

Analysis of Student Engagement Towards Learning Materials in Learning Management System: A Case Study

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Abstract—The use of learning management system nowadays in higher learning institution allows students to experience the learning process outside of its scheduled face-to-face class. As such, it is interesting to observe the students' engagement with the learning materials uploaded on the learning management system. Furthermore, are the interactivity in the materials affects the student engagement with it? Based on the learning materials uploaded in Moodle platform utilized in Universiti Teknikal Malaysia Melaka as the learning management system, an analysis was done to the course analytics recorded in two sessions for a Digital System course delivered to bachelor's degree student in the Fakulti Teknologi dan Kejuruteraan Elektronik dan Komputer. The finding shows that on average, the students' engagement for materials grouped under Resources reached the highest engagement percentage that are 73.72% and 79.46% for the two sessions respectively, compared to the materials grouped under Activities (59.96% and 75.00%), and Assessments (52.90% and 73.52%). The trend is consistent for both semesters, although the average percentage was different. As observed from the findings, the students' engagement with the learning materials uploaded online depends on the student's perceived importance of the materials; whether it helps them increase their understanding of the course content or not regardless to the levels of interactivity in the materials.

Keywords—learning materials, learning management system (LMS), students' engagement

I. INTRODUCTION

Learning Management System (LMS) is an online platform that integrates the learning materials and allow users to experience the learning process online with the course instructors as facilitator in the learning platform [1][2][3]. As such, it is important that the materials uploaded in the platform match the Course Learning Outcome (CLO) to facilitate the learning process of users. There are several LMS platform available nowadays such as Apex Learning, Dokeos, Druppal, Moodle, Saba Software, Sakai and many others that can be used to aid the learning process [4][5][6]. Some of them are open source, while the others are proprietary or commercial

platforms [5]. Regardless of the popularity or advantages offered by the platforms, its utilization can provide the users with online learning experiences.

In Universiti Teknikal Malaysia Melaka (UTeM), the Moodle platform was adopted as the LMS and becomes the hub for the online learning materials in campus [7]. With LMS, the learning experience that was provided to the students covered a wide spectrum including their online learning experience as well. In other words, learning does not only happen during scheduled contact hours in class but also can happen virtually in the LMS while the students are interacting with the learning materials. Such combination of learning experience is also called blended learning, in which it is one of the branches in student-centered learning method [8][9]. A course is defined as implementing the blended learning method if it has 30% to 60% of its learning experience conducted online in combination with its face-to-face learning experience [10]. The learning experience conducted online was measured based on the three categories of materials uploaded in the LMS that are: (1) Resources, (2) Activity, and (3) Assessment. These three categories of materials are based on the constructive alignment in course design approach that concerns on the course materials that enable the attainment of CLO in Outcome Based Education (OBE) approach [11][12].

As both instructors and students nowadays come from different generational cohorts due to the large age-gap between them [13], it is challenging for instructors when it comes to interactive course materials preparation [14]. However, students in higher learning institutions are generally coming from generation Z (born around 1996 to 2010+), which was claimed as more interested in interactive materials when it comes to online learning preference [15]. Still, is it really the scenario when it comes to specific course? As such, the outcome of the analysis in this paper will give some insights on whether the interactivity in the materials uploaded in the LMS affects the students' engagement with the materials. The findings can also be a basis for instructors to

get some idea on preparing their course materials to support students' preference, and eventually promote healthy learning experience for students.

II. METHODOLOGY

A. Data Collection

The data in this paper was obtained from the LMS analytics of a core course delivered in Fakulti Teknologi dan Kejuruteraan Elektronik dan Komputer (FTKEK) in UTeM, that is Digital Systems [16][17]. This course is offered to second year student in the Bachelor of Electronic Engineering with Honours program. The data reported was collected from the LMS analytics of the course in latest two sessions that are in Semester 2 (Session 2022/2023) and Semester 2 (Session 2023/2024). From the LMS analytics, the number of unique visitors for each material were extracted to check the pattern of users' engagement with the material. The categories of materials uploaded in the LMS which are: (1) Resources, (2) Activity, and (3) Assessment; supports the attainment of the course CLO. Each of the materials in the category comprises of several types as summarized in Table I.

