A Mobile Learning Model for Universities

Re-Blending the Current Learning Environment

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Abstract—**The use of mobile technologies in education impacts learner motivation, collaboration, information sharing, mobility and interactivity which provide opportunities for learners, teachers and the university. This paper investigates the use of mobile learning technologies in higher education, and proposes a blended mobile learning model, which has the ability to serve the emerging learning process and delivery, and provide a well balanced learning environment that meets the current learners' needs.**

Index Terms—**mobile learning, blended learning, higher education, learning model**

I. INTRODUCTION

The challenge to experiment with new technological innovations for learning is a constant factor for Higher education institutions. At present universities are finding the application of mobile learning to be boundless, and that mobile devices are now becoming common amongst students. In this paper we propose a model based upon the integration of blended learning and mobile learning into the higher education environment. Blended learning has proved to be an effective model in higher education, as it can merge with new innovative technologies [1]. It is our intention to revise the current blended learning model (presented in Figure 4) to include a mobile learning extension that will cater to today's learner and the learning environment of the future. We see this model as a means of providing the framework that will create a solid foundation for the integration of mobile learning and mobile technologies into the higher education sector.

We believe that by blending mobile technologies into the mix, improvements will be evident in learning accessibility, collaboration and flexibility. Further research will be aimed at support the previous statement.

The proposed theoretical blended mobile learning model for use at the higher education level, emphasizes the importance of taking a systems view of all the elements that need to be in place in a mobile learning environment, such as: the communication infrastructure, mobile devices, learners and teachers. Each of these elements is essential to ensure the effective adoption of mobile technologies in higher education.

Therefore we see that by designing a blended mobile learning model, it will not only provide benefits for the university education practices, but also towards setting guidelines for proper integration of mobile learning. This in-turn can create a flexible, blended, and collaborative learning environment within the university setting.

II. MOBILE LEARNING AND ITS APPLICATION

A. Defining "Mobile"

Being mobile is being detachable, unfixed or not limited to a location, constantly transferable and freely movable from one place to another. Humans by their very nature are mobile. In today's society humans carry hi-tech devices with them so that others can reach them and they can reach others remotely. The hi-tech devices they carry around with them are not attached to any wires; therefore it is wireless, portable, transferable, thus making it a mobile device. Therefore, by mobile we mean the unattached mobility that allows the student to access the material from a non-fixed location.

Mobile devices are now starting to be used for learning, and have been integrated into the educational process. It is believed that mobile devices play an important role in creating more collaborative environment for learning than web-based learning, because the mobility, flexibility and portability of these hi-tech devices, will allow their user to learn on–the-go. Therefore it could be seen as a way to reduced feelings of isolation, by making users more mobile, and enabling them to connect and communicate, share and collaborate, and finally reflect and learn while going about their daily activities, instead of being fixed to one location, e.g. in-front of a computer screen.

B. What is Mobile Learning?

Mobile learning can be defined in many ways. It is learning which takes place via wireless devices like mobile phones, PDAs, ipod, palmtop, laptop or even digital cameras and USB keys [2].

Mobile learning technology is portable as the name suggests and it is wireless. The learning tool is able to be moved with the learner. Learning while being mobile, and through the use of a mobile device, is considered to be independent from time and location, as it could occur at anytime and in any place. It also provides access-on-demand learning content for learners.

Mobile learning can be viewed as the focal point, where mobile technologies and web-based learning intersect to offer anywhere anytime instant on-demand educational information.

Mobile learning is generally defined as a means of e-learning which occur through a mobile device [3]. Generally learners have to find a personal computer with internet access to learn in an e-learning environment. Meisenberger and Nischelwitzer [4] states however that this can not be considered as fully anytime anywhere learning, as the learner is fixed to their location.
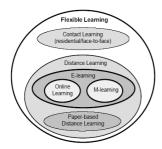
Figure 1.   The subset of flexible learning [5].

According to Brown [5] "Mobile technologies have the power to make learning even more widely available and accessible than we are used to in existing web-based learning environments". Brown [5] proposed Figure 1 as a diagram of flexible learning.

