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Mobile learning application: flipped classroom

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ABSTRACT

This study attempts to illustrate the phases of designing a flipped learning mobile application. It is worth noting that changes in students' learning behavior should be met by changes in the classroom – particularly on the way a course should be delivered. Studies have shown that students who learn using the flipped learning method are less likely to fail as opposed to their counterparts in the traditional classroom setting. The rising importance and popularity of flipped learning necessitates the development of a mobile application that assists both students to learn and allow instructors to manage their course via their mobile devices, almost anywhere and anytime. The software development life cycle (SDLC) is divided into four distinct phases: 1) Preliminary study, 2) content design, 3) System design and development, and 4) System evaluation. The effectiveness of the application is tested using electroencephalography (EEG). The findings suggest effectiveness of the mobile application falls within the acceptable range. Improvements for the flipped learning mobile application is also presented.

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1. INTRODUCTION

Technological advancements have contributed to the rising popularity of e-learning and mobile learning. With these learning methods, learners can access information anywhere and anytime, all at the touch of their fingertips. Universities are not exempted from joining the mobile-learning bandwagon to cater to learners' changing needs. Studies have revealed that students who were exposed to flipped learning have better grades and are 150% less likely to fail compared to their traditional classroom counterparts [1]. Students perceive one-way lectures in traditional classrooms as boring and inefficient.

A study found that Malaysian students expects to be spoon-fed by their instructors. These students relied heavily on textbooks and lecture notes, seldom involved in problem solving activities, rarely voice out their own ideas [2]. The flipped learning method attempts to get students to be actively involved in classroom activities. The adoption of the flipped learning methodology enables instructors to use class time for student-centred learning activities that require higher-order thinking skills. Moreover, students are more excited to attend classes when they have control over theirs learning [3]. It is therefore timely to develop a mobile application that will support the flipped learning pedagogical approach that allows students to learn the materials prior class time, and instructors to manage their class materials.

The objective of this study is to illustrate the four phases undertaken by the researchers in developing a mobile application that assist both learners and instructors in the flipped learning classroom.

The four phases of the software development life cycle are: 1) preliminary study, 2) content design, 3) system design and development, and 4) system evaluation using electroencephalography (EEG). Suggestions for improvements were also illustrated based on the findings of face to face interviews with the respondents.

2. FLIPPED LEARNING

In flipped learning, students' exposure to new materials takes place outside of the classroom, typically in an online environment. This allows for class time to be used for student-centred activities, allowing for collaboration, acquire interpersonal skills, think creatively, and communicate creatively [3, 4]. The continuously growing access to information on the Internet, traditional classroom settings of the teacher as a sage on the stage will soon become obsolete [5].

A comparison of the traditional classroom setting versus the flipped classroom is illustrated in Figure 1. In a traditional classroom, learning contents are delivered via lectures, and homework are assigned for students to complete outside of the classroom. The flipped learning classroom, students study the learning materials prior coming to class, reserving class time for inquiries, applications, and assessments. The main purpose of the flipped classroom is to allow greater focus on the application of knowledge and avoid students to become *surface learners*.

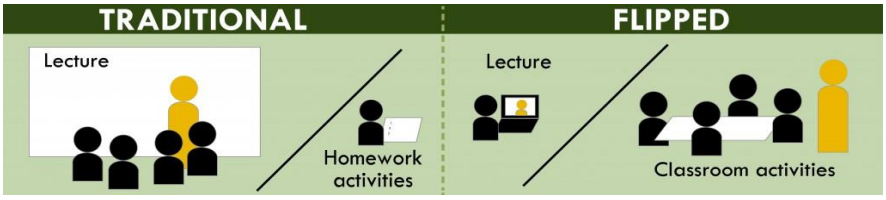

Figure 1. Traditional classroom and flipped classroom comparison

The flipped learning environment addresses individual needs. Students of varying abilities have control over theirs learning. Students can watch the learning materials as much or as little as they need, at their own convenience and speed. Students are able to stop, pause, rewind, and even replay materials for advanced concepts. Understanding the which topic that they require more help with allow for a more personalized tutoring with the instructor during class time [6-10].

In comparison to blended learning, traditional learning, and e-learning on self-efficacy, intrinsic motivation, perceived flexibility, and learners' performance, learners using the flipped learning method showed superior performance than the other three learning methods. The method also seemed to have positive effects on learners' self-efficacy and intrinsic motivation. Students who obtained better understanding before attending face-to-face sessions are engaged in higher level of cognitive processing [4, 10, 11].