TABLE I. NUMBER OF MATERIALS UPLOADED IN THE LMS FOR THE DIGITAL SYSTEMS COURSE

No.	Category	Types ^a	Session	
			2022/2023	2023/2024
1.	Resource	PDF	20	18
		URL	2	7
2.	Activity	Forum	6	7
		Group Choice	1	1
		Feedback	1	1
3.	Assessment	Revision Quiz	7	10
		Assessment Quiz	1	2
		Assignment Submission	2	1
		Total	40	47

^a Material types when creating the activity in LMS (Moodle)

B. Data Analysis

The data analysis was done based on the extracted LMS analytics of the materials listed in Table I. The LMS analytics process is as illustrated in Fig. 1. In this paper, the students' engagement is denoted as users' engagement, which was represented by the number of unique viewers that accessed the material (extracted from the LMS analytics). The number of unique viewers for the material was then converted by equation (1) to get the 'percentage of users' engagement' for each material where a = number of unique viewers, and b = number of total users enrolled in the course.

$$\text{Percentage of Users' Engagement} = (a/b) * 100 \% \quad (1)$$

Sample analytics collected for Semester 2 (Session 2023/2024) grouped under 'Resource' is shown in Table II, where the percentage of users' engagement had been calculated using equation (1) to demonstrate the calculated

percentage for users' engagement. In the calculation, the number of total users enrolled for the course is 52.

TABLE II. SAMPLE ANALYTICS FOR 'RESOURCE' IN SEMESTER 2 (SESSION 2023/2024)

No.	Resource Name	Resource Types	Number of Viewers	Percentage of Users Engagement
1.	Teaching Plan	PDF	33	63.46 %
2.	Chapter 0	PDF	47	90.38 %
3.	Chapter 1 - P1	PDF	52	100.00 %
4.	Chapter 1 - P2-1	PDF	52	100.00 %
5.	Chapter 1 - P2-2	PDF	51	98.08 %
6.	IC Technology	URL	27	51.92 %
7.	Exercise - C1 (Part 1)	PDF	52	100.00 %
8.	Exercise - C1	PDF	48	92.31 %
9.	Chapter 2 - P1	PDF	50	96.15 %
10.	Chapter 2 - P2	PDF	49	94.23 %
11.	Exercise - C2	PDF	45	86.54 %
12.	FSM - Brief Introduction	URL	33	63.46 %
13.	FSM - Embedded System	URL	24	46.15 %
14.	Chapter 3	PDF	49	94.23 %
15.	Exercise - C3	PDF	42	80.77 %
16.	Chapter 4	PDF	40	76.92 %
17.	Chapter 5	PDF	49	94.23 %
18.	Chapter 6	PDF	45	86.54 %
19.	Exercise - C4-6	PDF	39	75.00 %
20.	Survey on Programming	URL	13	25.00 %
21.	What is Verilog	URL	28	53.85 %
22.	Online Verilog - Terminal	URL	43	82.69 %
23.	Online Verilog - Waveform	URL	32	61.54 %
24.	Assignment Question	PDF	48	92.31 %
25.	Marking Scheme	PDF	42	80.77 %
		Average	41	79.46 %

From the LMS analytics of materials in Table 1, the average percentage of users' engagement was compared between the two sessions to get the trend for the three materials categories (Resource, Activity and Assessment). Another analysis was recorded to compare the users' engagement for different types of materials in each category, and another analysis was presented specifically for 'Resources' content to know the student preference in terms of the materials interactivity. The following section will display the result for these analysis for the two sessions.

