Development of mobile application upon mechanical engineering students’ learning styles

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Abstract. The use of technology in this era of globalisation is growing from day to seconds. Mobile learning or also known as m-learning is commonly heard lately as we are in the 21st century of education. Mobile applications developed are to enhance m-learning among students. Henceforth, making students engaged to m-learning is only possible when we had identified their learning styles. Current paper presents the development of mobile application for Polytechnic Mechanical Engineering Students (PolyMES) based on the previous analysis of learning styles among premier polytechnic mechanical engineering students in Malaysia. The aim of this study is achieved whereby the design for PolyMES is developed according to these mechanical engineering students’ learning style. The mobile application developed requires the understanding of students’ learning style to enhance m-learning. PolyMES is designed to be user friendly application that enables students to study the subject at their own space. They can read the simple notes with related video and images. In addition, students are able to test themselves with the quiz and exercises given and also view the list of formulas and symbols with sample calculation as a practice. The features available in PolyMES designed to suit students’ different types of learning styles. As known every individual has their own learning styles of retaining new information and skills. Hereby, PolyMES design is developed to cater students using smartphones at various learning style and might be useful for further implementations of m-learning.

1. Introduction

Regarding to the readiness of Malaysia’s citizen about the implementation of ‘m-learning’ apps in Malaysia Higher Education, the statistics by Malaysian Communications and Multimedia Commission from 2009 to 2017 shown that the number of mobile phones used by the citizen are mostly at the age group of adults (20 to 49 years). In addition, mobile learning is known as independent where in terms of time and place [1]. It is suitable for learning practice since the use of mobile devices increased and inclined with the advancement of learning opportunities and learning resources.

There are many mobile applications in the current market. The factors involved using mobile technology among students will be the access, connectivity, integration, and ownership. As technological constraints apply to mobile platforms in the form of limited physical resources and rapidly changing specifications [2]. But implementing mobile computing in a collaborative learning environment in classroom allow instructors to develop pedagogical models that respond to real needs of learners and instructors [3]. Moreover, in every assessed mobile learning project trial, most learners are engaged with the learning they could undertake together [4]. It is either by sharing the wireless devices, or by passing data between them and consequently, learning should be built around this. Hence, it is
vital to develop a mobile application that is flexible and convenient to be used among the users. Nevertheless, there is also a great variety of devices where each having particular hardware characteristics, firmware and operating systems.

The use of well-designed mobile learning applications to support field based scientific inquiry can have a positive effect on student learning and engagement [5]. If an application does not meet the needs of the user, it can be an impediment to education and may prevent students from achieving specific learning outcomes [6]. This will lead to poor lesson delivery and boring. Furthermore, when a poorly designed mobile application, may place extraneous cognitive loads on students and preventing them from accomplishing their goals, improving their skills, or enjoying the learning experience [7]. Today, the mobile world is a growing and evolving market in every its facets. A proper design of learning framework in situated learning and mobile technologies can serve as a stimulus to bring the presences of ideas and information to the psychical world. Thus, enhancing learners' sense making and interaction with reality world. Besides, the availability of various media enables students to learn in different ways based on their preferred learning styles using their mobile device.

Mobile technology is very flexible as this device can incorporate with other learning devices and function in wireless local area network. The mobile technology is very useful in learning environment. It can also function on electronic whiteboard. Teachers and students benefit in all learning processes of communication, exchange of ideas and information, interactions, collaboration in team work too to solve problems [8]. On the contrary, there are research mentioned that implementing the learning method of m-learning enhances students' interest, encourages learners to focus in learning and boosts students’ performances. Thus, to develop a mobile application software for the students in mechanical engineering field it is very important to look into their learning styles. It is important and essential to understand the usage of mobile technology among students to facilitate in their learning attributes.

1.1. Mobile application
In the recent time, mobile phone such as smart phone, cell phone and personal digital assistant (PDAs) are built with functions that allow different application, which enable connectivity and some other internet applications [9]. The core challenge in mobile learning is the design of the information capturing procedure. Due to ineffective implementations of learning activities in the classroom students have shown negative attributes towards instructional technology [10]. Many applications are developed to enhance studying method among students and also teaching strategies for educators to make teaching process more interesting. Following Figure 1 is sample prototype of mobile application in Android and also iPhone.

![Figure 1](image1.png)

**Figure 1.** sample prototype of mobile application in Android and iPhone for mechanical engineers. (a) The Axon Calc app offers heat transfer calculators, (b) A part of Multi Educator’s iPhone Formulator Line that contains over 300 mechanical engineering formulas.

Indeed, the development of improved tools and technology has increased the demand for mobile devices for educational purposes [11]. Many applications are developed to enhance studying method among students and also teaching strategies for educators to make teaching process more interesting.
Hereby, certain areas need to be focused to develop a mobile application in education. It is posited that mobile devices are well suited to context-aware ubiquitous learning environment as they are available in different contexts and can draw on those contexts to enhance the learning activities.