This diagram shows that e-learning is a subset of distance learning, online learning and mobile learning (M-learning) is a subset of e-learning. In past terms this assumption perhaps is generally true of many learning environments. However it is now believed that mobile learning provides location awareness applications to learners, and that learning content can be accessed from anywhere and at anytime, thus making mobile learning flexible and portable [3].

It is our intention through the research that will be conducted as part of this on going study to identify whether mobile learning has application not just at the e-learning level but at the face-to-face classroom level as well.

It will be through the model presented in this paper and the future research that will be conducted, to acknowledge whether mobile learning holds application in a blended learning environment.

C.   Mobile Devices Usability

According to the Australian mobile telecommunication association report for 2007 [6], more than 88% of individuals own at least one mobile phone, and mobile phone use peaks in the age range from 18 to 39 years, where 94% of this age group regularly use a mobile phone. The majority of university students fall in this age group [7],[25], thus making the mobile phone the most commonly used device amongst university students. Therefore universities should take the challenge to use these mobile devices, in particular the mobile phone, to provide and offer learning services.

New technologies are constantly being developed and produced; Figure 2 is an illustration of different mobile devices which could be used for learning today. The figure includes items such as: mobile phones, iPods, GPS, MP3 etc.

With the rapid advancement of new technologies, you generally will only need one mobile device which will be capable to integrate many features to support learning. Therefore the learner does not have to own multiple devices but rather one mobile device which will be able to meet their needs. For example a standard mobile phone in today's market is equipped with many functionalities, which if used effectively, can make learning an easy process.

Figure 2.   Types and functionality of mobile devices [24]

Most of the hi-tech mobile phones, currently available, like the 3G iphone, the Google G-1 phone, or any smart phone, contain the functionalities to help the users perform many tasks, and allow them access to information as required, anytime and from anywhere. This access of information is normally achieved in an interactive way, where the mobile phone user feels in control of handling the accessibility, management and sharing of resources.

Today mobile devices have some unique features which make them an efficient device capable of providing, sharing and exchanging of learning content. Some of these features are summarised by Jo et, al. [8] and are presented as follows:

- **Portability and mobility**: because of the small size and lightweight of mobile devices, students find them convenient to use and carry with them.
- **Flexibility**: students and teachers can access the server from almost anywhere.
- **Convenience**: Whenever students need to contact teachers or urgently need information from the Internet, remote access is available to them. In particular, accessing the server through WAP (Wireless Application Protocol).
- **Remote Accessibility**: Students can add or update information remotely.
- **Ease of use**: Using an iPhone provides a larger screen than an ordinary mobile phone and it is convenient for learner's input.
- **Utility**: most of the smart phones provide almost all of the capabilities of a standard computer, such as processing and storing data [8].

Previous studies done by Meisenberger and Nischelwistzer[4], showed that mobile devices have some restrictions to be used for learning. They summarized these restrictions as follow:

- Limited processing power and resources
- Variety of screen sizes and the general low resolution of the display
- Variety of different input possibilities
- Variety of different operating systems [4].

Mobile technology has come a long way in the past four years, especially in its application for learning. Mobile devices are now capable of processing information as much the same way as a desktop computer. For example, many iPods and other similar Mp4 players are today more than just a music player. These devices now contain the functionalities that can be used for delivering teaching and learning.

These functionalities may include the followings:

- Text documents
- Audio recording
- Video playback
- Podcasting
- Notes taking
- Internet access
- Photo capturing
- Calendar
- Interactive content
- RSS feeds

Most of the above mentioned features can be used by learners to aid their learning process. It is worth noting that mobile devices currently owned by learners do vary in their capabilities and performance. Also the accessibility to information via the World Wide Web (www) is normally set by the network carrier; and is often dependant on the plan or deal that the user and services provider have agreed on. Also the cost of internet acces via a standard desktop computer and a mobile device differ dramatically in favor of the desktop computer. These factors may limit the use of mobile device for learning and for accessing the internet for any given learner. So consideration should be made in the content design stage for information that will be delivered in this mode.