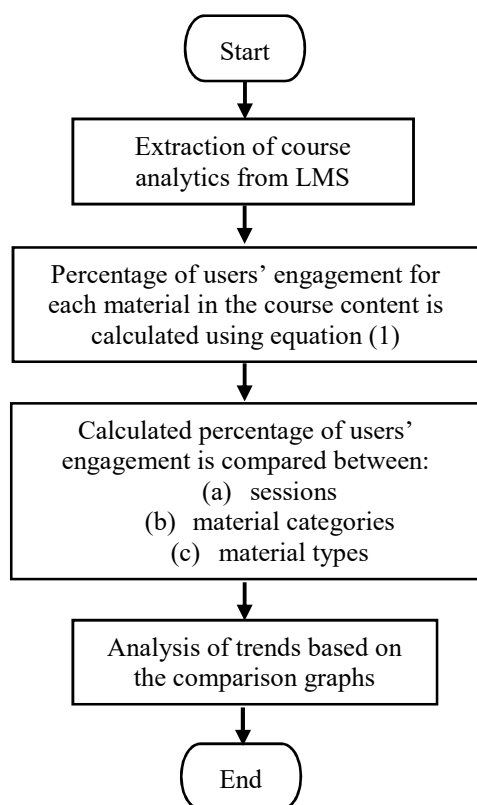


Fig. 1. LMS analytics process for data analysis.

III. RESULT AND ANALYSIS

Fig. 2 shows the average percentage of users' engagement for the three categories of materials uploaded in the LMS. It shows the same trend for the two sessions; where the highest users' engagement is with the Resources followed by

Activities and lastly the Assessment. The difference is only in the average percentage values where higher percentage of users' engagement were recorded for session 2023/2024 (79.49 %, 75% and 73.52%; each for Resources, Activities and Assessment) compared to the former session 2022/2023 (73.72 %, 59.96% and 52.9%; each for Resources, Activities and Assessment).

There are two types of materials in 'Resource' that are PDF notes and external URL. The 'Resource' materials in PDF are static text with images, while external URL redirect the users to additional websites with related content. Based on the graph in Fig. 3, it shows that users' engagement in PDF notes is higher (above 79% for both sessions) than the external URL (less than 55% for both sessions). This is one of the indicator that the interactivity in the material is not the main concern that will affect the users' engagement with the materials.

In terms of 'Activities' which is interactive in its own nature as the students got to respond and provide replies on their own, the materials uploaded consists of Forum, Group Choice and Feedback. The highest users' engagement among the 'Activities' materials is Group Choice that are 88.41% and 96.15% each for sessions 2022/2023 and 2023/2024 respectively. The others that are Forum and Feedback; all recorded less than 75% of users' engagement, which again shows that the interactivity in the materials does not affect the students' engagement with it. As Group Choice is an individual task that requires students to pick their preferred team for groupwork, it explains the highest percentage of users' engagement for 'Activities' materials. The other two 'Activities' materials depend on student's free will to engage as Forum comprises of group discussions and replies; while Feedback comprises of student's personal will to provide feedback.

