Integrating Mobile Learning into the Foundation in Engineering Programme

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Abstract—The world of academia is fast revolving fostering a need for rapid use of innovative teaching pedagogies and teaching tools to enhance the effectiveness of teaching and learning activities within the classroom. Video recorded lectures that enable direct communication with learners have been recently exploited by the more technology savvy academics. Mobile learning has introduced learners to a new kind of learning enabling them to learn anytime and anywhere. The purpose of this paper is to study the effects that mobile learning had on the achievement and attitude of students within the Foundation in Engineering programme.

Keywords—mobile learning, foundation in engineering, e-learning, innovative teaching

I. INTRODUCTION

In this section the opportunities and limitations of mobile learning are discussed. The application of mobile technologies in teaching and learning is largely dependent on the learning styles of the millennial learners. Hence the notion of here and now learning is derived from the relationship between these learners and their mobile devices which subsequently causes a tension between teaching strategy, digital proficiency and technical possibilities. Using the here and now mobile learning framework, the effects of mobile learning on the learning environment is also explained.

II. MOBILE LEARNING

A. What is Mobile Learning?

In the recent decade, e-learning has been transforming education from the conventional book-based platform to a modernized digital-based platform. Among various new initiatives and tools that were introduced as part of the e-learning umbrella, there is this new learning model called mobile learning, which has slowly becoming one of the most popular models in the academia world. Mobile learning refers to the use of mobile devices such as mobile phones, tablet, personal computers, laptops and the cloud-based platform in teaching and learning [1]. Sophonhiranrak et al. [2] explained that mobile learning consists of four main components: input, connectivity, sensing and output. Each component supporting teaching and learning through touch, vision, hearing and communication with the aid of hardware (device), software (applications) and internet access (cloud-based platform like Google Drive, OneDrive and Dropbox).

Mobile learning is regarded as an extension of the e-learning because it is e-learning supported on mobile devices [3-4]. The characteristics of mobile devices, according to Viswanathan [5], are:

1. Wi-Fi or cellular access to the internet
2. A battery that powers the device for several hours
3. A physical or onscreen keyboard for entering information
4. Size and weight that allows it to be carried in one hand and manipulated with the other hand
5. Touch-screen interface in almost all cases
6. A virtual assistant, like Siri, Cortana, Google Assistant or an interactive ‘help’ search assistant
7. The ability to download data from the internet, including apps and books
8. Wireless operation

The proliferation of mobile technologies provides numerous opportunities for learning in both physical and virtual learning environments. Supporting both the content and process of learning, the use of mobile devices promotes greater accessibility and portability due to their smart capabilities, thus offering solutions to many educational problems. Owing to the advantages of mobile devices, educators and learners have applied them as flexible learning tools in both formal and informal learning environments.

The application of mobile learning is not without its limitations. Besides technical difficulties (issues concerning device and network), the common barriers of mobile learning include digital and information literacy, readiness level, cheating, cyberbullying and distraction [2]. It is crucial that these limitations are elucidated so that potential challenges in learning can be addressed and managed effectively. Despite these challenges, mobile learning is integrated in various education programmes and levels worldwide. The use of mobile technologies in teaching and learning is inevitable as the popularity and evolution of mobile devices are continuously advancing.
B. Millennials and their learning styles

Due to the dramatic increase in the ownership of smartphones, tablets and wearable technologies, mobile learning have changed the way people acquire, consume and personalise information. It provides an alternative environment to the traditional face-to-face or on-campus learning. As millennials constitute a large cohort in a population of those who own mobile devices, their learning needs are dictated by their distinctive learning style. As the “digital native” generation, millennials learn differently because of their lifelong relationship with technology [6]. Millennial learners are known to be heavily attached to their devices in contrast to Baby Boomers or even Gen X-ers. Both positive and concerning, millennials are uniquely characterised to be gadget-dependent, ambitious, confident and achievement-oriented who also craves attention while having short attention span [7].

Due to these characteristics, students are reported to have more abilities than their professors for accessing, manipulating and transforming data [4]. The relationship between educators, learners and technology is now the tension that exist between the strategy of the educator, the skills of the learners and the possibilities of mobile devices in supporting learning. Educators should employ technologies with continuous adaptation to allow learners to use their devices in ways in which they are accustomed to in order to promote greater engagement. However, the dilemma in practical reality is that learners, with their technological affinity, may not be meaningfully or thoroughly engaged in learning. This could lead to distracting activities like aimless searches and meaningless browsing which is both undesirable and unproductive.