Therefore selecting the appropriate mobile devices for educational purposes will determine the way students can access learning resources and material, and certain factors must be considered when using mobile devices for learning. According to Singh [9] these factors can be summarized to cover the followings:

- Cost
- Security
- Battery life
- Display size
- Data input
- Form factor
- Storage capacity
- Processing power
- Communications options
- Application development tools

Universities are yet to have a standardized device to be used by all students, until recently a research project was carried out at Abilene Christian University (ACU) in the United States to integrate mobile phone technologies for learning. After a thorough investigation which included students and teachers surveys, mobile technology and devices, they finally were able to integrate the 3G iphone to promote mobile learning at the university, and this practice has been on offer since the beginning of 2008 [10] .

III. BENEFITS OF MOBILE DEVICES

A recent study done by Ooms, Linsey, Webb and Panayiotidis [11], suggested that the use of mobile devices for learning in a classroom setting is effective, as it can promote greater interaction, enhance feedback for both students and teachers, thus allowing teachers to adapt their teaching based on this feedback. Their findings show that

mobile devices if used for teaching and learning purpose can act as catalysts for change in learning and teaching approaches, and it can provide benefit for both teachers and students, they summarised their findings in Figure 3.

We believe that mobile learning technology act as the thread which links web-based learning and mobile learning together. Also the current practice of pod-casting lectures and other subject related materials is rapidly growing as a popular way of delivery lectures and learning content in higher education. The attraction for teachers and students is evident as the content normally an audio or video digital recording is placed online, and can be downloaded from the website to students iPods, mobile phone, MP3 player, PDA or any other portable device which supports the content format. Deakin University in Australia is just one example in which learning materials can be downloaded via iLecture to home computers or any portable device.

Currently, major universities around the world are working on research projects to discover how iLecture and similar web-based technologies can be further developed to best support learning and teaching wirelessly [12]. A project into the mobile innovations used in four Australian TAFE colleges was conducted in 2005. The project presented the mobile devices that were integrated to deliver learning material to learners and to deliver creative learning initiatives [13]. The findings of the project were positive, and evidence show that the methods used have been ongoing for a period of time.

According to Becta [14], mobile devices are useful where learners need to record information during a lesson, input data, extended writing, share information, and work on individual pieces of assessment. Hence if we take these factors into account then integrating mobile technologies into existing curriculum and university network environments, should be feasible in the foreseeable future.

An important pedagogical aspect concerning mobile technologies is that they extend the learning environment beyond the university setting [15]. As they provide learning content with a portable, flexible, independent learner-controlled environment, that provides the learner with an efficient method of communication both between themselves, the teachers and their devices.

The application of mobile learning technology within a university setting is still in its infancy, and the development of new models, methods, and systems are needed to be put in place for a successful integration. We believe a re-blending of the current learning environment at universities is required to ensure a successful mobile learning environment.
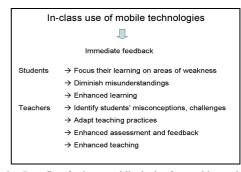
Figure 3. Benefits of using a mobile device for teaching and learning [11]

IV. RE-BLENDING TO INCLUDE MOBILE LEARNING

Mobile learning has the potential to shift the higher education landscape, by enabling flexible collaborative learning, and by providing access to different learning resources from anywhere and at anytime. Many studies have focused on learning in general, but collaboration and transfer of knowledge via mobile devices should also be analyzed. It is important to ensure that mobile learning technologies work effectively in terms of transferring knowledge and learning material to the learners. This is especially true if mobile learning is to integrate within existing forms of learning models. Rapid development of mobile technology exposes some opportunities for integration at a higher education level. Most students use mobile phones as part of their daily life, and this use is changing situations and environments within the university. Hence, universities must look towards the integration of these technologies and therefore experiment with the design of mobile learning models to examine the advantages and disadvantages of mobile devices in higher education. There is a need to determine how students think about using mobile technology as a means for learning. Stead [16] stated that mobile learning is starting to invade the education system in our major universities, because most of today's learners are already using their mobile devices to capture images of the whiteboard, download audio lectures, or share useful web links or resources among each other.

