INTEGRATE WECHAT WITH MOODLE TO PROVIDE A MOBILE LEARNING ENVIRONMENT FOR STUDENTS

Jiao Jianli*
*Future Education Research Center, South China Normal University **
*Tianhe District, Guangzhou, China, 510631 **

Li Zhigao*
Department of Foreign Langauge, Zhaoqing Medical College
Zhaoqing, Guangdong, China,526020

Fan Yibo*
*Future Education Research Center, South China Normal University **
*Tianhe District, Guangzhou, China, 510631**

ABSTRACT

In the information age, learning has become ubiquitous, and mobile learning enabled by mobile technologies is expected to play a significant role in various educational settings. Currently, there exist some limitations on mobile learning from the perspective of technology. The implementation of mobile learning usually depends on the development of applications. In this paper, a whole different and flexible model is proposed, in which the development of applications is replaced by the direct utilization of WeChat. That is, we use WeChat instead of developing a new application to integrate with Moodle to provide students a mobile learning environment. After three years in practice, students become more inclined to log into Moodle directly via WeChat with the evolution of the mobile learning environment. And over a half of surveyed students think the mobile learning environment useful.

KEYWORDS

Learning Environment, Moodle, WeChat, Mobile Learning

1. INTRODUCTION

Nowadays, learning has become ubiquitous, since people are surrounded by mobile technologies in their daily lives(Shin & Kang 2015). The affordances of mobile technologies make timely and active knowledge acquisition through the exchange of learning materials a reality(Woodill 2010; Jones et al. 2013). Therefore, mobile learning enabled by mobile technology is expected to play a significant role in various learning settings(Cheon et al. 2012). However, the availability of mobile technology does not necessarily guarantee that it will be used in an educational setting(Hwang & Chang 2011; Shin & Kang 2015). Similarly, the mere adoption of mobile technology does not ensure students' learning effectiveness(Shin & Kang 2015). Some researchers now begin to place great focus on the integration of mobile technology with Learning Management Systems, namely, the Mobile LMSs, in order to provide a flexible and convenient mobile learning environment for students. More specifically, researchers focus on the use of mobile applications with such systems.

However, in a literature review on mobile learning with learning content management system (Napoleon & Åke 2014), Napoleon and Åke conclude that most of issues addressed focus on learning management systems in general rather than mobile learning management systems or mobile learning content management systems in particular. Though the literature number on mobile LMSs is limited, yet there are some research addressing this issue.

For instance, Huang, Lam, Wong and Chan(2016) developed a mobile version of Learning Management System in order to enhance students' learning experience. They used a Client-Server model, which, in fact, is a very complicated process for many teachers and students. They found that the students' usage of the mobile

app is high. By examining students' usage pattern of the mobile app, the suggestions for developers to design and develop mobile app of LMS was proposed.

Admittedly, use of mobile technologies is already widespread in many daily activities of a majority of the world's population, but not yet so in learning process(Napoleon & Åke 2014), partly due to the limitations of mobile devices in terms of application development. Overall, studies on mobile LMSs are mainly about technology(Napoleon & Åke 2014). In educational settings the integration of mobile devices with LMSs to create mobile LMSs is implemented by developing applications, while the development and update of applications takes too much time and efforts to achieve. What is more, the use expense for students is tremendously high, because they have to first download the application, then install it, and finally register an account before they can use. And developers have to update the application at times to fix bugs and improve student experience, which takes much time and is a rather complicated process. And developers have to develop applications for different OS such as Android, iOS etc., Technology itself should not be a barrier, it should be a ladder or a bridge. However, apparently, the mobile LMS in educational settings still faces technological obstacles, which raises questions about whether there is a better way to achieve mobile LMS?

In this paper, a totally different model integrating mobile technology with learning management system is introduced. Instead of developing a new desktop version of Moodle, WeChat is utilized and integrate with Moodle to provide students a mobile learning environment, namely mobile LMS. WeChat (WeiXin in Chinese) a mobile instant text and voice messaging communication service, a very popular social networking service in China was developed by Tencent Holdings Ltd. in China on January 21, 2011. It has similar features to WhatsApp to generate both text and voice messages. And it is free to download, install and use(Lien & Cao 2014). It is available on Android, iPhone, Blackberry, Windows Phone and Symbian phones. As of May 2016, WeChat has over a billion created accounts, 700 million active students, with more than 70 million outside of China (as of December 2015) (https://en.wikipedia.org/wiki/WeChat). Almost every college student has WeChat installed in their phone, it is used in different ways ranging from socializing with friends and entertaining to exchanging information and experiences regarding a product or service(Lien & Cao 2014). It has become one of the most widely used social networking service in China(Gao & Zhang 2013).