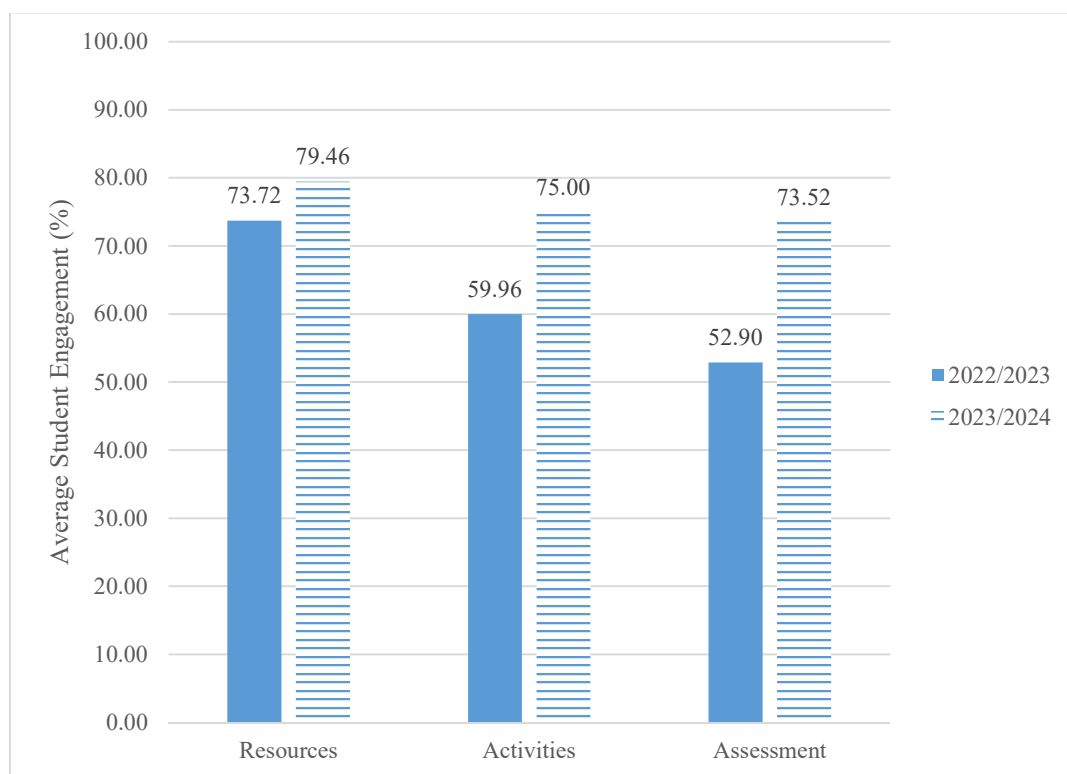


Fig. 2. Average percentage of users engagement for three categories of materials in the LMS for the two sessions.

