Using Reminder Tools to Increase Learning Motivation

A Comparison of Mobile Devices, Email and E-learning Platforms

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Abstract—Most students are not actively concerned about curriculum activity times. However, without reminders, students will miss out on learning opportunities from the course activities. Therefore, due to the use of smartphones— which are central to people's everyday lives —, this study combined apps and the curriculum to develop a course activity notification system — Mobile Secretary of Operating Systems (MSOS) —, as a curriculum reminder tool. This tool reminds the student of the curriculum activity times anytime and anywhere, like a secretary. This study also investigates students' preferences between three distinct reminder tools — the reminder app, e-mail notifications and online learning platform announcements — in terms of their effectiveness in accessing curriculum-related matters, and in previewing and reviewing courses. Additionally, the study examines the efficacy of the MSOS app by comparing the questionnaire results of the students who used the app and those who did not use it. From the results of the questionnaire, it is also ascertained whether those students who used MSOS consider the app to be more convenient and immediate than e-mail notifications and the online learning platform, both in giving access to curriculum-related matters and in previewing and reviewing courses.

Keywords—Learning Motivation, Mobile Learning, Reminder Tool

1. Introduction

With the increasing popularity of smartphones, teaching strategies have changed. In the past, some research utilized smartphones for learning in historical museums [1], and some used smartphone cameras for visualization as a memory aid [2]. As well as the aforementioned research, quite a few studies have opted to use mobile networks due to smartphones acquiring network connectivity.

In recent years, wireless networks have developed rapidly. 3G networks and Wi-Fi have been become increasingly popular. Many shops provide Wi-Fi for customers, and wireless networks increase the immediacy and convenience of handheld devices. For example, communication software can be used to share things that happen around us, or Google Maps can be used to choose routes. Due to network advancement, many teachers upload courses to their network space, and students can download them. Also, students can use handheld devices to obtain course contents via wireless networks, and the course contents are displayed in different forms such as text or video. Students can get access to learning from anywhere at any time.

At the beginning of the new term, teachers prepare the schedule for exams and assignments. Students can become familiar with the course as per the schedule. Most students will not pay attention to the scheduled time of course activities. If students are not notified, they may miss out on learning opportunities derived from activities. If there is a course activity reminder, like a secretary, students can check pending engagements, and it can remind students of the time of such engagements.

The online learning system can post course contents and a calendar on the website; the students can arrange their learning according to the calendar. This study used 'i-learning' of Chung Yuan Christian University. This system sends reminder notices to students. However, students have to look at the notice after they log in. This study selected this online learning platform as a reminder tool.

In the past, many studies used e-mail as a teaching tool, and e-mails attached with video or text of teaching material were sent to students [3][4]. Teaching materials are sent to students every day, and students can participate in learning. This is very helpful for students. Thus, this study used e-mail as one of the reminder tools to remind students of current course activities or of the time of the next activity, and to send key course contents to students.

With the convenience and multifunctionality of smartphones, people can use their devices to accomplish more and more things such as shopping, navigation and reading. Thus, smartphones are indispensable to our lives and affect usage habits of modern people. With the popularization of mobile phones, many studies have combined mobile phones with course contents, integrating them into daily life [5]. In view of this, a calendar app is provided for students. The automatic reminder function of this app reminds students of the course activities, and they can keep track of the course progress and course activity times. Additionally, it can remind students of key contents, and students can grasp the key points.

Nowadays, students rely on networks and smart phones, and carry their devices with them everywhere. In keeping with this trend, the course reminder app can be installed on smart phones. The app reminds students of key course contents and the aim of each course activity. This study discussed whether the reminder app is more effective than online learning platforms and e-mail.

