Engaging online learning activities using Padlet in teaching mathematics for engineering students

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ABSTRACT – Recently, the COVID-19 pandemic has changed the higher educational system in Malaysia where the needs to transform the face-to-face teaching into online teaching becomes necessary. In this paper, we describe how the Padlet can be used to engage the learning activities in teaching mathematics for high education students. Mathematic courses in engineering program requires high skills mathematic calculation and a thorough explanation for efficient delivery by the lecturer. This paper highlights the Padlet activities in teaching mathematics and how mathematics lecturer frames their teaching content to help and guide students in online teaching. The satisfaction survey has been conducted to review students' feedback and comments. The results indicate that students agreed by using Padlet in online class helped them to enhance their understanding. It also found that the Padlet was effective to provide alternative platform as good as face-to-face meeting. Furthermore, the engagement in online classroom could be improved using Padlet.

1. INTRODUCTION

Growing use of the educational technology has been increased in recent years. Especially, during the pandemic Covid-19 that prevents face-to-face meeting in the campus. Thus, it is important to adapt with the new norm of education to integrate the educational technology into teaching. However, there were some issues with online learning, such as it caused absence of face-to-face relationship among students and lecturers, thus the instructional achievement was arguable [1]. Another issue was the adaptation in the attitudes of the lecturers and the students on the significance of online learning [2]. On the other hands, online learning had advantages, such as flexibility [3], interactivity [4], and self-pacing [5].

The most important process in teaching Mathematics is developing the student's comprehension and problem-solving skills. The student interaction with lecturer to learn the mathematical steps, to use the language of calculation of various ideas correctly and accurately [6] was crucial. Malaysia-Education-Blueprint-2015-2025 (Higher Education) highlights the essential competencies in the 21st century education which are critical thinking and problem solving, communications, collaborations and creativity and innovations [7]. One of the main components must be comprehensively implemented is to practice participatory learning model by creating collaborative, interactive and innovative skills [8]. Generally, the real time guidance is provided by the lecturer in face-to-face classroom to self-monitoring of student's understanding when students solve problems by themselves.

The transformation to online learning significantly influences the nature of mathematics course which requires hands on activity by students and parallel monitoring by the lecturers. Therefore, lecturers need to rethink and redesign the delivery model so that it is more student-centered and lecturers can act as facilitator in online platform [9]. It is important that students are actively involved in classroom activities such as solve problems, participating in discussions, ask questions and share solutions in context of mathematic courses [10].

There are a growing number of educational technologies that provide a cloud-based software and host a real-time collaborative online platform. One of them is Padlet which acts as virtual bulletin boards that can be used to upload, organize, and share content among lecturer and students. In this paper, we describe how the Padlet can be used to engage the learning activities in teaching mathematics for high education students. The Padlet can offer collaborative and interactive activities between lecturer and students. Zainuddin et al. [11] has shown that active learning through Padlet has a significant effect on improving students' engagement in classroom activities. This finding is supported by Ellis [12] that concluded Padlet helps smaller the gap for students to have discussion with lecturers and provide opportunities to engage with class activities. With all, Padlet is a useful tool that can be used significantly in online teaching and learning activities. Therefore, the objective of this study is to identify the level of student engagement using Padlet in learning mathematics course that requires close and parallel monitoring by the lecturer during class.

2. METHODOLOGY

The research question is how the Padlet (online bulletin board) can accommodate student's need in learning mathematics and how effective is the Padlet in online teaching and learning. The methodology of this research is as following.

2.1. Control group

The control group consists of 65 undergraduate engineering students of Bachelor of Electrical Engineering (BEKG), Fakulti Kejuruteraan Elektrik, Universiti Teknikal Malaysia Melaka (UTeM). The BEKG programme is an engineering degree programme which requires high skills of mathematics literacy for

solving practical problems. Two courses are involved, namely Engineering Mathematics I and Differential Equations.

2.2. Instruments

A questionnaire has been conducted to identify students' level of engagement in class and their satisfactory on the delivery of teaching and learning. The questionnaire is divided into 3 parts: A. Students' self-reflection, B. Usefulness and C. Effectiveness of Padlet activities. In each part, the scoring scheme is in ascending order (for e.g '1' denotes 'Ineffective' and '5' denotes 'Very Effective').

