool: A Case Study," *Journal of Interactive Learning Research*," Vol. 18, N. 2, 2007, 251-265.

[8] Raga Jr, R. C., Raga, J. D., "Monitoring Class Activity and Predicting Student Performance Using Moodle Action Log Data," International Journal of Computing Sciences Research, Vol. 1, No. 3, pp. 1-16, doi: 10.25147/ijcsr.2017.001.1.09
https://stepacademic.net

[9] Keshtkar, F., Southeast Missouri State University, "Analyzing Students' Interaction Based On Their Responses To Determine Learning Outcomes" www.educationaldatamining.org/EDM2015/uploads/papers/paper_286.pdf