In order to promote learning and motivation among the millennials, new dimensions of mobile learning have emerged within the current decade to include (1) microlearning and (2) here and now learning. Microlearning provides bite-sized, quick, and easily digestible bits of information best presented through short sessions [6]. The combination of mobile-based microlearning unites the features of mobile learning and microlearning to deliver small learning units and short-term learning activities [8]. The presentation of information in small chunks reduces cognitive load, eases the perceived burden of learning, and gives learners a sense of empowerment. Here and now learning, also researched as situated learning, is defined as learning that occurs when learners have access to information anytime and anywhere via mobile technologies to perform authentic activities in the context of their learning [9]. As learning is not independent of context, mobile technologies serve as enablers for students to learn in an environment that integrates learning resources from both the real world and the digital world.

C. The effect of mobile learning

Using the Here and now mobile learning framework by Martin & Ertzberger [10], there are three characteristics that can be used to explain the effect of mobile learning on the learning environment: (1) student engagement, (2) authentic learning activities, and (3) informal learning.

(1) Student engagement

Although there is a considerable variation in how student engagement is defined, the term is generally used to describe meaningful student involvement throughout the learning environment [9]. It is the relationship between the student and the following elements of the learning environment: the school community, the adults at school, the student’s peers, the instruction and the curriculum. As a multifaceted construct, student engagement includes these dimensions: (1) intellectual engagement, (2) behavioral engagement, and (3) emotional engagement.

Intellectual or cognitive engagement refers to the focus on students’ level of investment in learning. In the current culture of video games and interactive entertainment, students have come to expect a high level of engagement during their learning activities. Instructors are expected to design interactive lessons to gain students’ attention and maintain their interest throughout the lesson. Seemingly difficult as both attention and interest, albeit part of learning engagement, vary in intensity and duration. Promoting intellectual engagement can be done in many ways in mobile learning. Co-constructing content through collaborative platforms such as Google Docs and online forums encourage learners to participate and contribute towards creating the content instead of just being the recipient of knowledge. Differentiated tasks for learners of different abilities and interest by customising the process and outcomes is also a way to engage students cognitively. Use technologies that support the acquisition, application and integration of knowledge help students learn how to learn and assess themselves in the process. Robert Marzano also pointed out that corrective, timely feedback can be one of the best strategies an instructor can use [11] to engage students in the context.

Behavioral engagement focuses on encouraging participation in academic and social activities that aims to foster behaviors that are more conducive to learning. In mobile learning, integrating game mechanics through gamification is a good approach to amplify and transform the level of student behavioral engagement. The main principles of gamification are twofold: (1) it allows learners to compete with themselves and others; and (2) to know how close they are to accomplishing a certain set of goals and acquiring its accompanying rewards or reputation. Gaming elements such as stamps, badges, points and leaderboards can be used to recognise achievements especially with regards to fostering positive behaviours, attitudes and skills.

Emotional engagement, which is likely the most complicated and important form of engagement, focuses on the extent and nature of positive and negative reactions to teachers, classmates, academics, and school. It aims to promote positive emotions in students that will facilitate the learning process, minimize negative behaviors, or keep students from dropping out. In mobile learning, it is crucial that educators are able to monitor student moods and emotions as these are the preconditions to student readiness and engagement. The use of online portfolios, vlogs and private messaging applications that allow for mentoring, personal reflection and counselling is important to give students the opportunity to learn about themselves and to be emotionally supported.

Contrasting results from various literatures show both positive and negative effects of mobile learning on student engagement. Huizenga, Admiraal, Akkerman & Dam...
environments, mobile learning gives students the opportunity to learn in various contexts. Applied in classroom, fieldwork or virtual learning environments, mobile learning allows consistent involvement with other professionals, regardless of their geographical, cultural, or socio-political isolation. This involvement increases engagement, and leads into authentic activities by participants.

(2) Authentic learning activities
Authentic learning is learning designed to connect what students are taught in school to real-world issues, problems, and applications. These learning experiences are designed to mirror the complexities and ambiguities of real life [14]. It prioritises on experience that encourages students to make meaning from their learning. The integration of content and process give opportunities for students to be practitioners by engaging in their contexts meaningfully and purposefully.