This papers aims to provide a new way to create mobile learning environment. By integrating WeChat with Moodle, students are able to easily log into Moodle directly via WeChat. And they have the same learning interface and learning experience as on desktop computer because Moodle employs a responsive design structure and supports HTML5. WeChat has its natural advantages in terms of popularity compared with previous model of developing specific application. Therefore, students are more inclined to learn via WeChat because they do not have to download a specific application and what they need to do is just to scan a QR code and subscribe to the learning website (based on Moodle). Apart from the design of the mobile LMS, we also explore students' usage of the mobile learning environment and their perceived usefulness of the learning environment. Therefore, three research questions are asked in this paper:

1. What is the basic structure of the new mobile learning environment?
2. What is the students' usage of the mobile learning environment?
3. To what extent, if at all, do the students think the mobile learning environment useful?

The rest of the paper is organized as follows: Section 2 describes the detailed design process of the mobile learning environment. Section 3 presents students' usage of the mobile learning environment and their perceived usefulness of the learning environment.

2. DESIGN OF THE MOBILE LEARNING ENVIRONMENT

In this section, we describe very comprehensively the design and evolution of the mobile learning environment. To make Moodle be accessed on mobile devices, the following two steps are needed.

1. Introduce responsive theme so that the appearance of Moodle can be adaptive to mobile devices with different OS. There are a lot of responsive Moodle themes in Moodle Community, what we used is a theme titled "Pioneer". One of the features of the theme is that it supports customized banner for every different course so that each course can have a featured banner on top of the course homepage.
2. Besides the appearance, the content of a course needs to be responsive as well. Table 1 is the guidance for teachers to upload different types of resources.

Resource Type	Requirement
Video	MP4, H.264, AVC, 720p

Audio	MP3, 128k, Stereo
Webpage	HTML5
Courseware Package	HTML5

Table 1. Guidance for teachers to upload different types of resources

Before we go into the design and evolution of mobile learning environment we create, a brief introduction to Official Account provided by WeChat is need, the Official Account is one of the unique characteristics of WeChat compared with its counterpart such as WhatsApp, this specific feature allows developers to commit secondary development. And this is the basis of the mobile learning environment presented in this paper.

Official Account works as one of the contacts on WeChat. The basic idea of it is to send group messages to all the subscribers (followers), not only in text, but also in/with video, audio, photos, and URL. Subscribers can read the message and reply if necessary. Official account can also set up auto reply to some keywords. Official Account is categorized into Subscription Account and Service Account.

Subscription Account provides a new information propagation means for media and individuals to build up better communication and management with readers. Service Account provides more powerful business service and student management capabilities for enterprises and organizations, to help enterprises quickly implement a brand-new official account service platform. (https://admin.WeChat.com/cgi-bin/readtemplate?t=ibg_en/en_faq_tmpl&type=info&lang=en_US)

Functions and Permissions	Subscription Account	Verified Subscription Account	Service Account	Verified Service Account
Messages display	In the "Subscription Accounts" folder	In the "Subscription Accounts" folder	In the friend session list	In the friend session list
Number of group messages	1 everyday	1 everyday	4 every month	4 every month
Basic message receiving/reply API	No	Yes	Yes	Yes
Custom menu at the bottom of chat interface	No	Yes	Yes	Yes
Nine advanced APIs	No	No	No	Yes
Application for WeChat payment	No	No	No	Yes

Table 2. The comparison between Subscription Account and Service Account

2.1 Stage1: Preliminary Integration

At stage1, we use WeChat OA Subscription Account as mobile portal for Moodle. Students can scan a QR code to subscribe to an Official Account and receive group messages from administrator on WeChat on their mobile devices every day. The messages include notifications, learning tasks, updates of courses, or some learning related articles. Every time students receive a message, there will be a link named “Read more” at the end of the content for students to click and if click they will be redirected to the Moodle homepage, which includes courses, resources or activities. There is a built-in web browser on WeChat, by which the students can access Moodle without even quitting WeChat. But since this is a preliminary integration, there is no student authentication mechanism for Moodle, therefore the students still need to type into name and password to log into Moodle. The following figure 1 presents the basic structure of the preliminary integration.