2. Related Work

2.1. Definition and characteristics of m-learning

In the past, when wireless networks were not yet widely-used and transmission rates were slower, network access was only available using wired networks and computers. In order to change traditional face-to-face teaching methods, the e-learning system – using computers and wired networks – was introduced. This learning method allows students to learn at anytime, anywhere. Learners can choose precisely when they wish to access the learning content. In recent years, with the advancement of mobile devices and wireless networks, educators have been able to overcome previous space limitations, and can now digitize and display the courses on mobile phones for learning. This is called m-learning [15]. Laouris et al. [16] stated that e-learning is achieved using digital electronic tools, media and analogue signals, and m-learning is a form of e-learning achieved by mobile devices and wireless transmission. Motiwalla [17] mentioned that this learning method was developed because it integrates the Internet, wireless networks, mobile devices and e-learning systems. Although both e-learning and m-learning are digital learning, the latter has the added feature of mobility. M-learning breaks e-learning's limitation of having to be accessed in a fixed location. M-learning is designed for mobile devices, such as PDAs and smartphones [18]. Thus, m-learning has three features: convenience, suitability and immediacy [19]. Past studies have found that m-learning has the following advantages [20]:

1. Mobile devices are portable. Mobile devices are easy to carry around, and this improves the convenience of m-learning [21].
2. Learning contents are stored anytime and anywhere. With mobile devices, learning content can be instantaneously accessed through m-learning, and immediacy of m-learning can be achieved [24].
3. Interaction between teachers and students can be enhanced. Wireless networks promote real-time interaction between teachers and students, teachers can stay up to speed on students' learning progress, and introverted students can have their voices heard through mobile devices.
4. Learning contents can be read in real time. Digitalized information can be accessed by users anytime and anywhere.
5. Student-centered learning methods can be enhanced. M-learning can enable students to decide the time and place of learning, and gives them full autonomy.
6. A multimedia environment can attract students who are technologically-proficient. Students nowadays live in an age of rapid multimedia development, and a traditional learning environment may not attract the attention of students.
7. M-learning supports the different needs of students and offers personalized learning. M-learning records the activities of the students in their learning environment, and provides suitable teaching for students according to their learning journey.

8. M-learning utilizes the students' preferred communication method, and reduces communication barriers between teachers and students. Currently, social media apps are the most highly-favored communication tools among students. If teachers can get along with students, interaction between teachers and students can be enhanced.
9. Synchronous and asynchronous communication can promote cooperative learning. Through communication, students can solve serious problems relating to their course by means of cooperative learning.

Although m-learning has many advantages and has a positive effect on students, there are still some problems to be solved:

1. Mobile phone and PDA screens are too small to be able to display many contents, and even if course contents can be displayed on the device, learners may feel screen space is too crowded. [20].
2. Limited battery life can present an issue for m-learning. Although a portable power supply may be carried, the learning process can often be interrupted [22].
3. Mobile devices have many recreation, entertainment and social community applications. The students may be addicted to these applications. This may occupy the original learning time, and may affect their learning [23].
4. If the whole course relies on m-learning assistance, students without mobile devices may be isolated, and learning opportunities may be affected [20].

2.2. M-learning application

Pinkwart [6] suggested that mobile devices should be a learning tool to support the traditional learning process, although the process of learning should not be undertaken using mobile devices alone. The m-learning cases proposed by the past studies are as follows:

1. In the outdoor environment, mobile phones are used for learning. The study applied mobile phone cameras to learning, and visual codes of plants and animals were taken. Mobile phones can immediately obtain information about the relevant plants and animals [7].
2. iPods and podcasts are used as a tool for review after class. The term "podcast" is derived from the terms "iPod" and "broadcast"; podcasts have the dual function of MP3 and web broadcast. Thus, the audio files are sent to a network, where they can be downloaded from the network or listened to via subscription [8].
3. Courses based around local culture can use PDAs to enable pupils to learn about temples. The pupils can use PDAs to discover features of buildings and temples through autonomous exploration [9].
4. In gardens, mobile phones are used with RFID for learning. Using mobile devices, students can inquire about data via RFID tagging of plants, and the system provides personalized guidance or reminders; thus, students' interaction with mobile devices is increased.

5. Mobile phones are used to practice oral English. Students can use their devices to record a short video of spoken English. After several weeks of practice, frequency of use of the vocabulary from the recorded short video was increased. Thus, students' oral English ability was significantly improved [10].
6. Through PDA and sensory techniques, nursing students can familiarize themselves with the correct physical assessment theories and are kept up to date with the standard procedures thereof. This set of systems can enable students to become conversant with the standard procedures of the respiratory system; they can also obtain information through their PDAs and answer questions [11].