A mobile learning environment supports this need by virtue of its portability and accessibility. This learning-on-the-go approach means students can be engaged in any tasks whenever they need to or wherever the learning is situated. Likewise, educators are able to develop lessons, observe, provide support, assess and reflect in various learning contexts. Applied in classroom, fieldwork or virtual learning environments, mobile learning gives students the opportunity to learn through doing, to adapt and change, and to form the habits required to do this successfully in their lives beyond school [14]. When learners use their mobile devices to their fullest potential it gives them the freedom and ability to self-regulate and learn even without being constantly directed. This forms the basis of informal learning.

(3) Informal learning
Based on the definition from McGivney [15], informal learning is learning that takes place outside a dedicated learning environment and which arises from the activities and interests of individuals and groups. This form of learning is based on the idea that people may each learn different lessons from similar experiences, because they see the experiences differently. What is learned are skills, knowledge and understanding generated and then acquired by people making sense from experiences. Martin & Ertzberger [10] defines informal learning as learning that takes place naturally and without directed effort. It corresponds to Smith’s [16] idea that this learning occurs even without one knowing that they are learning.

Informal learning is one of the effects of the mobile learning approach. Besides intended learning outcomes, informal learning encompasses the skills and knowledge that are acquired which may not be assessed or intended in the tasks. After all, most learning is personal, experiential and contextual in nature. For example, a student may learn by observing an experienced colleague or pick up a skill or habit while being engaged in an assignment. The outcomes of informal learning are particularly useful in practice and in workplaces as these are the knowledge and skills which are adaptable and authentic in solving real-world challenges.

III. METHODOLOGY
This section will explain how mobile learning is implemented in the Foundation in Engineering programme at Taylor’s University, Malaysia. The main objective of this project is to improve teaching and learning in the institution through innovation and technological advancement. Foundation year is chosen as the pilot group in this project due to the readiness and inclination towards technology in the millenials.

As pointed by Sophonhiranrak et al. [2], mobile learning in the programme is also designed to cater the four components - touch, vision, hearing and communication. i-Book is adopted to replace the conventional and bulky textbook, mobile apps for the module online platform is introduced, lecture capture facility is equipped, social media platform to enhance communication between lecturer-to-student and student-to-student.

A. I-Book to replace textbook
One of the key components in mobile learning in this project is the introduction of i-Book and replacing the use of physical textbook. Figure 2.1a and Figure 2.1b showing the screenshot of an i-Book for Physics where notes are now not just texts but it is embedded with interactive quiz and video. Besides that, once downloaded, student can access the entire content of the i-Book anytime anywhere, even when internet is not available. Different than e-book, where some content like video requires internet access, i-Book is good in both online and offline situation.

![Figure 2.1a Interactive quiz embedded in i-Book](image-url)
B. Social media platform for mobile learning

Social media in this context means the use of Facebook Group Page for the class. Facebook Group Page has been set up for the class and both teachers and student are invited to join the page. Changes or updates on lecture notes, related video, related news and posts were shared on the group page and students are encouraged to discuss about it, with or without teacher’s facilitation. Figure 2.2 showing a screenshot of the group page.

The group page is also acting as the platform for student to post questions and feedback to lecturers. While the lecturer attending to the questions, student having the same or related question also benefits from it. Besides, discussion taken place may leads to more breakthrough or insight in the matter being discussed.

D. ReWIND lectures online through lecture capture facilities

Taylor’s University is the only university in Malaysia that has implemented a campus-wide lecture capturing system that allow lectures and class activities to be recorded automatically. These scheduled recordings are made available to students through the TIMeS module site. This feature provides a unique solution to address the short attention span of a millennial student. Being able to rewind lecture videos allow students to review lessons at their preferred time and pace. Capturing the audio, video and the content, the learners will be able to get a full experience of the in-class activities and discussions. The system allows the viewer to rewind, fast forward, pause or skip to the particular segments that they desire. As an added bonus, these videos are also downloadable in both video and audio formats for future reference or to avoid network congestion during peak hours. Besides allowing lecture review, ReWIND lecture capture system is also a tool to promote student reflection. For instance, when presenting a project in the class, the students can assess their presentation and reflect on their own performance.

E. Measuring the impact of mobile teaching and learning

The Teaching Engagement Scale (TES) is a system created to assist a lecturer’s teaching development by collecting feedback from 4 key stakeholders: students, peer, self and superior. The TES system then generates several reports, including the TES Scorecard, using these four viewpoints, meaning that a lecturer’s teaching will be considered from more than one viewpoint. In this system, both quantitative (score) and qualitative (student comments and feedback) means are used to assess teaching engagement.