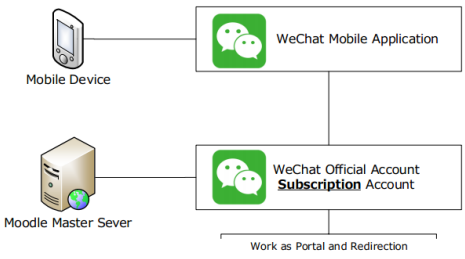

Figure 1. The basic structure of preliminary integration

At stage1, we provide an efficient way to send messages and notifications to our students, and the effective arriving rate is much higher than email since most of our students use WeChat almost every hour and seldom check emails.

On the other hand, there exist several limitations at Stage 1, as listed below:

1. Group Message can only be sent by administrators or teachers manually and only one message can be sent every day.
2. Group Message cannot be customized for each individual student.
3. Lack of student authentication mechanism for Moodle.

2.2 Stage2: Use Service Account for Advanced Integration

WeChat OA Service Account provides a more powerful way to integrate different services. There is a huge amount of APIs for developers in developer mode. So at this stage, we develop a WeChat service and message output plugin for Moodle. And this plugin is used to connect with WeChat Official Account developer service, by doing this, we are able to:

1. **Binding Moodle and students' WeChat profile (student avatar, WeChat OpenID et al.).** There is a unique QR code for each individual student to scan with his or her WeChat the first time he or she logs into Moodle. In this way, Moodle could access the student's WeChat information and finish the account binding. After this, each time when students try to access Moodle from WeChat built-in browser, they could automatically log into the system without authentication.
2. **Sending Templated Messages to individual student automatically.** Service Account provides a more powerful messaging function called Templated Message. The Templated Message is a type of message with a predefined structure with some variables. This kind of message can be customized for each individual student and sent to any specific student's WeChat automatically as many as necessary every day. What is more, different from preliminary integration model, in which messages are displayed in the "Subscription Account" folder, at Stage 2, the Service Account is displayed directly on the friend session list, which makes it more like a normal message from friends and easier to open with fewer screen touches. Thus, effective arriving rate of the message is much higher than that at Stage1. The WeChat service and message output plugin provides students a better way to receive notifications and messages from Moodle. It directly pushes customized information to students' WeChat as Templated Messages. Student can read the message on WeChat, click it if necessary to log into Moodle automatically and access to the related course, resource and activities.

Stage2 is a huge leap forward from Stage1. At this stage, the notifications and messages are not sent manually by teachers, but automatically pushed by Moodle. And the messages are much easier to find since they are displayed on the friend session list. And once students successfully bind their WeChat account with Moodle, they can automatically log into Moodle within the WeChat built-in web browser. They could simply click the Templated Messages and will be redirected to the destinations if they want to have further interaction with Moodle. The following Figure 2 shows the basic structure of advanced integration.

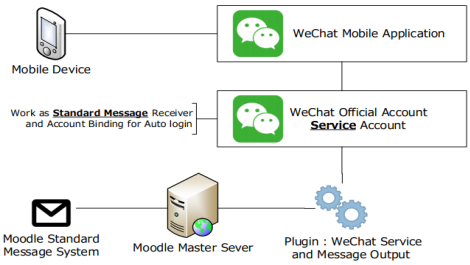

Figure 2. The basic structure of advanced integration

2.3 Stage3: Installing Plugins to Increase Student Viscosity

There are tons of Moodle plugins with various functions. At this stage, we install two essential plugins to increase student viscosity by sending notifications and internal emails.

1. **Plugin "Reminder"** There are already a large amount of notification services embedded within the standard Moodle package. But there is still a long way to go before it reaches perfection. "Reminder" provides five new types of event notifications: Site, Student, Course, Group, and Activity events. Administrators can configure how many weeks, days or even hours in advance to send the event notifications. Once the administrators or teachers add any date and time requirements to the site, courses or activities, Moodle will automatically create an event in the calendar, and students can create event for themselves on the calendar as well. The Reminder plugin will automatically send notifications in advance. And this kind of notifications is sent to a specific group of students by WeChat Templated Message.
2. **Plugin "Email"** The Moodle internal message system can send messages to any student over the site,

which can cause tremendous disturbances to students since there is a lack of traffic management. What is more, the message system provides only plain text message editor, and is unfriendly for sending attachments. The "Email" plugin is an excellent alternative to solve this problem. With this plugin, students can only send emails to each other within the same course or even the same group. Students can send email without knowing the actual email address of the others. The Email is sent by names, groups, and teachers can send to a group of selected students within a course easily with attachments. The interface of this internal Email is clear and resembles normal email service with a powerful text editor which supports the modification of text font, size, and audios, videos, pictures and links can also be embedded. What's more, the internal email can push a notification in the form of Templated Message which can be read directly on students' WeChat.