The mobile devices used for m-learning range from small-sized mp3 players to larger-sized notebooks; the early research devices were mainly PDAs because they are easy to carry, can enable access to information via a network, can interact with other people and have a built-in camera function. However, there has been a greater and greater demand for smartphones; thus, smartphones have become more sophisticated and the technology has been constantly advancing. Nowadays, functions and specifications of smartphones are different from the handheld devices of the past. Thus, m-learning applications have shifted to smartphones in recent years.

2.3. Relevant researches for reminder

In the e-learning of the past, web pages were often used as learning platforms; these platforms have calendars to remind students to engage in an activity within a specified time [12]. If a learning platform is not used for a course, e-mail can be used to send course-related information to students. [3][4] [13]. However, learning platforms and e-mail require desktop computers; thus, in some studies, students are notified by text message [3] [14]. The learning platform and e-mail are passive reminding methods, and PDAs and traditional mobile phones have the calendar function, but the calendars are not integrated with the course.

3. Experimental Design

This study selected "Operation System", a compulsory module of the 3rd Year of the Department of Information Engineering, Chung Yuan Christian University, as its experiment course. The course assignment and test were submitted online. The deadline of assignments and tests was set at the beginning of the semester, and the relevant information can be obtained from the online learning platform. However, students have to log into the online learning platform to prevent failure to finish a course activity. This study presents three reminder tools, and discussed which of these tools has the best effect. The reminder tools are as follows:

- i-learning online platform

If the i-learning course activity reminder is used, students can inquire about the times of all the course activities on the event calendar, as well as the assignment

submission and test times on the relevant pages, after they log into the online learning platform. In addition, attention notices shall be posted on the course notice page. The i-learning online platform provides a video of key points; students can review these key points before and after class, and make preparations.

- E-mail

According to the course activity schedule, the system would send course contents via e-mail and remind students of the course activity time and key points. The contents are consistent with those in the video of key points and are displayed as text.

- Mobile Secretary of Operating Systems (MSOS)

Currently, most students have smartphones. The "Our Mobile Planet: Taiwan Report" released by Google indicated that a large percentage of people use smartphones in daily life. This reveals that smartphones have become a central part of people's lives. Thus, the Mobile Secretary of Operating Systems (MSOS) app was developed for this study. It utilizes students' dependence on mobile phones and can remind students anytime and anywhere. Fig.1. shows the main menu of this system.

Fig.1. MSOS main menu

The main menu has two functions:

- Key point prompt

The key point prompt page is classified by course chapters, and students can select the chapter they want to review, as shown in Fig. 2. The key point prompt of MSOS

has the same contents as the video content of key points of the i-learning platform, and the contents are displayed as text, as shown in Fig. 3.

Fig.2. Key point prompt

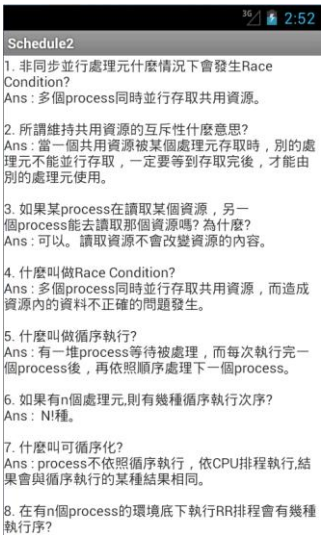


Fig.3. MSOS key point prompt displayed as text

- Calendar

  The calendar menu displays a one-month calendar, as shown in Fig. 4.

Fig.4. Calendar menu

The symbol "*" means that there is a course activity on this date. Users can check the current course activities. In addition, users can click on the date to enter the activity menu, as shown in Fig.5. Students can add or delete the current course activity content according to their learning process, and with this calendar, they can choose to set a reminder of the scheduled time of a particular course activity, as shown in Fig. 6.