3. RELATED WORKS

A self-regulated flipped learning approach was developed by [12] to effectively read and understand learning materials prior class time so that learners would be capable of interacting with their peers and instructors for in-depth discussions. Figure 2 illustrates the learning flow of the self-regulated flipped learning approach. The instructor will introduce the syllabus, the self-regulated learning mode, and the flipped classroom method at the beginning of the course. Once the students understand the learning mode, a learning goal will be set based on students' prior learning experience. After completing the goal setting, students are then allowed to utilize the out-of-class learning system. The out-of-class learning system allows learners to read the e-books and attempt quizzes where ever and whenever. The learners' learning logs and performance are recorded in the database. Based on students' learning logs and performance, the instructor will conduct discussions that are appropriate with the learners' abilities. Face-to-face class time enables instructors to discuss any misunderstandings on the concepts, or error-prone questions.

On top of discussions, interactive learning activities are also conducted during class time. After completion of both in-class and out-of-class learning activities, learners are guided to perform self-evaluation in the self-regulated monitoring system. Upon completion, the database will provide learners with a diagnosis of theirs learning performance. Learners will then adjust their self-regulation accordingly.

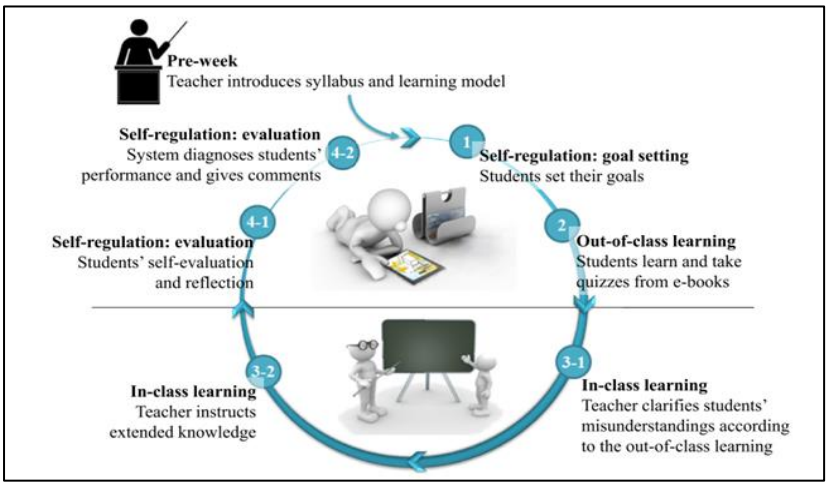

Figure 2. Learning flow of the self-regulated flipped classroom approach

4. REVIEW OF EXISTING SYSTEMS

To keep abreast with the current software demands, three existing systems (Khan Academy, edX, and OpenLearning) related to mobile-learning (M-Learning) were reviewed. Khan Academy is the most prominent pioneer among the new generation of digital learning organizations with almost 10 million unique visitors monthly [13]. EdX, developed through the collaboration of Ivy League universities are one of the main Massive Open Online Course (MOOC) platform with more than 15 million users worldwide [14]. In Malaysia, OpenLearning was elected as the official MOOC platform for all public higher learning institutions (HLIs). To prepare graduates for the 4th industrial revolution, the Malaysian government aims to have at least 15% of public HLIs courses be taught online by 2015, leading to 30% in 2020.

After reviewing the strengths and weaknesses of the functionality modules in each platforms, the researchers unanimously decided to include a discussion and quiz module, both of which were absent in all three platforms. The software, named as PokeLearn, have a *register* module, *login* module, and a *manage profile* module, similar to the three existing systems. On top of that, PokeLearn also includes a *view progress* module that enables instructors and students to track progress. The *learn* module and *discuss* module that is included in PokeLearn distinguishes the mobile application from Khan Academy, EdX and OpenLearning. The *learn* module allows instructors to create learning contents in multiple video and document formats such as .ppt, .pdf., .doc., .mp4, etc. Students need not download the learning contents to review them. The *discuss* module enables students to communicate with their instructor or peers via text or images in private chatrooms. This function allows students to get assistance when needed. This is different from an existing *forum* module on Open Learning where learners only have 'like' and 'comment' features that can be seen publicly.

5. METHODOLOGY

The software development begins with a preliminary study on the teaching methods currently being used in Malaysia. There are four phases in the SDLC, namely preliminary study, content design, system design and development, and evaluation. In the preliminary phase, the researchers construct the problem statement and review past literature in the areas of concern. There are three main activities conducted during this phase; a) analyze existing pedagogical approach commonly used in Malaysia, b) review types of educational applications, and c) identify the issues that exists in the adoption of existing applications. In the second phase, the researchers focus on content design. Similar to phase 1, there are also three main activities in the phase; a) review current technologies and tools used in mobile learning applications, b) study existing MOOC mobile learning applications, and c) design the learning contents for a Technopreneurship course on the OpenLearning platform. The output of this phase is the complete learning materials for Technopreneurship. In phase three, the researchers focuses on system design and development that comprises of five major activities; a) questionnaire development, b) application flow design, c) database design, d) user interface design, and e) system development. The evaluation of the application was conducted in the final phase using EEG. The three main activities in the final phase; a) verification and validation, b) post-project survey, and c) data collection on the new system.