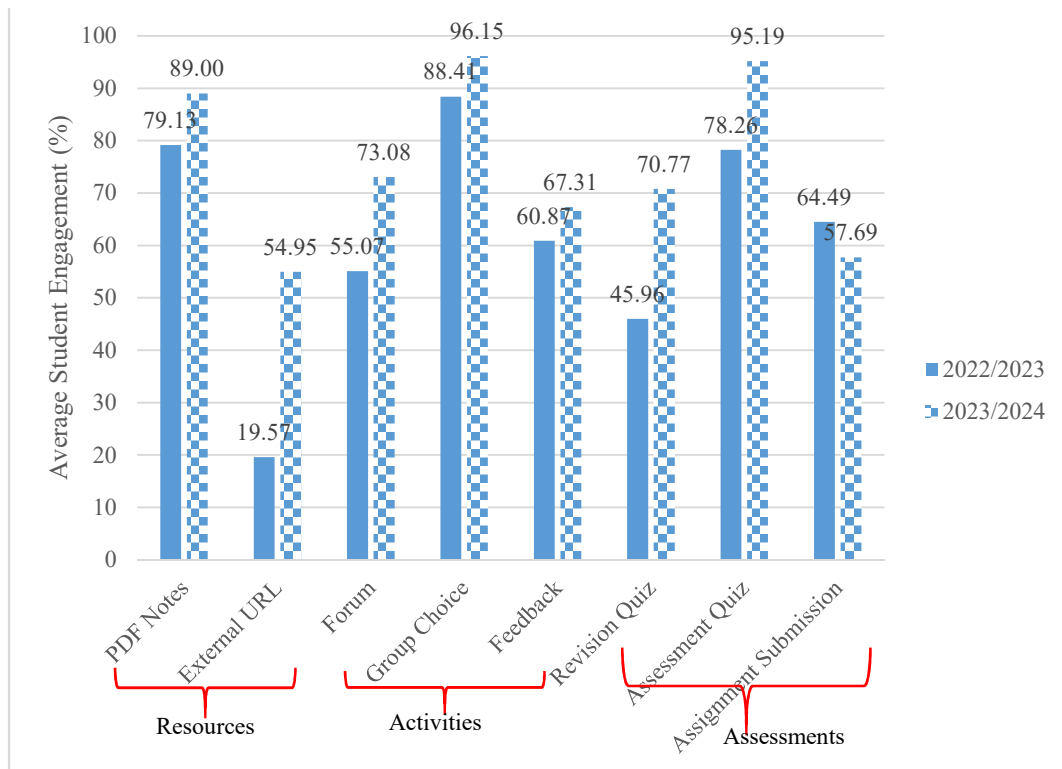


Fig. 3. Average percentage of users engagement for different types of materials uploaded in the LMS for two sessions.

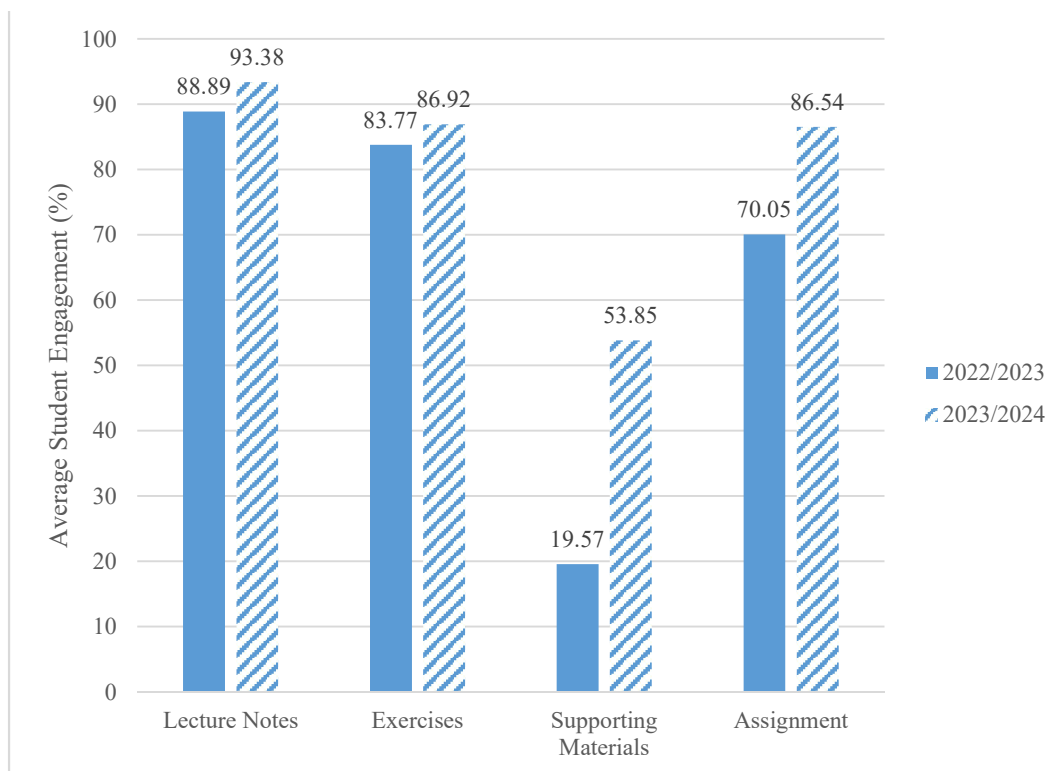


Fig. 4. Average percentage of users engagement for different 'Resources' content in the LMS for the two sessions.