1.2. Mobile development

There are steps taken in developing the mobile application [12]. Following are the six steps proposed where firstly it is to decide the scope of the mobile application. Next is the performance issues and challenges, thirdly is to design the right user interface, and then is to get the data model and communication model for the mobile application. Lastly is the packaging and deploying of the mobile application. ADDIE and ASSURE models are the two representative instructional system design (ISD) models which have been used and presented in the field of traditional education technology for decades.

Thus, ADDIE instructional model is used to develop the mobile application. ADDIE model involves analysis, design, development, implement, and evaluation phases [13]. The first phase is analysis; where the learning content of mechanical engineering subjects among polytechnic students is being surveyed. Proceeding with the next phase that is to design the mobile application in occurrence to the subject selected in mechanical engineering based on their learning styles. Then, the development phase of the mobile application is implemented. Figure 2 illustrates the framework for PolyMES stands for Polytechnic Mechanical Engineering Students. Once it has been developed, the mobile application is evaluated from the experts.

![Figure 2: PolyMES framework](image)

2. Methods

Quantitative method is used with the distribution of questionnaires. Before the mobile app is developed, the types of learning style and usage of mobile devices among the mechanical engineering students in the polytechnics is determined. The results stated that most of the students are using Android platform mobile devices and all four dimensions of Felder-Silverman learning styles model (FSLSM) are being used [14]. Descriptive design is used to analyse data obtained from the research participants. Then, the developed mobile app is validated upon experts’ feedback.

Construct validity involving face and content validities which is in translation validity [15] used to measure the instruments. As for reliability internal consistency is chosen where the value of Cronbach alpha was more than 0.7 that shows the reliability is sufficiently high and acceptable.

3. Results and Discussion

The software used to develop PolyMES is Android Studio version 3.0 as prior on the results obtained for smartphone device. This application has the essential notes, exercises, quiz, and list of formulas with symbols. It has the platform for students to comment on any doubts regarding the subject where they can discuss with each other to get a better understanding. Besides, there are quiz for students to test themselves regarding on what they have learnt and exercises in assisting to solve problems. These features of the application keep them active in learning and to be more fun. Everyone are able to study now at their own pace and convenience with PolyMES. The following Figures 3 display the interfaces of PolyMES.
Figures 3. Display the interfaces of PolyMES (a) Home page, (b) List of content interface, (c) Interface of note page, (d) Interface of video page, (e) Interface of quiz page, (f) Interface of exercise, (g) Interface of sample calculation, (h) Interface of symbol and formula, (i) Interface of symbol page.

PolyMES is developed to create student centred learning environment. It is a mobile application designed to cater mechanical engineering students’ studies based on their learning styles using FSLM involving all the four dimensions. Henceforth, m-learning can be enhanced among these students with PolyMES as an interactive tool for their study purpose.
Therefore, experts are chosen from different fields of expertise in education, information technology (IT), and mechanical engineering to evaluate the development of PolyMES. As known m-learning applications are designed according to the content delivery of a particular subject and to facilitate fun learning. Thus, seven experts from UPSI in the field of expertise under education and IT were selected. The same goes for premier polytechnics where seven experts were chosen from the expertise of mechanical engineering.

Almost all the experts strongly agree with the content design of PolyMES for the usage of polytechnic students. Even majority of the experts strongly agreed that PolyMES is suitable for polytechnic students where the language used is understandable and content divided straightforward. A collaborative learning environment having pedagogical model developed allows the real need for teaching and learning [3]. Hereby, as [1] the advancement of learning opportunities and resources with PolyMES is sure to enhance a truly independent learning among the students.

As an overall, the content delivery and design of PolyMES is accepted by experts with no disagreements. This is because all basic knowledge for the subject requirement included with brief explanation and related visual materials. It is an invention that suits all kind of learners using FSLSM upon the four dimensions. Most engineering students are active, sensing, visual and sequential learners [16]. Henceforth, PolyMES is an app that definite instils the interest among mechanical engineering students to study interactively at anywhere and anytime.

4. Conclusion
M-learning gives the students a head start in the IT revolution, equipping them with skills not only to do well in their studies but also to excel in their future careers. In Malaysia, the method of m-learning is not impossible to implement because most students nowadays have their own portable devices as known smart phone, laptop, tablet and so on. Moreover, the provisions of broadband facilities provided by the telecommunications companies have been widespread in Malaysia.

Furthermore, it is much easier to accommodate several mobile devices in a classroom than several desktop computers. Nevertheless, the possibility of providing individual with technology enhanced learning tools to assist them in their educational mission [17]. There are 430 broadband centres to be set up in rural areas and remote areas across the country within two years. These facilities were provided specifically for students and youths. Therefore, there will not be any problem to access the internet and is supported on m-learning.

Hereby, there are several suggestions have been made for other researchers to do further study. The future study should focus on the impact of m-learning towards students’ in their academic achievement. Future research can also look into the limitation of the conceptualization of m-learning in this study at other research settings. It may involve the participation of lecturers in the ability to teach and instruct students via mobile learning in the future research study.

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