With "Reminder", Moodle can automatically notify students for any event that has been set. "Email" can help administrators or teachers to send messages and attachments manually to a selected group of students. The Templated Message helps push notifications to students' WeChat, thus increasing student viscosity. Figure 3 shows the basic structure of this integration after installing "Reminder" and "Email".

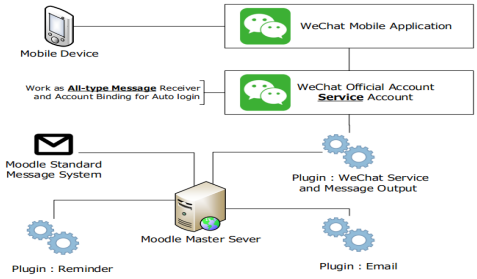

Figure 3. The basic structure of the third integration after installing "Reminder" and "Email"

3. IMPLEMENTATION OF THE MOBILE LEARNING ENVIRONMENT

To examine students' usage and their perceived usefulness of the mobile learning environment we proposed, we collect data from *Baidu Statistics* and *questionnaire*. Data stored in *Baidu Statistics* is used to explore students' usage of the learning environment and the *questionnaire* is aimed to check students' perceived usefulness on the mobile learning environment.

3.1 Context

Zhaoqing Medical College is located in Zhaoqing City, Guangdong Province, China and has been adopting Moodle since 2007 in order to support online teaching and learning. In around 2013, due to the immediate popularity of WeChat in China, we tried to integrate WeChat with Moodle to create a mobile learning environment for students. *Baidu Statistics* is a professional website traffic tracking and analyzing tool developed by Baidu, Inc. By using this tool, some basic information about students accessing the website can be obtained, such as the types of devices they are using, what kinds of web browser they are using and what time they access the website in a day etc.

To answer the third research question, we asked students' perceived usefulness of the mobile learning environment. In fact, the question is from a questionnaire on students' learning style. The students who completed the questionnaire are in their first and second year and finally we collected 3690 feedbacks.

3.2 Students' usage of the mobile learning environment

As shown above, the evolution of our mobile learning environment is divided into three Stages, Stage 1 is from December 2014 to November 2015, Stage 2 is from December 2015 to April 2016 and in May 2016 the development of the learning environment came into Stage 3. The following Table 3 presents the percentage of different devices that students use to access Moodle and total pages viewed in different stages.

	Total PV	Computer	Mobile Device
Stage 1	7705722	68.87%	31.13%
Stage 2	6318410	62.66%	37.34%
Stage 3	892956	63.40%	36.60%

Table 3. Percentages of devices used to access Moodle and pages viewed in different stages

At Stage 1, the percentage of mobile devices is 31.13%, 37.34% at Stage 2 and 36.60% at Stage 3. Overall, from the figures we can identify that the percentage of mobile devices used to access Moodle is increasing.

Table 4 shows students' specific way to access Moodle, from the Table it can be found that the percentage of WeChat at Stage 2 is higher than that at Stage 1, which means that students are getting more accustomed to log in directly via WeChat, but the percentage is rather smaller compared with that of "Direct Visit". However, the "Direct Visit" figure is actually not what it shows. At stage 1, we send students group message with a link named "Read more" at the end of message, and by clicking the link, the students will be redirected to Moodle. *Baidu Statistics* can identify the whole process and regard it as access via WeChat instead of "Direct Visit'. At stage 2, a Moodle plugin is developed to integrate with WeChat Service Account. The mechanism is much different from that at Stage 1. The redirection process at Stage 1 is avoided at Stage 2. Because of the customized Templated Messages are pushed by Moodle, if students access Moodle via built-in WeChat browser, then the traffic generated in this process will be categorized in the "Direct Visit" rather than in WeChat. Therefore, in fact, the percentage of access via WeChat at Stage 2 is actually much higher than 8.22%.

	Average Monthly PV	Direct Visit	Search Engines	WeChat	Email
Stage 1	642143	59.26%	28.6%	6.58%	0.3%
Stage 2	1263682	54.18%	36.23%	8.22%	0.02%
Stage 3	861424	62.07%	33.79%	2.31%	0.05%

Table 4. Students' specific way to access Moodle

Figure 4 presents students' daily access to Moodle by mobile devices and computers in the three different stages, from which we can see that the percentage of mobile devices is lower in contrast to that of computers. What is motivating is that the percentage of mobile devices in Stage 2 is increasing, partly because the more advanced integration introduced above and students getting used to accessing Moodle directly via WeChat. Stage 3 has only been available for students for less than two months, therefore it is sound that we neglect the usage and access in this stage. From 6 to around 9 in the morning, the percentage of mobile devices is higher than that of computers, most of students wake up at this time and check their WeChat messages. Though some students' primary intention is not to check the messages sent by teachers, yet WeChat does offer the possibility for students to check messages from teachers after they finish reading messages from other sources. And this possibility barely exists in case we integrate specific application instead of WeChat with Moodle.