The last category of materials uploaded in the LMS is 'Assessment' which comprises of Revision Quiz, Assessment Quiz and Assignment Submission; also shows an interesting finding. The highest among the three 'Assessment' materials is Assessment Quiz which is 78.26% and 95.19% for each

sessions 2022/2023 and 2023/2024. The others recorded less than 75% of users' engagement, where the lowest is 45.96% for Revision Quiz in session 2022/2023. As the Assessment Quiz is an individual task that eventually will be included in the student's grade, it explains that highest users' engagement

for 'Assessment' materials. Whereas the Assignment Submission is a group work where it only need any one group member to complete the submission, hence it recorded lesser users' engagement compared to the Assessment Quiz. The other 'Assessment' materials that is Revision Quiz is an individual work that is not included in the student's grade, but rather acts as an exercise depending on student's free will to complete them. It recorded the least percentage of users' engagement for 'Assessment' materials in session 2022/2023 but the second highest (70.77%) for session 2023/2024; which shows that students in session 2023/2024 are more willing to do extra exercises in their own time. Still, in terms of interactivity of materials, the percentage of users' engagement for 'Assessment' materials show that it is not the main concern that affects the students' engagement with it.

In order to analyse the interactivity of the materials content-wise, average percentage based on 'Resources' content is presented in Fig. 4. It comprises of four types of content that are Lecture Notes, Exercises, Supporting Materials and Assignment. Among the four types of content, Lecture Notes recorded the highest users' engagement percentage that is 88.89% and 93.38% respectively for sessions 2022/2023 and 2023/2024. It follows by Exercises with 83.77% and 86.92% respectively for sessions 2022/2023 and 2023/2024. The least is recorded by Supporting Materials for session 2022/2023 which is 19.57%. The trend was the same for both semesters which suggests that students are more likely to engage in the materials if it is directly connected to their grade achievement for the course regardless of whether the materials are of highly interactive or not. This is because, both Lecture Notes and Exercises are PDF files with texts and static images; while Supporting Materials which is an external URL are additional websites consisting of resources rich in interactivity.

IV. CONCLUSION

The observation based on the analysis done in this paper is for one course only that spanned for two sessions duration that are session 2022/2023 and 2023/2024. The students generational cohort based on their birthyear is generation Z (referred to as digital natives), which is claimed to be more interested in interactive materials when it comes to resources uploaded in the LMS.

Based on the analysis in this paper, it shows that the interactivity of the materials is not the main concern when it comes to the students' engagement with the materials. Rather, students' engagement with the materials depend on the students' perceived importance of the materials with regard to their assessment grade for the course. This is observed as the highest students' engagement in the LMS materials is in 'Resources'; where the interactivity in the materials are not as rich as the other two types of materials which are 'Activities' and 'Assessment'. The content of 'Resources' are Lecture Notes, Exercises, Assignment and Supporting Materials; which are directly related to the course content and engagement with the materials allows them to further enhance their understanding of the course content that eventually helps them to score their grade. Furthermore, these are the materials that mainly covered during their scheduled contact hours in class by the instructor.

Whereas for the other two LMS materials that are 'Activities' and 'Assessment' which are rich in interactivity where students got to personally respond and in some cases

post replies; the users' engagement are not as high as the 'Resources'. Furthermore, the highest recorded users' engagement regardless of sessions in each LMS materials are Group Choice (96.15% for 'Activities') and Assessment Quiz (95.15% for 'Assessment') indicates that students pay high attention to materials that had direct relationship to their grade. This is not to say that other materials are not related to the their grade or course content; it's just that the way the student perceived the materials can make the difference in how they engage with the materials. As such, instructors are suggested to stress or highlight the importance of all uploaded materials online through constructive instructional design in class. It will indirectly increase the students' engagement with the materials online, outside of their scheduled class hours. In addition to that, it will promote life-long learning skills among students, which is one of the many important skills required for the 20th century graduates.

Still, the observation concluded in this paper is limited to the Digital System course offered in FTKEK, UTeM for bachelor degree students. The observation might be different for other courses in other faculties in other universities because of different cohorts of students and also content coverage in the course. This limitation suggests for further research that can be done in this area to complement the constraint imposed in the analysis shared in this paper. All in all, whether the learning materials is interactive or not, it is important to note that students are likely to interact or engage more in materials that had direct impact to their understanding of the course which will eventually affect their grade achievement of the course.

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