



An Effective Self-directed Personalized Learning Environment for Engineering Students During the COVID-19 Pandemic

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ABSTRACT

This study has brought a new dimension in engineering education where the researchers investigated the motivation of engineering undergraduates in using a specifically developed self-directed personalized learning environment utilizing WhatsApp application to overcome the issues that hamper the teaching and learning process during the COVID-19 pandemic. The findings showed that the respondents responded positively towards the intrinsic motivation and self-determination while the respondents responded negatively on assessment anxiety and grade motivation. The findings revealed that the developed platform need to be improved in order to bring forward as an alternative teaching and learning platform in future.

Key words: Self-directed Learning; Motivation; Collaborative Learning

INTRODUCTION

The outbreak of the COVID-19 pandemic has created a global public health emergency and caused an unusual disruption to all sectors, including education. Particularly for Malaysia, online platforms have replaced face-to-face instruction in engineering education.

For three weeks, researchers observed the online learning strategies conducted via real-time video conferencing and reviewed the uploaded lecture materials in the learning management system (LMS) for the Communication 2 subject of Year 2 Electrical Engineering students for Semester 4 at University A, Malaysia. This subject aims to expose the students to digital communications, such as digital coding, sampling, modulation, error control codes, and channel coding. It also introduces the concept of antenna and wave propagation. Communication 2 is a compulsory three-credit subject for Year 2 Electrical Engineering students.



Several issues were identified in the online engagement of the students for the subject during the pandemic period. These issues are as follows:

- a. The average level of participation among the students involved in real-time video conferencing was not encouraging. Attendance was at only around 45% due to the inefficient Internet coverage, especially in rural areas.
- b. Students did not participate well in the LMS, with an average of only 36% of students downloading the teaching materials. At the same time, an average of only 25% students submitted their tutorial exercises via LMS.

These issues were mainly attributed to the (i) lack of Internet coverage and (ii) the low motivation to learn how to use the dedicated LMS. To solve this problem, the researchers proposed to the educator in this study the application of a self-directed personalized learning (PL) strategy that uses social media platforms for online teaching and learning.

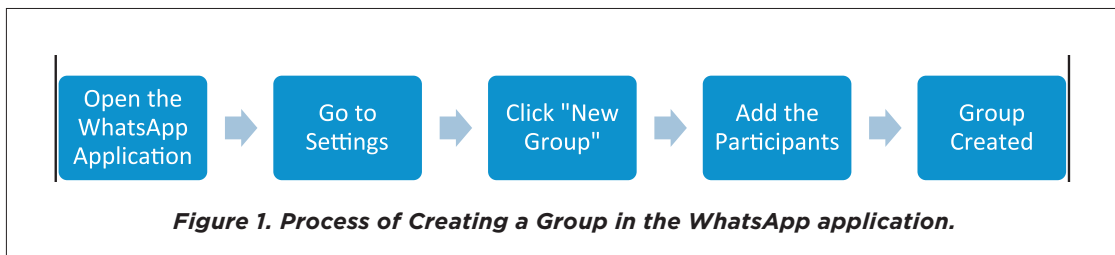
Given the rapid development in the use of digital technologies and social media among students, especially for the current generation of students, namely, Gen Z, the proposed method can be an effective substitute to the existing approach for online learning (Xie et al., 2019; Reynolds, 2019). PL provides a conducive platform for students to direct themselves in acquiring new information available online. They can freely choose from the learning materials and activities available online, especially in social media, according to their preferences, which are mainly determined by their learning styles (Kurilovas, 2019). Most importantly, they can learn at their own pace and manage when and how to learn. This flexibility helps students from rural areas who have limited Internet connectivity because the access to social platforms is not as complex compared to other systems such as the LMS.

To make the learning process more effective in the PL environment, the learning platform is designed to integrate the elements of (i) self-directed learning via social media, (ii) guidance from lecturer, and (iii) collaborative learning among peers.

The presence of the educator is vital to guide and motivate the students (Balakrishnan, 2018). Educators play an essential role in ensuring students are engaged actively in the learning process. Moreover, students should be encouraged to share their learning sources because this provides a platform for collaborative learning in a self-directed learning environment (Normadhi et al., 2019). Sharing feedback on the learning materials may bring the learners toward a higher level of the learning process.