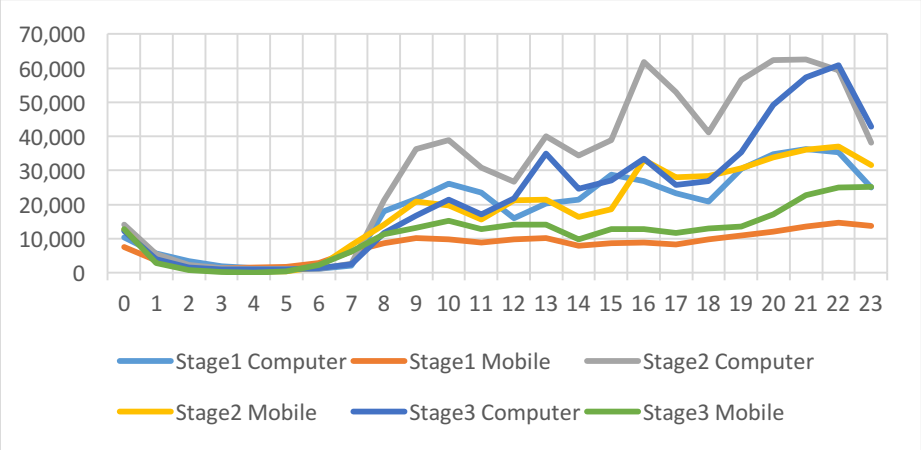

Figure 4. Students' daily access to Moodle by mobile devices and computers in the three stages

3.3 Students' perceived usefulness of the mobile learning environment

In order to learn students' perceived usefulness of the mobile learning environment, we conducted a survey on 3690 students in Zhaoqing Medical College. We use a 5-point Likert scale(Dawes 2008; R. R. Gliem & J. A. Gliem 2003) to examine students' perceived usefulness. The item is "I think the integration of WeChat with Moodle is very helpful for my learning". Figure 5 shows the results of the survey.

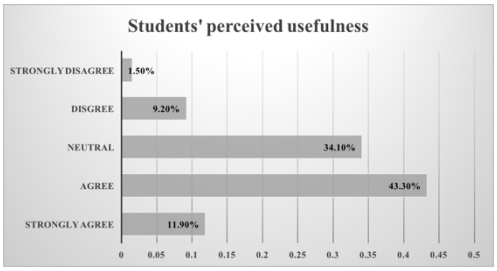

Figure 5. Students' perceived usefulness of the mobile learning environment

From the result we can find that over a half of students think the integration of WeChat with Moodle very helpful for their learning.

Besides, during our daily teaching, we have informal interview with students asking them opinion about our mobile learning environment, most of the students think highly of it. For instance, some students state that "compared with other way of accessing Moodle, WeChat is more convenient and useful".

4. CONCLUSION

In this paper, we propose a totally different way of creating mobile learning environment. Rather than developing a new application, we integrate WeChat with Moodle instead. The new integration is more convenient for both teachers and students. The design and evolution process can be categorized into three different stages, namely, Stage 1, Stage 2 and Stage 3.

At Stage 1, WeChat OA Subscription Account works as mobile portal for Moodle. Students can subscribe to an official account and receive group messages every day by scanning a QR code with WeChat. But since there is no student authentication mechanism for Moodle at this Stage, the students would have to type into name and password to login to Moodle. At Stage 2, we make major updates by binding Moodle and students' WeChat profile together, thus making the automatic login without authentication a reality. What is more, we replace Subscription Account at Stage 1 with Service Account. A more powerful messaging function called Templated Message is contained in Service Account. More importantly, the Service Account is displayed directly on the friend session list, which makes it more like a normal message from friends and easier to open with fewer screen touches. Therefore, effective arriving rate of messages is much higher than that at Stage 1. At Stage 3, we install two essential plugins to increase student viscosity by sending notifications and internal emails. With "Reminder", Moodle can automatically notify students for any event that has been set. "Email" can help administrators or teachers to send messages and attachments manually to a selected group of students. The Templated Message helps push notifications to students' WeChat, thus increasing student viscosity.

From the data stored in *Baidu Statistics*, it is found that with the evolution of mobile learning environment, students become more inclined to log into Moodle directly via WeChat. And over a half of the surveyed students have a high perceived usefulness of the mobile learning environment.

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