2.3. Procedure

Students are invited to the Padlet platform via link generated in Padlet. The link is embedded into UTeM Learning Management System known as ULearn. During the synchronous and asynchronous class sessions, students must upload their works or solutions to the class activities in Padlet. The lecturer is then giving feedback and comments on how the students can improve their works or to correct the wrong solutions. Students are called to response to the feedback in real time and resubmit the correct solutions in synchronous class. The setting of the Padlet allow the lecturer to rate the students' works (rate of 1 to 5 stars). 5 stars denotes as the solutions are correct and other students can use them as reference. The Padlet is then can be accessed via the ULearn at any time and at anywhere the students wanted to do revisions.

2.4. Task activity

A series of Padlet tasks was designed for students to carry out during and after class hour. Here is the list of Padlet activities that have been designed.

Students are divided into several breakout rooms during class. The breakout rooms are conducted via Microsoft Teams (a platform of meeting hub). Each room is assigned one set of questions to be solved within the set time. Students must upload their solutions by group in the Padlet. Before the class ends, lecturer gives feedback and comments to the student's works and students are required to make corrections after class hour.

Students are assigned to one hands-on question at the end of explanation of one subtopic. The solutions are uploaded in the Padlet and lecturer responses to the submission in instance. Students get the feedback and do correction.

Choose one question from the tutorial questions. Students upload one video to explain their solution in Padlet. Students can view, like and comments their friend's video. Next, an example of self-learning activity is in Figure 1.

Course's Name: BMFG1313 Engineering Mathematics I
Topic: Solution to Nonlinear Equations
Week: 3
Program: 1 BEKG

Instructions	Learning Tools	Heutagogy's Principles	21st Century Learning Skills
1. Form a group learning consists of maximum 5 team members.		Self-determined group member	Collaboration Learning Skill
2. Based on the stated Learning Outcomes, find information about the following methods a. Bisection Method. b. Simple fixed point Method c. Newton Raphson Method Choose 1 method only and distribute the methods fairly between groups.	YouTube/ Internet/ Textbooks	Knowing how to learn independently	Critical Thinking Life-long learning
3. Prepare a short infographic of the topic using any tools/apps such as Piktochart or Power Point.	Piktochart / Power Point	Self-directed on preference learning experience. Self-determined on the way how they will present the notes.	Digital skill Critical Thinking
4. Share the notes with your friends through padlet in Dr. Rahifa's website: BMFG1313	e-Learning	Self-determined on sharing information	Digital Skill Social Skill

Figure 1 The plan

3. RESULTS AND ANALYSIS

Figure 2 shows that 70% of the students think that Padlet is a good platform for lecturer to reach students during online classes. Some statements from the students said that the Padlet activities can improve him/her calculus techniques, 'I like the variety of activities in classroom and this course is much easier to understand as compared to the other courses.

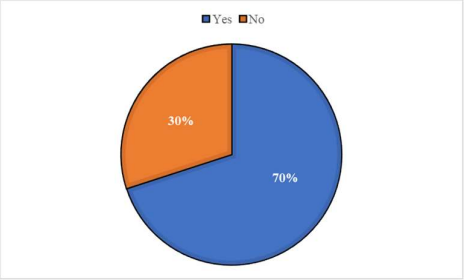

Figure 2 Percentage of students who think that Padlet is a good platform for lecturers to reach students.

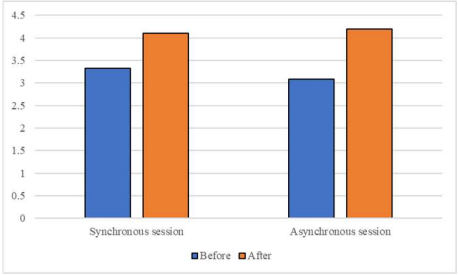

Figure 3 The level of students' mathematical literacy before and after the class session.

The level of students' mathematical literacy on class content before and after the class session which is conducted using Padlet board is shown in Figure 3. It demonstrates that the level is increased by 23.65% and 35.96% for synchronous session and asynchronous

session, respectively. Therefore, it shows that the Padlet activities help to improve and enhance students learning in the classroom.

Figure 4 depicts the analysis related to usefulness of the Padlet activities in online class. It is found that most of the students agree that Padlet is useful to provide a collaborative learning among students (51 students, 78.46%) and the lecturers (59 students, 90.77%) by sharing information and exchanging files. The engagement in the classroom occurs which can ensure that students are keeping up with the contents and current information. Furthermore, about 43 students (66.15%) agree that Padlet offers one of the learning techniques for them to achieve better result. However, there are small number of students who disagree that Padlet is useful for them. Further investigation found that these students prefer to have a face-to-face class instead of online class.