In assessing the implementation of mobile learning in the FIE programme, the TES allows for quick and anonymous feedback on a module to measure the effect on students’ learning. Students will have the opportunity to provide feedback on their modules and their lecturers. This will empower the learners to have a say on how their curriculum is developed and implemented as well as how they are affected by it. This is important as good learning is determined by students’ success in which student feedback is a key to gain perspective into how a module or a learning approach is received. Also, it helps to close the loop of mobile learning as the lecturers will then get to review the application of the implementation of mobile learning in their courses. There are two parts that constitute this module-based online survey on TES that students will respond to: TES Question Statements and Module Question Statements (see Figure
2.5a). In addition, Qualitative comments by students (Figure 2.5b) provide a more descriptive form of feedback on the implementation of mobile learning.

![Figure 2.5a Student survey questions on TES](image1)

![Figure 2.5b Comments by students on TES](image2)

Apart from obtaining students’ input, it is also important to acquire feedback from a fellow lecturer, from the perspective of another educator. The process of providing peer feedback is done via an academic visitation by an assigned peer. This visitation, done every semester, provides an opportunity for a lecturer to observe how another lecturer conducts a lesson within the context of mobile learning in the FIE programme. It serves as a way to evaluate others and self in relation to the teaching and learning approach that is used in the programme. Two methods are employed as insight to an educator’s teaching performance. An academic visitation report is prepared to record observations done during class visitation, and TES score will be entered based on common practices in consultation with the lecturer being assessed. In the TES, seven dimensions based on the Taylor’s Teaching Excellence Framework are used to evaluate teaching performance (see Figure 2.5c). In this context, the score translates to the efficacy of mobile learning in a particular course. As a result of this evaluation, areas of strength and improvement will be identified so that an action plan can be worked out.

![Figure 2.5c TES dimensions and training identified](image3)

IV. RESULTS AND DISCUSSION

In this section, the authors will discuss the impact of adopting mobile learning on the teaching experience, benefits to the student, feedback from the students and the possible improvement and changes that might be able to improve the model holistically.

Feedback from students have indicated positive results in the implementation of mobile learning across the programme. Students have reported that they like the learning environment and the support that they receive from the lecturers. For example, student A wrote that, “This module was excellent as the learning environment provided ensured students to be able to confidently ask questions without feeling (for the lack of better phrasing) stupid”. Student B mentioned that the module was “planned and executed well”. Likewise, student C claimed that she enjoyed her classes by stating that, “...always a fun and interactive class”.

In terms of learning engagement and fun factor, students have commented that they enjoyed the learning experience that is both interactive and meaningful. Student D said that her lecturer “gives very good constructive comments during our assignments and makes sure there are interactive activities throughout the lesson. I felt all the assignments were beneficial and made me think carefully about how it will contribute to my future”. In addition, student E, commented that “I really love the game, discussion and presentation based teaching and learning, very fun and engaging”.

Feedback regarding authentic learning experience are also favourable. Student F’s comment on her lecturer is that “a very good lecturer, gives us a lot of knowledge and real life examples on how we can incorporate technology to make teaching and learning better”. This opinion is supported by student G’s claim that “I have more thinking in-depth experiences through sem 3. For instance, I like how the tests were set based on case studies, rather than normal qa type of assessment which link towards critical thinking and self-evaluation. Tq”.

A simple survey on students’ mobile learning experience have also been conducted. The average score of 8.5 out of 10 in a sample of 32 students indicated that students were generally pleased with the mobile learning experience in their modules.
CONCLUSION
This paper presents various ways in which mobile learning is integrated in the Foundation in Engineering Programme. In general, the use of mobile technologies in the courses within this programme is well-received. This supported by the feedback from the students as well as the lecturers in the programme. Claims that mobile learning approach improves student engagement and performance while providing a fun and adaptive learning environment have paved the way to more possibilities of how this can be implemented at a more advanced level. Perhaps students should take on a major role in contributing towards the design of their learning in terms of creating content, apps or games that support their distinctive style of learning as well as to cater to the needs of each course or project. On a wider scale, mobile learning can be integrated in other courses where young learners are involved as an approach to foster greater engagement and productivity among these digital natives.

REFERENCES