METHODS

A learning group was created using the WhatsApp application, which can be installed in a mobile phone. The students who enrolled in the Communication 2 subject were required to create



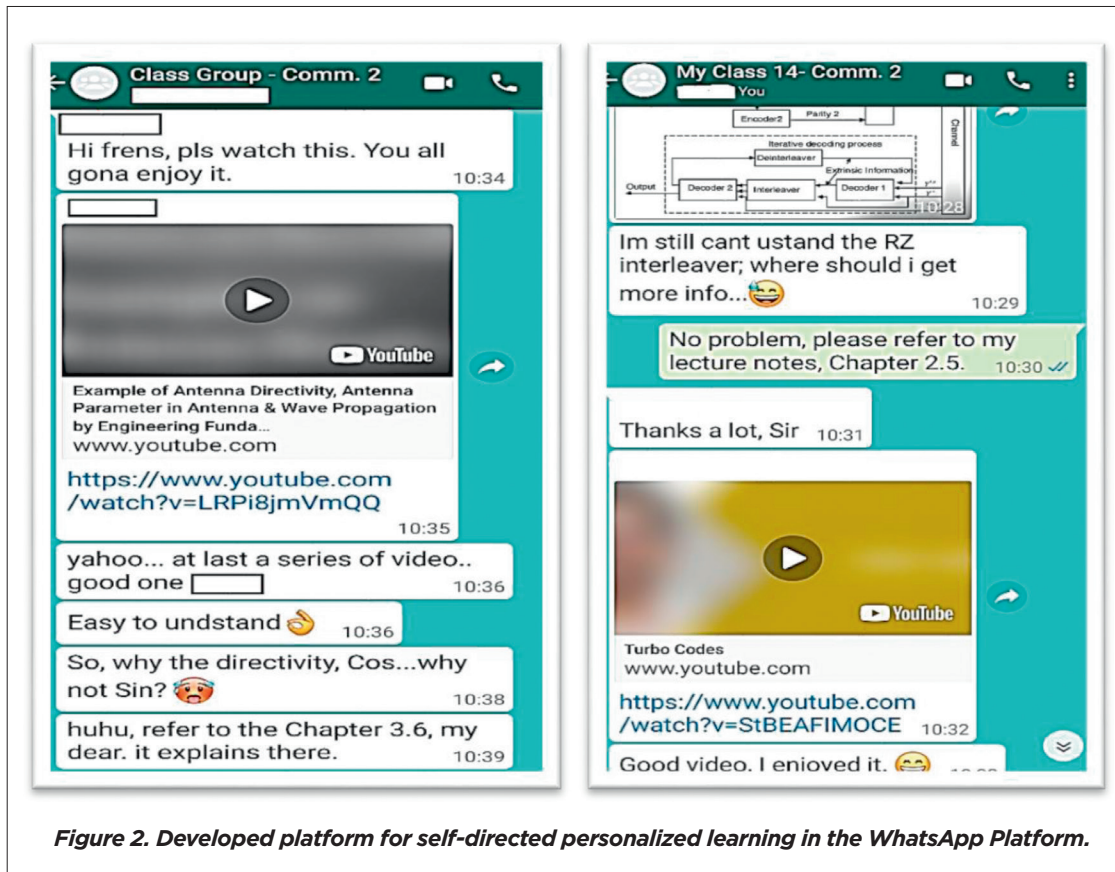
a personal group (My Class), which included the student and the lecturer, as well as join the Class Group created by the lecturer. The creation of the learning platforms, namely, Class Group and My Class, via the WhatsApp application is free of charge. Users only need to install the application in their respective smart-phones via Play Store for Android and App Store for iOS. The application is also downloadable in their computers.

Figure 1 depicts the process of creating the group in WhatsApp.

The students were asked to share the learning sources they found related to the subject matter via social media in both personal and class groups. In the personal group, the lecturer continued to guide and monitor each student's learning process. The sharing of learning sources, personal questions related to the subject, and submission of tutorial exercises were all conducted in the personal group - My Class. The personal group was labeled using numbers for each student according to the student list.