Therefore the concern is no longer whether mobile learning works affectively but rather how best universities integrate it into their current blend of learning methods, whilst still provided quality of service and content to their students.

While there appears to be many research studies focused on the potential of mobile technologies, research on affective collaboration, and blending methods on how universities can use and adapt to mobile technologies is sparse. Before universities embrace mobile learning technologies, research needs to be conducted in this area. The penetration of mobile technologies into universities cannot be ignored, as it forms part of the e-learning blend, and their importance will continue to grow over the coming years.

We have already seen how blended collaborative learning showed effectiveness in learning outcome at universities [17], but how could this be applied when learning is being acquired via a mobile device? How could universities integrate and blend mobile technologies within their current system to provide student with an effective mobile collaborative learning environment?

Therefore redesigning the existing model is required to make place for mobile learning.

The new model draws on certain aspects mentioned within the current literature, in order to provide a strategy for the effective adoption of mobile technologies in education. Our proposed model takes all factors influencing the successful adoption of mobile learning, which are also applicable in universities. The model requires necessary policies and standards to be in place; these are beyond the scope of this paper.

According to Naismith et, al. [2], there is no concrete theory of mobile learning. However, there is a direction towards integrating the use of mobile learning technologies with existing methods of learning but with different approaches, thus making the blended learning approach an effective opportunity to integrate the innovative mobile learning technologies.

Naismith et, al. [2] emphasize that blended approach facilitates learning with mobile technologies, as the approach engages different activities from a number of different theories and practices. Blended learning via a mobile device brings multimedia effects like pictures, animations, video clips, simulations and instant real live images. These multimedia effects are capable of enhancing the learning process, and making learning a pleasant experience for students.

This is also was apparent in a similar study by Issack et, al. [18], the authors stated that even though mobile learning can't be used for delivering large amount of reading material, it is very effective in supporting small, concise and informative content. He also considered mobile learning technologies as a value added feature, which can form an effective blend of the pedagogical approach within the learning environment.

Few researchers have implemented models in which mobile learning technologies can be integrated effectively. Barker, Krull, Mallinson, [19] proposed a model which illustrated that mobile devices can fit seamlessly within existing setting by providing support for learners via web-based assessment, delivering content, and access to the internet via mobile devices. This model focused on a mobile learning environment, which can be adapted to encourage and improve traditional learning environments. This environment was supported by effective mobile learning policies and instructions. The communications infrastructure presented within the model contained a mobile access point, which in term can enable communication among the mobile devices. This model focused in general on the info-structure, polices and guidelines of the learning environment. It used mobile devices as an external support for traditional learning and not as a blended model by itself, which has the strength to offer learning content in a collaborative, blended and flexible learning environment.

V. THE PROPOSED MOBILE LEARNING MODULE

Before the proposed model is presented for implementation, we shall first review the blended learning model to which our extension of mobile learning will be added.

Blended learning is defined as the combination of characteristics from both traditional learning and e-learning environments [20] [21], [22]. It is seen as merging aspects of e-learning such as: web-based instruction, streaming video, audio, synchronous and asynchronous communication, etc; with traditional face-to-face learning. Blended learning provides educators with the opportunity to combine learning resources and technology from face-to-face and online environment to create flexible learning options for students.

Blended learning can be seen as a mix of the e-learning elements and technologies with traditional forms of classroom training and one-to-one instruction. It is through this mix which we hope to include aspects and technologies of mobile learning. The potential of blended learning is almost limitless and represents a natural evolution from the traditional forms of learning, to a more personalized and focused development path. We aim to demonstrate that the

next natural progression is to incorporate the mobile technologies into the current blended learning environments.

The original blended learning model, as extracted from Lanham [1], and presented in Figure 4, incorporates various aspects and methods from the two prominent learning methods of the time, face-to-face and online learning, to create a blended environment in which to conduct learning.

The blended learning model focused on providing the platform to allow the creation of a more flexible learning environment. We hope to take this model one step further with the inclusion of mobile learning technology.