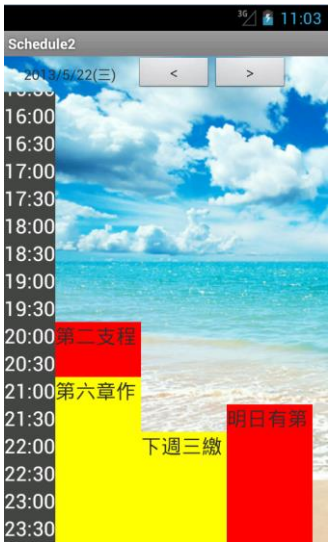


Fig.5. Display of course activity content

Fig.6. Add/delete setting of course activity

When the time of the scheduled activity is reached, the activity may appear at the top of the mobile phone display (red circle), as shown in Fig.7. The course activity reminder starts, and students can find and inquire about the course activity when using mobile devices.

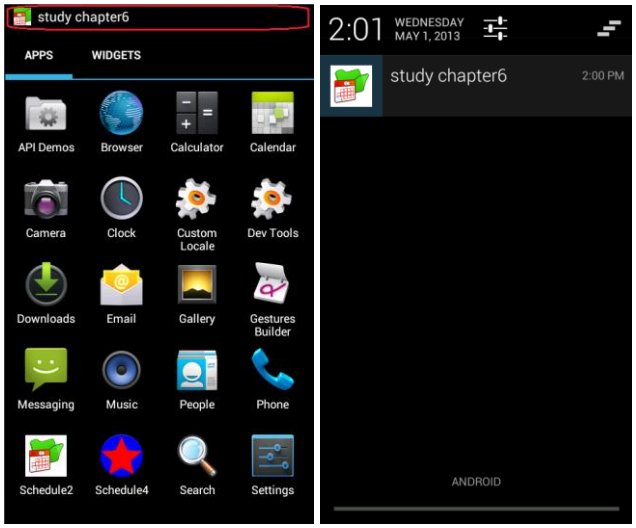


Fig.7. Course activity reminder

In addition, MSOS can be used when no network is accessed. When MSOS detects network access on mobile phones, it will actively connect with, and send user information to, the server. Meanwhile, the server may update course contents on MSOS.

4. Experimental Process

This experiment course-operation system contains the following 12 chapters: Introduction to Operating Systems, Computer System Structures, Operating System Structures, Process, CPU Scheduling, Process Synchronization, Deadlock, Memory Management, Virtual Memory, File System, File System Structures, and Secondary Memory Structures. This experiment procedure is divided into three steps, as shown in Fig. 8. The first step includes an investigation into the number of students using Android phones, MSOS installation, and i-learning, e-mail and MSOS reminder tools. In the second step, the students with the Android operating system use MSOS, while others use e-mail and i-learning during the two-week experiment. In the third step, reminder tool questionnaires are conducted so as to ascertain which reminder tool the students consider to be of the most assistance in learning.

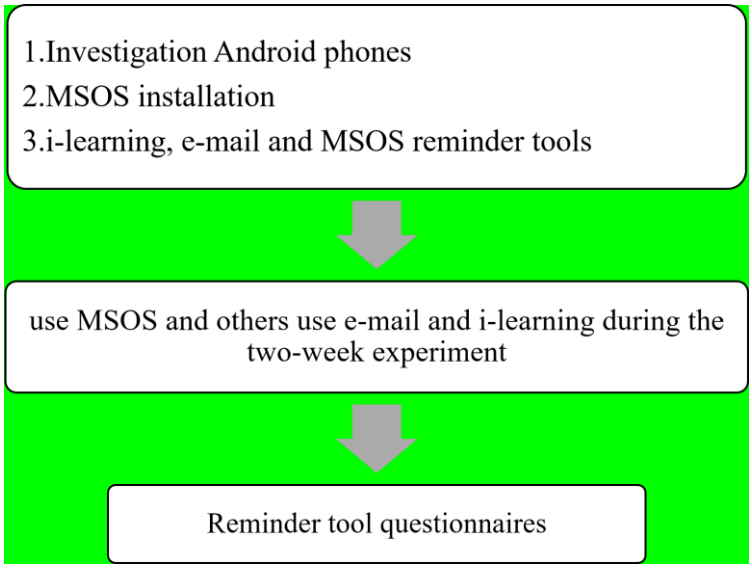
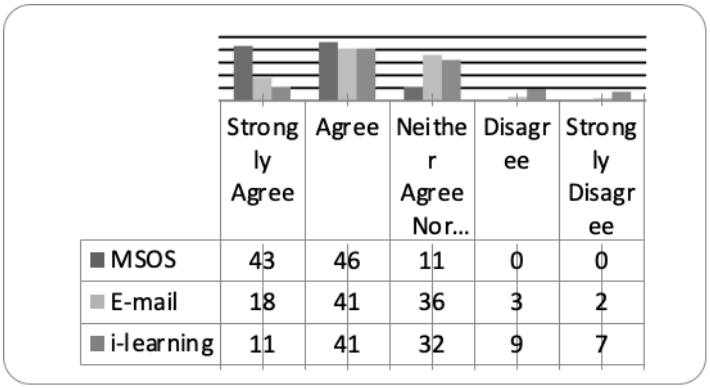