Meanwhile, the learning materials were uploaded by the lecturer in the Class Group. The students likewise shared the learning sources they found via social media platforms in this Class Group. Such sharing enabled the students to have discussions and share their thoughts on the learning materials. Every learning material shared by the students in the Class Group must be reviewed and approved by the lecturer, who advised the students on whether or not the materials were suitable to share in the Class Group. The material was considered appropriate if it met the requirements of the Communication 2 syllabus. Learning materials deemed inappropriate were recommended for removal by the lecturer.

This learning platform was able to overcome one of the issues in the learning process of students in the LMS. The WhatsApp application only needs low Internet bandwidth (wireless connection) to operate (i.e., 1-5 Mbps), whereas the LMS needs more than 5 Mbps to be accessed by the student (Koomson, 2019). Thus, the students were able to obtain the learning sources and messages from the lecturer and their peers instantly via the developed platform, whereas in the LMS platform, the students needed to provide their username and password before they could receive any messages. In addition, access to the LMS greatly depends on the channel capacity of the server provided by the university. Access to the learning sources available in social media platforms, such as YouTube



videos, is easier via the developed platform because streaming can happen in the application itself, whereas in the LMS, the learning sources need to be transferred to the dedicated site first before streaming can happen.

Figure 2 shows the My Class and Class Group platforms that were created for the subject. After 10 weeks of learning via this self-directed learning platform, the researcher measured the motivation level of the students in this new learning paradigm. Seventy-five students who enrolled in the subject participated in this study.

A questionnaire was administered to the respondents to measure their level of motivation in learning the subject (Communication 2) during the COVID-19 health emergency period utilizing this new learning platform. The questionnaire was based on the Science Motivation Questionnaire (SMQ) developed by Glynn et al. (2009). Several related items from the SMQ were selected and re-phrased to contextualize the need of the current study, which focused on the learning process that happened using the new platform. For this study, 9 items were selected out of the 25 items listed in the SMQ, comprising the components of intrinsic motivation, self-determination, assessment anxiety,



and grade motivation. Different from the items in the SMQ, which focused on the motivation for learning a science subject, the items in the questionnaire were modified from the existing SMQ to suit the Communication 2 subject. The questionnaire was validated - content validation - by three engineering education experts who have more than 15 years of experience in engineering education and instructional technology. Content validation has been conducted by this panel of experts who determines the following criteria:

1. Questionnaire items that modified are adequately measure the construct that intend to assess.
2. Questionnaire items that modified measure the domain of interest of this investigation.
3. Questionnaire items that modified are clear and easy to answer by the respondents.

The panel of experts found that the modified questionnaire fulfilled all the criteria that mentioned above.

The engagement level of the students from week 1 to 14 was also measured to evaluate the progress of their engagement level in the context of their participation, downloading and sharing of learning sources, and tutorial submissions. The data for the LMS and the developed self-directed PL platform were collected respectively in weeks 1-3 and weeks 4-14.

PRELIMINARY RESULTS

A total of 75 respondents responded, for a total return rate of 100%. A Cronbach's alpha value of 0.857 indicated that the research data obtained were reliable (Creswell, 2017). The Cronbach's Alpha value was measured across all the nine items in the questionnaire. This way of calculating Cronbach's Alpha value was utilized by Balakrishnan (2018) whereby in this study we were focusing to measure the inter-correlation between the items of the questionnaire. The mean values and standard deviations for each item are depicted in Table 1.

Table 1 clearly shows that the students responded positively to the items related to (A) Intrinsic Motivation and (B) Self-determination, but the responses were not as encouraging for the items related to (C) Assessment Anxiety and (D) Grade Motivation. The concerns of the students in this study were about getting good marks during the pandemic period, given that the new learning process was still unable to give them the confidence to achieve good marks in the assessment process. Based on the researchers' observation on the students' activity, the students actively participated in the new platform and the sources shared were referred to from websites and social media platforms. However, challenges such as low Internet coverage and coping with the new normal learning process remained. The findings also strongly suggest that self-directed PL with a proper monitoring mechanism from the lecturer and collaborative learning may be associated with self-motivation and self-determination to learn the subject matter effectively.



Table 1. Mean Values and Standard Deviations for Measured Constructs.