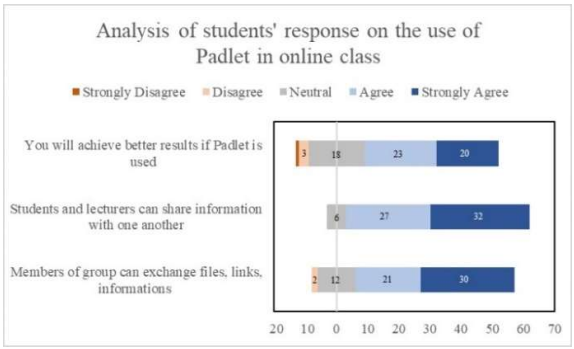

Figure 4 The analysis of students' response on the usefulness of the Padlet activities.

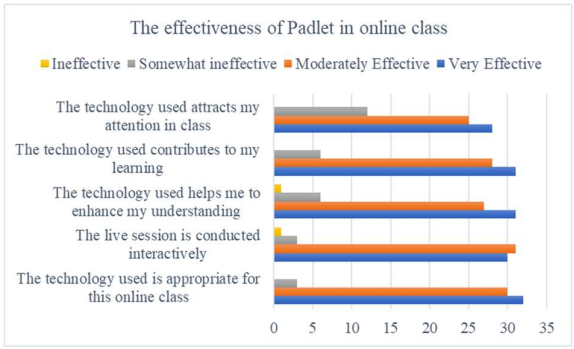

Figure 5 The effectiveness of Padlet board in online class.

The effectiveness of Padlet board in online teaching and learning is studied and the results are shown in Figure 5. The findings indicate that the use of Padlet has significant effect in online teaching and learning, and it helps students to enhance their understanding in the discussed topics. On the other hand, it is proven that the synchronous session is conducted interactively using Padlet which improves students' engagement. Nevertheless, about 12 students and 7 students said that the Padlet is ineffective to attract their attention in class and enhance their understanding, respectively. Such results are found to be technical errors (internet lagging) occur during online class, not interested in the topic and hard to understand mathematics.

An analysis has been done on students' performance based on their marks in midterm test and final exam. The results were based on the BMCG 1013 Differential Equations course. The teaching and learning were conducting via online throughout the semester. Padlet activities were carried out in both synchronous and asynchronous sessions as discussed in 2.4. Both assessments were conducted in online platform. Figure 6 shows the overall performance of students for midterm test and final exam. The results indicate that the performance of students was slightly improved in final exam as compared to midterm test. It can be verified by the descriptive statistical analysis as shown in Table 1. The mean of marks for final exam was 66.14 with standard deviation 15.25 which is higher than the mean of marks of midterm test, 59.46 with standard deviation 17.07. Meanwhile, Table 1 The descriptive statistical analysis of students' performance.

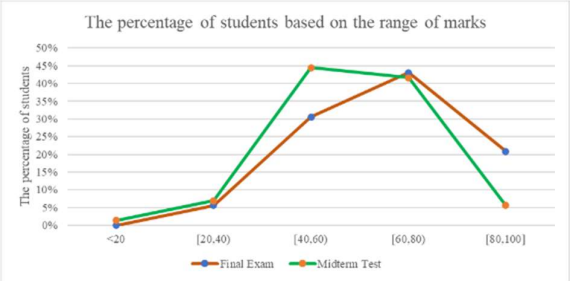

Figure 6 The percentage of students based on the range of marks.

Table 1 Students' performance

Descriptive Statistics	Final Exam	Midterm Test
Mean	66.1408451	59.46180556
Median	68	60
Mode	68	60
Standard Deviation	15.2548365	17.07587973
Skewness	-0.28168969	-0.584611337

4. CONCLUSION

This paper presents an outline regarding the 21st century teaching and learning approach. The findings show that Padlet online board is a useful teaching aid that could help lecturers to engage with students and to improve students' learning experience in online classes. Padlet activities can be conducted via both synchronous and asynchronous online sessions. Various teaching activities for Mathematic courses can be designed which allow students to work as individual or in group tasks. Furthermore, the activities increase the students' engagement via collaborative and active learning in classroom while sharing information and knowledge with others are embedded. The learning process becomes more effective with the use of Padlet which contributes to enhance students' understanding. It is shown that the use of Padlet contributes to improve students' performance. Therefore, it is suggested to determine the relative contribution of Padlet on performance of the students in Mathematic course in future work.

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