Fig.8. Experiment procedure

5. Experimental Results and Discussion

A total of 93 reminder tool questionnaires were collected. Through statistical analysis of these questionnaires, we were able to determine how the three reminder tools compare in helping students to obtain relevant course information anytime and anywhere, as shown in Fig. 9. The statistical results show that 43% of students "strongly agree" and 46% "agree" with the statement "the MSOS calendar can more easily assist you in obtaining relevant course information anytime and anywhere"; 18% of students "strongly agree" and 41% of students "agree" with the statement "e-mail notification can more easily assist you in obtaining relevant course information

anytime and anywhere"; 11% of students "strongly agree" and 41% of students "agree" with the statement that "i-learning notification can more easily assist you in obtaining relevant course information anytime and anywhere". From this, we can surmise that students considered the MSOS app to be the most effective at reminding students anytime and anywhere, and e-mail and i-learning were considered to be less effective in this regard.



	Strongly Agree	Agree	Neither Agree Nor...	Disagree	Strongly Disagree
MSOS	43	46	11	0	0
E-mail	18	41	36	3	2
i-learning	11	41	32	9	7

Fig.9. Responses to "MSOS/e-mail/i-learning can help you obtain relevant course information anytime and anywhere"

In addition, we discussed which of the three reminder tools can more easily assist you in reviewing course contents anytime and anywhere. The statistical results show that 39% "strongly agree" and 48% "agree" with the statement "the MSOS key point prompt can more easily assist you in reviewing course contents anytime and anywhere"; 14% "strongly agree" and 41% "agree" with the statement "the e-mail key point prompt can assist you in reviewing course contents anytime and anywhere"; 16% "strongly agree" and 50% "agree" with the statement "the 'i-learning' key point prompt can more easily assist you in reviewing course contents anytime and anywhere". From this, it can be seen that students consider the MSOS app to more easily provide assistance in previewing and reviewing course contents anytime and anywhere, as compared to e-mail and i-learning.

Based on the reminder tool questionnaire results, it can be seen that students consider the effect of MSOS to be positive. In the questionnaires of students who use MSOS, the feedback for MSOS's two functions indicate that 37% "strongly agree" that MSOS can effectively notify students of the course contents, and 50% of students "agree" that it can achieve this; in addition, for the question of whether the MSOS key point prompt can effectively help you preview and review course contents, 25% "strongly agree" and 59% "agree". From this, most students consider the MSOS calendar and key point prompt to have a positive effect on their learning of Operation System. For the question "Can the MSOS key point prompt give assistance in answering questions in class?", the results indicate 29% "strongly agree" and 62% "agree" that it can give assistance. Thus, the key point prompt can also give assistance in class, and enable the course contents to make a deeper impression on students.

This study discussed two functions of the three reminder tools. The first function is the method of reminder, namely: MSOS calendar, e-mail notification and i-learning notification. ANOVA and LSD tests were conducted for the results of the question "Which reminder method can provide more assistance for you in obtaining course contents anytime and anywhere?", so as to analyze which reminder tool is optimal in obtaining relevant course contents. From Table 1, a significant difference can be seen with regard to which reminder tools students select to obtain relevant course information. As shown by the LSD after-event test in Table 2, through analysis and pairwise observation, a significant difference exists when all the students select MSOS to obtain course information as compared to e-mail and i-learning.