	Mean Value (M)	Standard Deviation (SD)
5 (Strongly Agree), 1 (Strongly Disagree)		
Part (A) - Intrinsic Motivation		
A1: Learning the subject was interesting for me during this pandemic period.	4.561	0.117
A2: The topics I learned have practical values for me.	4.325	0.125
A3: Understanding the topics of the subject gives me a sense of accomplishment, especially during this pandemic period.	4.456	0.142
A4: I think about how I will put the topics of this subject into practice.	4.358	0.140
A5: I think about how the topics of this subject I have learned will be helpful to me during this pandemic period.	4.414	0.142
Part (B) - Self-determination		
B1: I put enough effort in learning the topics of this subject by using this platform during this pandemic period.	4.217	0.121
Part (C) - Assessment Anxiety		
C1: I am confident that I will do well in the test/exam for this subject during the pandemic period.	2.011	0.102
C2: I am confident I will score well in projects/assignments for this subject during this pandemic period.	1.912	0.039
Part (D) - Grade Motivation		
D1: I expect to do well or better than other students in the assessment for this subject during this pandemic period.	2.031	0.061

Table 2. Data on the engagement level of participants in the learning management system and the developed personalized learning platform.

Learning Platform	Participation (%)	Downloading / Sharing Learning Sources (%)	Tutorial Submission (%)
Learning management system (LMS)	W1: 44.0	W1:37.0	W1:No Tutorial Submission
	W2: 46.0	W2:36.0	W2:No Tutorial Submission
	W3: 45.0	W3:38.0	W3:25.0
	Average: 45.0%	Average: 36.0%	Average: 25.0%
Developed self-directed personal learning platform - (WhatsApp)	W4: 95.0	W4: 95.0	W4: No Tutorial Submission
	W5: 95.0	W5: 95.0	W5: No Tutorial Submission
	W6: 95.0	W6: 95.0	W6: 98.0
	W7: 97.0	W7: 97.0	W7: No Tutorial Submission
	W8: 97.0	W8: 97.0	W8: No Tutorial Submission
	W9: 97.0	W9: 97.0	W9: 98.0
	W10: 97.0	W10: 97.0	W10: No Tutorial Submission
	W11: 97.0	W11: 97.0	W11: No Tutorial Submission
	W12: 98.0	W12: 98.0	W12: 98.0
	W13: 98.0	W13: 98.0	W13: No Tutorial Submission
	W14: 98.0	W14: 98.0	W14: 98.0
Average: 96.7%	Average: 96.7%	Average: 98.0%	



In Table 2, the developed self-directed PL environment is clearly shown to enhance the participation of respondents in the learning process. The average involvement among the students in terms of participating in the learning process using the developed platform, sharing learning sources, and submitting tutorial assignments was above 96.7%, substantially higher than the approximately 45.0% participation level in LMS for all three activities.

NEXT STEPS

The findings show that, in a self-directed PL process, the use of social media for learning, presence of a lecturer, and collaborative learning with peers may be associated with an enhanced overall learning process among students.

The researchers recommend the following strategies to promote an effective self-directed PL environment:

- a. Implement a dedicated platform utilizing social media for PL even after this pandemic passes (i.e., post COVID-19) to complement the traditional teaching and learning process.
- b. Construct an appropriate best practices guideline for engineering educators for an effective self-directed PL process. The best practices guideline can be emphasized in the context of the following:
 - i. pedagogical strategies that carve the path for self-directed learning among engineering undergraduates,
 - ii. encouraging creative and critical thinking in order to develop students who can think and develop a credible content of learning of the subject, and
 - iii. taking into consideration the preferences and learning styles of students when creating self-directed PL platforms.
- c. Encourage students to be content creators for the subjects taught in the engineering program. This approach will give them the motivation for self-directed learning and the confidence to excel in the subjects.
- d. Encourage more self-directed learning among engineering students in order for them to cope with any emergency situation. This practice will ensure that the learning process continues even without the presence of face-to-face instructions in physical classrooms and laboratories.
- e. Develop a new assessment mechanism to assess the students' involvement in providing effective learning sources, given that the students put considerable amount of effort to create content for the subject.



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