6. IMPLEMENTATION OF FLIPPED CLASSROOM

A flipped classroom approach is implemented post development of the M-Learning application. Figure 3 demonstrate the interface for all of the modules in the application. The pilot course for this project is a Technopreneurship course that being offered to second year bachelor's degree students. This is the reason why the researchers had to prepare learning materials for this course on OpenLearning in phase 2. Completed learning materials are then uploaded to PokeLearn. Students enrolled in the course are instructed to study the course materials prior class time. At the start of the class, students are required to complete an assignment or quiz to gauge their readiness and understanding of the topic. The instructor then guides the students through series of inquiries, activities and discussions.

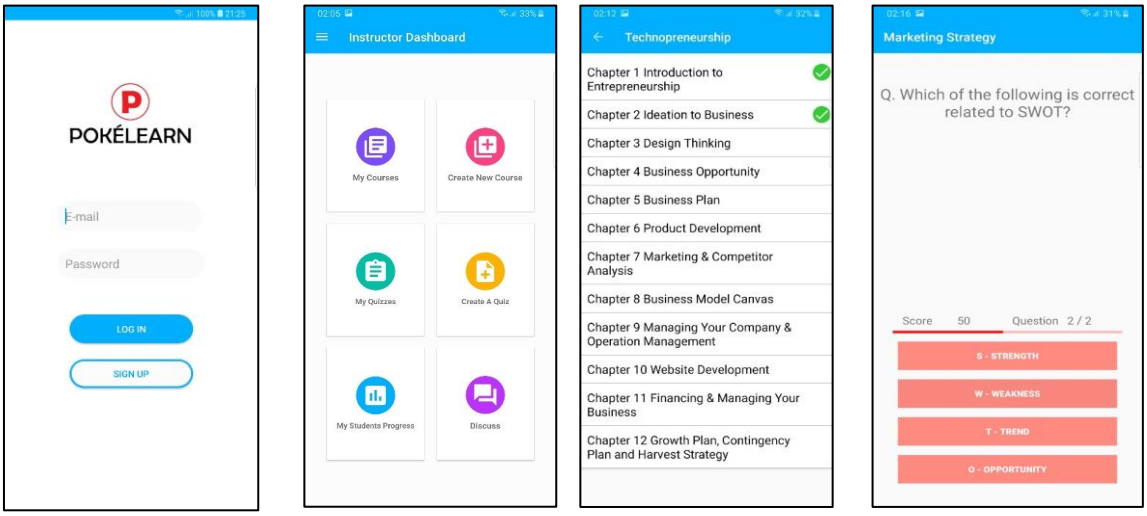

Figure 3. Mobile application (pokelearn)

7. EVALUATION

The researcher used the Effective Learner application to evaluate PokeLearn's effectiveness. Neurosky Mindwave headset were used to monitor learning effectiveness by measuring learners' focus levels. The headset detects tiny electrical impulses, or brainwaves and analyze it using the Effective Learner application. An Effectiveness Tracker shows current focus level and learning effectiveness using six color-coded levels [15], and provides a session report that includes the time plot of the effectiveness during the study duration with a pie chart showing percentages in different colors. Figure 4 illustrates the learning effectiveness scale. Learning effectiveness is represented by six colors from red to blue, with red being least effective, and blue being most effective. Upon completion of the evaluation, individuals were interviewed on their experience of using PokeLearn.

Least effective Most effective

Figure 4. Learning effectiveness scale

Prior testing, respondents were briefed on the tasks they need to complete on PokeLearn. The tasks given are illustrated in Table 1. Respondents were given the brainwave headset for them to put on before being given mobile devices that are pre-installed with PokeLearn. Respondents can begin completing the tasks given once the Effective Learner application detects brainwave readings.

Table 1. Respondents' Tasks

No.	Tasks
1.	Register an account
2.	Search for Technopreneurhsip course
3.	Enroll into the course
4.	Learn Chapter 7 (Marketing and Competitor Analysis) of the Technopreneurship course with the method they prefer, either reading PDF slide or watching video.
5.	Take a quiz on Chapter 7.
6.	Add a friend in the discussion function.
7.	View the progress of the course taken.

Upon completion, respondents are required to fill up their personal data comprises of their name, age, and gender. Once they have completed all tasks, they are interviewed on theirs learning experience using PokeLearn.

8. DATA COLLECTION

The effectiveness of the PokeLearn mobile application was evaluated by 10 respondents. Respondents' demographic profile, screenshots of user testing session reports, and interview responses is illustrated in Figure 5.