Table 1. ANOVA test of Reminder Tool (Notice)

Tool	Mean value	Std.	F	p-value
MSOS calendar	4.1075	0.81377	12.378	0.000
e-mail notice	3.6559	0.87842		
i-learning notice	3.4839	0.95112		

Table 2. LSD test of Reminder Tool(Notice)

LSD	Tool	Mean variance (I-J)	Sig.
	MSOS calendar(I)		
	e-mail notice (J)	0.45161*	0.001
	i-learning notice (J)	0.62366*	0.000
	e-mail notice(I)		
	MSOS calendar (J)	-0.45161*	0.001
	i-learning notice (J)	0.17204	0.185
	i-learning notice (I)		
	MSOS calendar (J)	-0.62366*	0.000
	e-mail notice (J)	-0.17204	0.185

The second function is key point prompt: MSOS key point prompt, e-mail review and the i-learning review video. ANOVA and LSD after-event tests were conducted for the questionnaire results of the question "Which key point prompt can easily assist you in reviewing course contents anytime and anywhere?", so as to analyze whether the students have significantly different preferences in their selection of reminder tools for reviewing course contents. From Table 3, a significant difference can be observed regarding their preference of key point prompt for reviewing course contents. As shown in the LSD after-event test in Table 4, through analysis and pairwise observation, a significant difference exists when all the students select MSOS to review course contents as compared to e-mail and i-learning.

Table 3. ANOVA Test of Reminder TOOL (Key point prompt)

Tool	Mean value	Std.	F	p-value
MSOS key point prompt	4.0753	0.83713	9.260	0.000
e-mail review	3.5484	0.85359		
i-learning review	3.7957	0.81506		

Table 4. LSD test of Reminder TOOL (Key point prompt)

LSD	Tool	Mean variance (I-J)	Sig.
	MSOS key point prompt (I)		
	e-mail review (J)	0.52688*	0.000
	i-learning review (J)	0.27957*	0.023
	e-mail review (I)		
	MSOS key point prompt (J)	-0. 52688*	0.000
	i-learning review (J)	-0.24731*	0.044
	i-learning review (I)		
	MSOS key point prompt (J)	-0. 27957*	0.023
	e-mail review (J)	0. 24731*	0.044

Finally, the third part of the questionnaire presents the question: "Which tool do the students like to select, and why?" Among fifty-six students who had used MSOS, 48 students selected it because mobile phones have more convenient access to relevant course information and prompts than other devices such as PCs. Other students selected e-mail because they are accustomed to sending and receiving e-mails. Nowadays, most mobile phones have e-mail functionality. It is understood that the students seldom use e-mail. The students favor the i-learning platform because they log into the online learning platform to obtain relevant knowledge and information every day.

Additionally, this experiment allows students to grade MSOS and to give their reasons for doing so. Based on the students' replies, it can be concluded that MSOS can remind students anytime and anywhere, and they are able to review course content anytime and anywhere.

6. Conclusion

From the reminder tool questionnaires, the students using MSOS consider it to be more convenient and immediate with regard to prompts and obtaining course information as compared to e-mail and i-learning. Although the MSOS key point prompt cannot enable students to become fully acquainted with course contents, it is very useful for both preview and review. From the questionnaires, it can also be observed that the use of e-mail is not popular. However, the students who select MSOS may also use e-mail as a reminder tool. It can be seen that students favor the device which is indispensable to their lives, namely smartphones, as the reminder tool. The course contents are integrated into the smartphone app, which acts as a secretary to assist students. This is both favorable and practical for students.

In addition, this study has also identified the students who did not select MSOS as a reminder tool. Although e-mail or i-learning was provided for those without smartphones, they still felt they were isolated and suffered unequal treatment. In future mobile learning research, the issue of how to keep the students without smartphones from being isolated needs to be solved urgently.

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