A. The Blended Learning Model

The main function of blended learning is to use the strengths of one learning environment to improve the weaknesses of another learning environment, therefore creating a stronger basis for students. So blended learning is a means of bridging the gaps of traditional classroom learning and contemporary online learning, as shown in Figure 4.

The bridging role that blended learning plays is evident by its physical position within the model (as shown in Figure 4). The blended learning element of the model provides the environment in which to combine the advantages of one learning environment with the limitations of the other. The outcome of this blending is aimed at achieving a more well round environment to enrich learning.

B. The Blended Mobile Learning Model

It is proposed that we will take the existing blended learning model and adapt it to include the new frontier of mobile learning. Previous researches have shown that mobile learning is more effective when it is used as part of an existing blend [23].

It is evident in Figure 5 that mobile learning can be blended in, as an additional method, which combines web-based and traditional learning environment, to form an effective, flexible, collaborative and efficient learning atmosphere. This is also true if we had to consider the flexible learning model presented by Browns [5], and was discussed in the literature.

Therefore mobile learning if designed to form a part of a blend, can offer benefits to classroom learners, online learners and distance learners. Online learners can download resources directly from the university server via a web-based instruction portal, or capture images and learning events into their mobile devices. Distance learner can also benefit, as they can text and interact with each other or the teachers, and access resources and course content remotely using their mobile phones. While on the other hand classroom or traditional learners can share learning content and resources via Bluetooth, and capture images, text, or even record presentations during their class time.

The proposed model is capable of providing learners with anywhere, anytime, and in real-time learning. The model makes students able to customize their ways of receiving their learning material, based on when and where they are. Students can ask questions and make suggestions, download material, reuse these material and share and collaborate with other students and with the teacher in real time. Figure 5 above illustrates the blended mobile learning model.
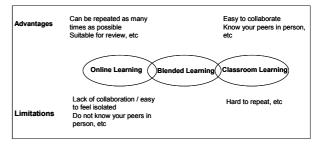

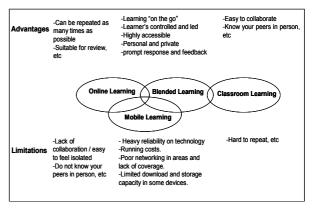Figure 4. The Blended Learning Model [1]

Figure 5. The Blended Mobile Learning Model

We have also considered three important aspects to differentiate our model: technology, university and students.

1. Technological aspects which include the followings:
   - Wireless mobile protocol
   - Learning content and resource delivery
   - Multimedia, audio/video
   - Compression and delivery methods

2. Aspects related to university
   - Learning content
   - Student data
   - Policy
   - Copy rights issues
   - Teachers and administrative

3. Aspects related to student
   - Student data
   - Learning acquisition
   - Personal information
   - Collaboration and sharing

It is proposed in the blended mobile learning model Figure 5, that the addition of mobile learning to the original blended learning model will enable us to incorporate the current trend of mobile technology into the innovative learning environments faced by Universities. We also took into consideration the advantages and limitations of each method as listed within the blended mobile learning model in Figure 5. These advantages and limitations will be carefully examined and considered during the implementation and testing stages.

It is through the integration of mobile technologies that we shall test our models effectiveness and efficiency. Results of these studies will be available in later publications.

VI. Conclusion

Learning is a continuous process, not just a one off knowledge acquisition experience. Therefore with the integration of blending mobile learning into the learning environment, we are extending the learners reach to the learning materials, and improving their accessibility to course content.

A blended mobile learning environment will provide a more natural and flexible way to learn. It will use the major components of each of the learning environments involved to create a comprehensive coverage of all learning methods.

In this paper we have proposed a model which takes into consideration all aspects of learning via technology, and how best to successfully integrate mobile devices into the university sector. It is through further discovery and research that we hope to produce a blended mobile learning model architecture which will provide a layered prototype for implementation into Universities, covering all major level of infrastructure. Further research within this study will also look towards the impact of the inclusion of these mobiles devices into the classroom for education purposes.

We believe that our proposed blended mobile learning model is capable of merging within the online learning and the traditional learning environment without any major changes, thus forming an important part within the overall flexible learning environment.

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