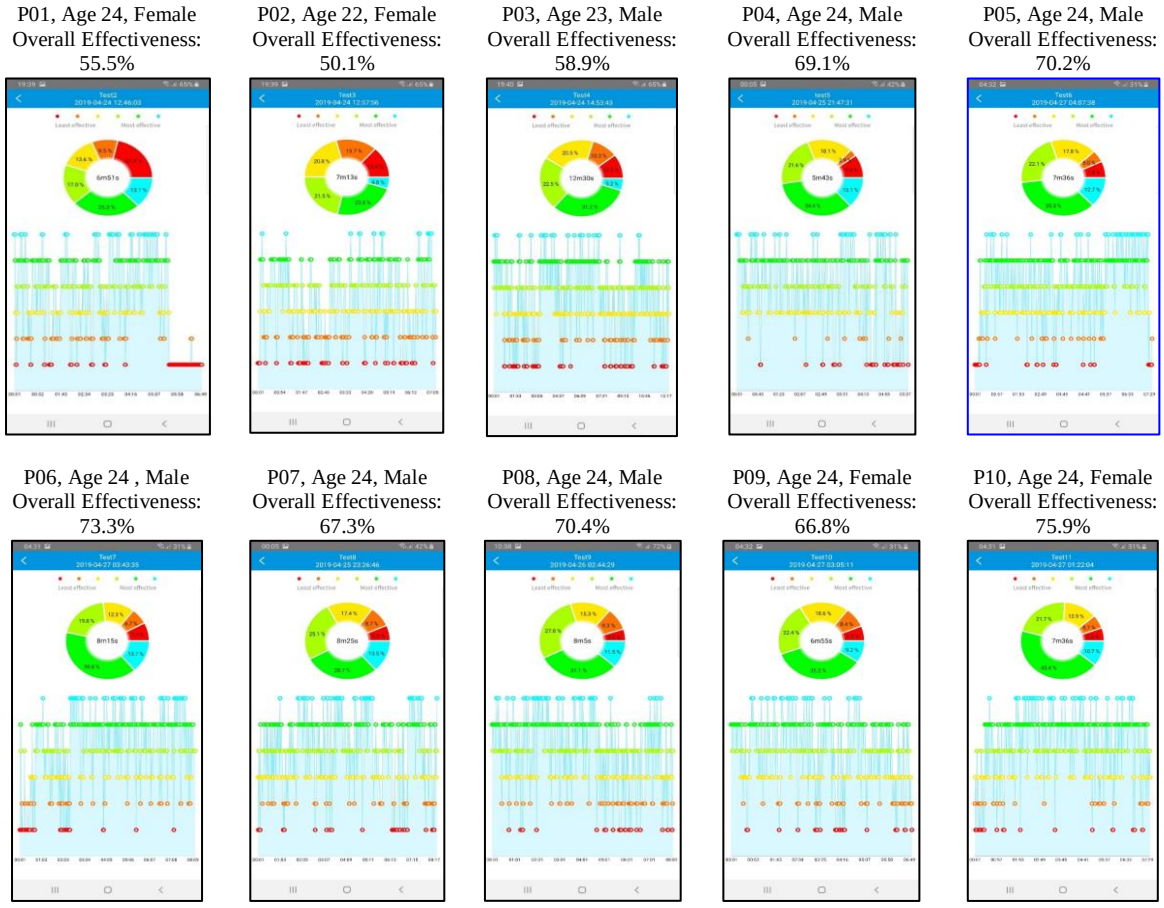

Figure 5. User testing session report

9. FINDING AND DISCUSSION

The respondents' demographic profile shows that 60% of the respondents are male. 80% of the total respondents are 24 years old. Respondents' total learning time ranges between 5 minutes 43 seconds and 12 minutes 30 seconds, which is within the recommended duration of M-learning of between 3 to 15 minutes [16-18]. The minimal learning times is expected as M-learning is anticipated to occur while learners are in between activities (waiting for a bus, in a coffee shop, waiting for laundry, etc.). The results suggest that the PokeLearn's effectiveness is between 50.1% to 75.9%, with an average effectiveness of 65.75% that is well within the effective range. All 10 respondents gave positive feedback about flipped learning, as well as on PokeLearn's interface. Findings from an interview with the respondents revealed that the respondents believe that flipped learning will enhance students' performance. Respondents suggested that user experience could be further improved with offline capabilities, gaming elements and assessment reviews.

10. CONCLUSION

The ever changing needs of learners call for a change in teaching methodologies. Learners today are easily distracted with the abundance of information that can be assessed online, therefore it is the responsibility of the instructors to teach using methodologies that would encourage students' engagement [19-21]. Findings of this study indicate that the flipped learning method assisted by M-Learning application does increase learning effectiveness [22-25].

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